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Understanding Design Thinking as an Approach to Solving Problems at a Large Public University

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Abstract

This dissertation investigated how designers, leaders, and clients at a large public research university enacted and perceived the value of design thinking as an approach to solving problems. A review of the literature found interest but little research in how design thinking may help higher education institutions address complex problems. The researcher visited the university, gathered documents, viewed and photographed work spaces used for design thinking, and conducted semi-structured interviews with 16 people at the university. Participants' responses were recorded and transcribed. The gathered data was analyzed for themes. Participants described enacting design thinking through Design Challenge events, using design thinking as approach to projects, and using design thinking as a flexible framework of activities. They described integrating design thinking practices with other design and change management frameworks. Participants described design thinking as a valuable approach to addressing complex problems they faced, though it was not described as helpful or appropriate in all cases. They also described challenges they faced in using design thinking. The findings of this research provide evidence that supports proposals that design thinking may be a helpful approach to addressing complex problems in higher education.

Dedication

For Kari Ann

Acknowledgements

Thank you to the people of Western University, your hospitality and generosity were incredible. I learned so much from you, thank you for sharing the exciting work that you are doing. To my committee Matt, Sam, and John, thank you for your guidance in this process. To my Doctoral cohort members at Bethel and Valpo, it has been a pleasure to go through this with you. Good luck and keep going! To my students and friends at Trinity, especially Michael, Erik, Mark, Patrick, Andrea, and Annemarie, I had so much fun and learned so much with you; continue to be amazing all the places you go. To my family and friends, thank you for your encouragement and patience; I look forward to seeing more of you soon. Kari Ann, thank you for everything; going through this adventure of life with you is fantastic. Your love, support, and encouragement have kept me going, thank you.

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Chapter 1: Introduction

Introduction

> Design thinking is an approach to solving problems and creating innovation. [Design thinking is] human centred, putting the needs of people first. It is generally viewed as a collaborative and iterative process that moves from generating insights about end users, to idea generation and testing, to implementation. Further, it is understood as an integrated approach with participation and engagement at the core. (Howard, 2015, p. 35)

Design thinking may be used to help people in higher education develop solutions to complex problems (Bell, 2010; Gilbert, Crow, & Anderson, 2017; Greenberg, n.d.; University of Minnesota, n.d.-a; Warman & Morris, 2014; Zenke, 2014). This study is a qualitative case study exploring how people at Western University (pseudonym), a large public university in the western United States, have enacted and perceived the value of design thinking.

Problem

Higher education leaders are increasingly interested in how design thinking can help to address complex challenges they face (Bell, 2010; Gilbert et al., 2017; Greenberg, n.d.; University of Minnesota, n.d.-a; Warman & Morris, 2014; Zenke,

2014). Universities have used design thinking to address problems such as academic program design, help students to better understand financial planning, or help prospective students create personalized degree plans (Berrett, 2015; Morris & Warman, 2015; University of Minnesota, n.d.-a; Weerts, Rasmussen, & Singh, 2015). Authors have argued that design thinking can help higher education leaders in addressing complex problems they face in a changing environment (Bell, 2010; Warman & Morris, 2014; Zenke, 2014). The purpose of this study was to understand how design thinking has been enacted and valued as an approach to solving problems at a university.

Defining Design Thinking

There is little consensus in the literature regarding a definition of design thinking. Design thinking literature spans more than 40 years and contains a variety of genres including empirical research, scholarly theory, epistemological arguments, popular business press books and articles, and toolkits that support design thinking activity in organizations (Badke-Schaub, Roozenburg, & Cardoso, 2010; Cross, 2007; Howard, 2015; Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013; Kimbell, 2011; Lindberg, Noweski, & Meinel, 2010). Several authors have worked to categorize the design thinking literature (Badke-Schaub et al., 2010; Howard, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011; Lindberg, et al., 2010). While there are disparities in the categories, the definitions, and characteristics of design thinking, common themes exist in defining and describing design thinking (Howard, 2015). These common themes coalesce in two ways:

1. Design thinking is a term used to describe research findings and theory of how designers think and work. (Badke-Schaub et al., 2010; Howard, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011; Lindberg, Noweski, et al., 2010)
2. Design thinking is a collaborative, human-centered approach to solving problems and creating innovation. (Brown, 2008; Brown & Wyatt, 2010; Howard, 2015; Liedtka & Ogilvie, 2011; Lockwood, 2009; Martin, 2009; Morris & Warman, 2015; Riverdale Country School & IDEO, 2012; Stanford University, 2010)

This study was primarily concerned with design thinking in the second definition: design thinking as an approach to solving problems and creating innovation.

Design Thinking as Research and Theory on how Designers Think and Work. In the first definition, design thinking relates to research and theory regarding how designers think and what they do to solve problems (Badke-Schaub et al., 2010; Johansson-Sköldberg et al., 2013; Kimbell, 2011). A strong tradition of empirical research and theory development has focused on the activity of people in traditional design roles such architecture or industrial design (Badke-Schaub et al., 2010; Cross, 2007; Johansson-Sköldberg et al., 2013; Kimbell, 2011). Rowe (1987) was one of the earliest writers to use the term design thinking in his study of the work of architects, however, design thinking research and theory draws from earlier design research (Schön, 1983; Simon, 1996). There is research exploring how architects and planners

solve design problems (Lawson, 2006; Rittel & Weber, 1973; Rowe, 1987; Schön, 1983), how industrial designers create new products (Christiaans & Dorst, 1992; Cross, 2007; Cross, Dorst, & Roozenburg, 1992), how instructional designers work (Ertmer et al., 2008; Kali, Goodyear, & Markauskaite, 2011; Rowland, 1992), how designers work to solve ill-defined problems (Buchanan, 1992; Rittel & Weber, 1973; Rowe, 1987), the logic structures that designers use in solving problems (Roozenburg, 1992), and how design relates to other knowledge traditions such as art and science (Buchanan, 1992; Cross, 2007; Owen, 2007).

Design Thinking as an Approach to Solving Problems and Creating Innovation. In the second definition, design thinking is a collaborative, human-centered approach to solving problems and creating innovation (Brown, 2008; Brown & Wyatt, 2010; Howard, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011; Liedtka & Ogilvie, 2011; Lindberg, et al., 2010; Martin, 2009). A variety of toolkits, courses, and training seminars have been developed to support organizations in using design thinking (IDEO, 2015; Liedtka & Ogilvie, 2011; Riverdale Country School & IDEO, 2012; Stanford University, 2010). Much of the literature is propositional, suggesting how design thinking can be used in organizations and it is often found in the popular business genre rather than as journal-based academic discourse (Howard, 2015; Johansson-Sköldberg et al., 2013). Some discourse and empirical research has focused on how organizations have used design thinking approaches to problem solving in government and business (Body, 2008; Howard, 2015).

Design Thinking and Higher Education. Within the first definition of design thinking, there is some research that explores how designers in higher education think and work, including studies exploring how instructional designers think and work (Kali et al., 2011; Rowland, 1992; Yamagata-Lynch & Luetkehans, 2014), how faculty and university leaders plan curricula, though the related research does not always use the term design thinking (Lattuca & Stark, 2009; Stark, Briggs, & Rowland-Poplawski, 2002), and how a large university has used a design thinking approach to make significant changes (Crow & Dabars, 2015; Gilbert et al., 2017).

In the definition of design thinking as an approach to solving problems and creating innovations, a number of colleges and universities have used design thinking to address problems (Berrett, 2015; Morris & Warman, 2015; University of Minnesota, n.d.-a). Some authors have argued design thinking may help higher education leaders and institutions in address complex problems (Bell, 2010; Warman & Morris, 2014; Zenke, 2014). It is not clear that any empirical research has explored how colleges and universities have used a design thinking approach to solve problems or create innovation.

Purpose

The purpose of this research was to explore how Western University, a large public university in the Western United States, has used design thinking to solve problems. In studying the work of Western University, this research provides insight into how designers, leaders and clients have enacted and perceived the value of design thinking as an approach to solving problems at a university. The findings of

this study will be useful to designers and leaders in higher education who are currently using or are considering using design thinking to address problems.

I am a leader in higher education and a part of my role is to develop new academic programs, learning environments, and learning systems. I am interested in how design thinking may be used to help solve problems and create innovations in higher education. Western University has used design thinking to address problems; I want to know how designers, leaders, and clients involved in design thinking at Western University enact and value design thinking. The findings of this research will inform my professional practice. I hope that the findings will be useful to other designers and leaders in higher education that may be using or considering using a design thinking approach to address challenges they face.

Research Questions

1. How do designers, leaders, and clients at Western University enact design thinking?
2. How do designers, leaders, and clients at Western University perceive the value of design thinking?

Definition of Terms

Design. There is not a shared definition of design (Buchanan, 1992). Design is a challenging concept as it can be used either as a verb or a noun (Kimbell, 2012; Lawson, 2006). In the noun form, design is an artifact or is manifested in an artifact. For example, someone might say, "I love the design of my new phone." The noun usage is common in daily interaction.

Design can also be used as verb as the act or process of creating an artifact or system. For example, educational leaders at a university could say, "next year, we will design a new curriculum." In its verb form, "design is the human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes," (Buchanan, 2001, p. 9) where products may include the design of symbolic communication, material things, actions, and complex systems. In this study, I am interested in the concept of design as verb, specifically, the activities of conceiving and planning solutions to problems at Western University.

Design Thinking. While scholars do not agree on a definition of design thinking, categories and characteristics discussed in the literature can be brought together to define design thinking as a term to describe how designers think and work and a collaborative, human-centered approach to solving problems (Badke-Schaub et al., 2010; Brown, 2008; Brown & Wyatt, 2010; Howard, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011; Liedtka & Ogilvie, 2011; Lindberg, Noweski, et al., 2010; Lockwood, 2009; Martin, 2009; Morris & Warman, 2015; Riverdale Country School & IDEO, 2012; Stanford University, 2010).

Abductive Logic. Designers use abductive logic to imagine possible solutions to problems (Martin, 2009; Roozenburg, 1992). Abductive logic reasons a case from a rule—it proposes what may be true (Martin, 2009; Roozenburg, 1992). Abduction is the logic of diagnosis, hypothesis, innovation, and design; it is the logic that proposes what may be true but is not currently operative (Martin, 2009; Roozenburg, 1992).

Well-defined Problems. Well-defined problems are problems where the variables, goals of the problem are well understood and there are established solutions or solution processes (Rowe, 1987; Simon, 1996).

Ill-defined Problems. Ill-defined problems are problems where goals and the solution processes are unknown or not fully understood at the start of the solution process (Rowe, 1987; Schön, 1983; Simon, 1996).

Wicked Problems. *Wicked problems* are a class of ill-defined problems that are particularly difficult to address (Buchanan, 1992; Rittel & Weber, 1973). *Wicked problems* have a number of characteristics; these characteristics are described in Chapter 2.

Divergent and Convergent Thinking. Design thinking uses divergent thinking—thinking that creates many ideas and concepts—and convergent thinking—thinking that narrows concepts to select the best options (Body, Terrey, & Tergas, 2010; Brown & Wyatt, 2010; Dym, Agogino, Eris, Frey, & Leifer, 2006; Lawson, 2006; Liedtka & Ogilvie, 2011; Riverdale Country School & IDEO, 2012).

Organization of the Remainder of the Study

This study is structured in five chapters. Chapter 2 consists of the literature review. Chapter 3 addresses the research methodology used in this study. Chapter 4 addresses the findings of the research. Chapter 5 discusses implications of the findings.

Chapter 2: Literature Review

Introduction

This chapter provides a review of the literature in design thinking. It addresses theoretical issues in design thinking, themes in designer behavior, roles in design thinking work, characteristics of design thinking, design thinking models and toolkits, design thinking in higher education, and concerns and critiques of design thinking. It addresses the literature surrounding the two definitions of design thinking; design thinking, design thinking as a term used to describe research findings and theory of how designers think and work and design thinking as a collaborative, human-centered approach to solving problems and creating innovation. This study primarily concerned with design thinking in the second definition; design thinking as an approach to solving problems and creating innovation. However, theory and research findings from the literature exploring how designers think is important in understanding design thinking as an approach to solving problems and creating innovation.

Design Thinking as Research and Theory on how Designers Think and Work

In the first definition, design thinking is a term used to describe research and theory on how designers think and what they do to solve problems (Badke-Schaub et

al., 2010; Howard, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011; Lindberg, Noweski, et al., 2010). In this section of the literature, scholars explore design thinking as "the cognitive processes that are manifested in design action" (Cross et al., 1992, p. 1). A strong tradition of empirical research and theory development exists exploring how architects and planners solve design problems (Lawson, 2006; Rittel & Weber, 1973; Rowe, 1987; Schön, 1983), how industrial designers create new products (Christiaans & Dorst, 1992; Cross, 2007; Cross et al., 1992), how instructional designers work (Ertmer et al., 2008; Kali et al., 2011; Rowland, 1992), theory regarding how designers work to solve ill-defined problems (Buchanan, 1992; Rittel & Weber, 1973; Rowe, 1987), the logic structures that designers use in solving problems (Roozenburg, 1992), and how design relates to other knowledge traditions such as art and science (Buchanan, 1992; Cross, 2007; Owen, 2007).

Important Theoretical Issues in Design Thinking

Design Thinking Can Be Applied to Problems in Many Disciplines. Design thinking can be applied to problems in many disciplines; "the subject matter of design is potentially universal in scope, because design thinking may be applied to any area of human experience" (Buchanan, 1992, p. 16).

Four Orders of Design Work. There are four broad contexts in which design impacts daily life and where professional and non-professional designers are at work shaping products and systems:

1. *Symbols.* These are items developed in the disciplines of graphic design, typography, or digital interfaces. These items may be created by graphic

designers, web designers, or professionals in other areas of visual communication such as film or animation (Buchanan, 1992, 2001).

2. *Things.* These are the designed material objects people encounter on a daily basis such as a kitchen utensil, clothing, tools of various complexity, furniture, or a car. These objects might be designed by industrial designers, furniture designers, clothing designers, or engineers (Buchanan, 1992, 2001).
3. *Actions.* This order focuses on the design of human action and is the realm of interaction designers. Interaction designers may design software interfaces, services, or organizations (Buchanan, 1992, 2001, 2004).
4. *Environments & Systems.* These human systems are "the integration of information, physical artifacts, and interactions in environments of living, working, playing and learning" (Buchanan, 1992, 2001). These systems may be designed by architects, urban planners, or higher education leaders (Buchanan, 1992, 2001; Crow & Dabars, 2015; Zenke, 2014).

Design Ability. Design is an ability that everyone has some level of capability in doing, though some may develop the skill and ability more than others (Buchanan, 1992, 2001; Cross, 2007).

> Everyone designs who devises courses of action aimed at changing existing situations into preferred ones…Design, so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools of architecture,

> business, education, law, and medicine, are all centrally concerned with the process of design (Simon, 1996, p. 111).

While all people may have some ability to design, not all people choose to solve problems as designers are observed to solve problems. In experiments testing the problem solving approaches of architecture students and science students, Lawson (2006) found that the two groups approached problem solving differently where "the scientists focused their attention on understanding the underlying rules, the architects were obsessed with achieving the desired result. Thus we might describe the scientists as having a problem-focused strategy and the architects as having a solution-focused strategy" (p. 43).

Not all people design at the same level. Design ability can be developed and there are differences in the practices and the quality of outcomes between novice and expert designers (Cross, 2007; Ertmer et al., 2008, 2009; Rowland, 1992; Schön, 1983). Additionally, design is an ability that can be lost as, Goel and Grafman (2000) found in their research involving an architect whose design abilities declined after he suffered brain damage.

Design Uses Abductive Logic. Designers use abductive logic to imagine possible solutions to problems (Martin, 2009; Roozenburg, 1992). Deductive logic reasons from a rule and a case—if all ravens are black, then it can be inferred that a brown bird is not a raven (Martin, 2009). Inductive logic reasons a rule from a case—all of these ravens are black, ravens must therefore be black (Martin, 2009). Abductive logic reasons a case from a rule—it proposes what may be true. Abduction

is the logic of diagnosis, hypothesis, innovation, and design; it is the logic that proposes what may be true but is not currently operative—ravens could be red if we could find a way to paint them or change the color of their feathers. (Martin, 2009; Roozenburg, 1992). Design is a "[course] of action aimed at changing existing situations into preferred ones" (Simon, 1996, p. 111). "Design is the human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes" (Buchanan, 2001, p. 9). This places the work of design in the realm of abductive logic, rather than deductive or inductive logic (Martin, 2009; Roozenburg, 1992).

Design and Ill-Defined, Wicked Problems. Design thinking is a useful approach to addressing ill-defined and *wicked problems* (Buchanan, 1992). Well-defined problems are problems where the variables and goals of the problem are well understood and there are established solutions or solution processes (Rowe, 1987; Simon, 1996). Solving for variables in an algebraic equation could be an example of a well-defined problem, also known as a tame problem (Rittel & Weber, 1973). Ill-defined problems are problems where goals and the solution processes are unknown or not fully understood at the start of the solution process (Rowe, 1987; Schön, 1983; Simon, 1996). "Many design problems are so ill-defined that they can only be called wicked problems" (Rowe, 1987, p. 41). *Wicked problems* are a class of ill-defined problems that are particularly difficult to address (Buchanan, 1992; Rittel & Weber, 1973). *Wicked problems* have the following characteristics:

1. There is no definitive formulation of a wicked problem.

2. Wicked problems have no stopping rule.

3. Solutions to wicked problems are not true-or-false, but good-or-bad.

4. There is no immediate and no ultimate test of a solution to a wicked problem.

5. Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial and error, every attempt counts significantly.

6. Wicked problems do not have an enumerable (or exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.

7. Every wicked problem is essentially unique.

8. Every wicked problem can be considered to be a symptom of another problem.

9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.

10. The planner has no right to be wrong. (Rittel & Weber, 1973)

Because the total number of variables cannot be known and accounted for in a wicked problem, developing the optimal solution is not possible (Rittel & Weber, 1973; Simon, 1996). Designers can only develop solutions to *wicked problems* that are more or less satisfactory, solutions that are better or worse. Determining if a solution is better or worse may vary by stakeholder and his or her positionality. Additionally, research suggested that designers will treat problems as ill-defined; they will not

always accept the problem as given and may modify their framing and understanding of the problem (Cross, 2007; Rowland, 1993).

Design as Proposing Meaning. Design is the work of giving form to something (Owen, 2007). Architects give form to the interiors and exteriors of buildings, graphic designers give form to print and digital visual materials, and industrial designers give form to material objects such as a chair or a lemon juicer. However, design also proposes meanings (Krippendorf, 1989; Verganti, 2009). Designed objects are more than their form and function; objects exist within cultural contexts of meaning in which the meanings of an object are created by designers and users (Krippendorf, 1989; Verganti, 2009). It is not just what a product does that will shape its adoption and use; use will also be shaped by what users understand the product to mean (Krippendorf, 1989).

> For example, driving below 55 miles per hour, a Porsche drives as well as a Honda Civic or a VW Rabbit. Worse, a Porsche offers less space, incurs far higher maintenance costs, and is more likely to be stolen, but it gives its owner a special flair, a sporty, wealthy, "yuppie" identity few other cars can provide. These attributes make the difference, not the technical data published and discussed in the salesroom. (Krippendorf, 1989, p. 24)

Design can also support innovation for organizations by proposing new meanings of products (Verganti, 2009). For example, the Nintendo Wii countered the traditional meaning of video games as activities for teenage boys to video games as whole body experiences that are fun for people of any age (Verganti, 2009).

User-centered design approaches that emphasize ethnographic research and rapid brainstorming—techniques that are common in design thinking models—may work well for developing incremental changes but may not work well for developing innovative products that propose new meanings (Verganti, 2009). Rather, new meanings may be best developed through a design process involving extensive research and interaction with cultural interpreters who propose new meanings for products (Verganti, 2009). For example, the firm Alessi worked with Michael Graves to bring the ideas of postmodern architecture to a coffee and tea service. The resulting Alessi 9093 teakettle was very successful even though other teakettles that boiled water were available at a much lower price (Verganti, 2009).

Is Design Art, Science, or Something Different? There is debate in the literature regarding the nature of design; is it art, science, or something different? While there is broad recognition that design entails complex thought and creativity, scholars do not agree to which knowledge tradition design belongs. Simon (1996) advocated for a science of design as "a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process" (p. 113). Buchanan (1992) argued for design as its own liberal art, distinct from art and science. Cross (2007) also discussed design as independent from the knowledge cultures of the sciences and the humanities. He discussed design as its own discipline, distinguishing the differing phenomena of study, methods, and values between science, the humanities, and design.

Table 1

Comparing Science, Humanities, and Design

Criteria	Science	Humanities	Design
Phenomenon of study:	The natural world	Human experience	The artificial world
Appropriate methods:	Controlled Experiment, Classification, Analysis	Analogy, Metaphor, Evaluation	Modeling, Pattern-Formation, Synthesis
Values:	Objectivity, Rationality, Neutrality, Concern for 'Truth'	Subjectivity, Imagination, Commitment, Concern for 'Justice'	Practicality, Ingenuity, Empathy, Concern for 'Appropriateness'

Adapted from Cross (2007, p. 18)

Owen (2007) distinguished between the disciplines of science, art, law, medicine, and design. Each discipline has different goals and values, and thus differing measures of quality. For example, science is oriented toward a goal of understanding and emphasizes values of correctness, thoroughness, and testability. Art is oriented toward a goal of expression and emphasizes values of insightfulness, novelty, and stimulation. Design is oriented toward a goal of giving form and emphasizes values of cultural fit, appropriateness, and effectiveness (Owen, 2007). Decision-making processes and measures are different within the disciplines based on their respective goals and values (Owen, 2007). This debate also exists in the instructional design literature.

> Some individuals take a 'rational' view and describe instructional design as a technical process in which designing is driven by known rules, principles, and procedures…other individuals describe instructional design as a creative process in which designing is driven by the recognition of opportunities and is carried out in iterative cycles. (Rowland, 1993, p. 88)

Themes in Designer Behavior. Cross (2007) summarized themes of designer behavior that occur in the design thinking research literature. The following are Cross' themes on design behavior.

Problem Formulation. Design problems are commonly understood as ill-defined problems. "In design, 'problems' are often defined only in relation to ideas for their 'solution', and designers do not typically proceed by first attempting to define their problems rigorously" (Cross, 2007, p. 100). Designers are also seen to approach problems as though they are ill-defined, even if the problem could have been approached as a well-defined problem (Cross, 2007).

Goal Analysis. Designers are different from other types of problem solvers in that they do not spend much attention on defining problems (Cross, 2007; Lawson, 2006).

> It appears that successful design behaviour is based not on extensive problem analysis, but on adequate 'problem scoping', and on a focused or directed approach to gathering problem information and prioritising criteria. Setting and changing goals are inherent elements of design activity (Cross, 2007, p. 114).

Solution Focusing. Designers are solution focused rather than problem focused. Designers focus their efforts on finding a sufficient, functional solution to a problem rather than being focused on understanding the aspects of the problem (Cross, 2007; Lawson, 2006).

> Many studies suggest that designers move rapidly to early solution conjectures, and use the conjectures as means of exploring and defining problem-and-solution together. This is not a strategy employed by all problem-solvers, many of whom attempt to define or understand the problem fully before making solution attempts. (Cross, 2007, p. 101)

Co-evolution of Problem and Solution. Designers use conjecture and proposing and testing of ideas as a means to both understand and develop solutions for a problem (Schön, 1983). Designers oscillate between developing an understanding the problem and developing a solution to the problem. The understanding of the problem and the creation of a solution are described as co-evolving; a designer's understanding of the problem develops through attempts to find a satisfactory solution (Cross, 2007).

Problem Framing. Designers do not limit themselves to solving problems as they are given (Schön, 1983). Instead, "designers select features of the problem space to which they choose to attend (naming) and identify areas of the solution space in which they choose to explore (framing)" (Cross, 2007, p. 102).

Fixation. Designers can become fixated on certain things, such as their framing of the problem, previous design solutions, or on being different from

previous design solutions (Cross, 2007). Yet, "it is not clear that 'fixation' is necessarily a bad thing in design…outstanding expert designers exhibit a form of 'fixation' on their problem frame, or on a guiding theme or principle" (Cross, 2007, p. 104).

Attachment to Concepts. Designers can become attached to a single concept and reluctant to abandon the idea, even if that idea presents significant challenges (Cross, 2007; Rowe, 1987).

Generation of Alternatives. While design thinking models suggest that designers should develop many concepts (e.g. Riverdale Country School & IDEO, 2012; Stanford University, 2010), it may be that in actual practice designers do not generate many substantially different concept alternatives (Cross, 2007).

> It may be that good designers produce good early concepts that do not need to be altered radically during further development. Or that good designers are able to modify their concepts rather fluently and easily as difficulties are encountered during development, without recourse to exploration of alternative concepts. Either way, it seems that designers are reluctant to abandon early concepts, and to generate ranges of alternatives. This does seem to be in conflict with a more "principled" approach to design, as recommended by design theorists, and even to conflict with the idea that it is the exploration of solution concepts that assist the designer's problem understanding. (Cross, 2007, p. 106)

Creativity. Creativity is an aspect of designer behavior (Cross, 2007).

> Designers themselves often emphasise the role of "intuition" in the generation of solution, and 'creativity' is widely regarded as an essential element in design thinking. Creative design is often characterised by the occurrence of a significant event, usually called the "creative leap."(Cross, 2007, p. 107)

This sudden flash of insight may be a case of designers becoming aware of their frame of reference and then reframing the problem in order to come up with a creative solution (Cross, 2007).

Sketching. Designers use sketching as a part of the design process. Sketching provides designers a way of visualizing and testing possible solutions (Cross, 2007; Schön, 1983). Schön (1983) discussed sketching as an aspect "design as a reflective conversation with the situation" (p. 76) in which designers develop and test potential solutions to a problem.

Structured Process. There are many design models that prescribe a processes for designers (Bernstein & Linsky, 2016; Brown, 2008; Dick, Carey, & Carey, 2009; Fink, 2013; Liedtka & Ogilvie, 2011; Liedtka, Salzman, & Azer, 2017; Riverdale Country School & IDEO, 2012; Stanford University, 2010; Wiggins & McTighe, 2005). There is some evidence that designers that follow a structured process are more successful than those that do not (Cross, 2007). However, there is also evidence that expert designers are aware of but do not necessarily strictly follow the process of a specific design model (Ertmer et al., 2008; Rowland, 1992).

Opportunism. Designers show opportunism by modifying a structured process to focus on something that catches the designer's attention (Cross, 2007). Designers may be surprised about ideas that develop out of their dialog with the situation that they then opportunistically follow (Liedtka, 2013; Lynda.com, 2014; Schön, 1983)

Modal Shifts. Design behavior seems to be episodic, moving between modes such as drawing and thinking (Cross, 2007). Designers move back and forth between exploration of form, unfettered exploration, and contemplative episodes (Rowe, 1987).

Novices and Experts. Novice and expert designers approach problem solving differently. These differences appear in a variety of situations including how they frame problems, how they generate solution ideas, and how they draw on previous experiences and resources (Cross, 2007; Ertmer et al., 2008, 2009; Rowland, 1992).

Design Thinking as an Approach to Solving Problems and Creating Innovation.

In the second definition, design thinking is defined as a collaborative, human-centered approach to solving problems and creating innovation (Brown, 2008; Brown & Wyatt, 2010; Howard, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011; Liedtka & Ogilvie, 2011; Lockwood, 2009; Martin, 2009; Morris & Warman, 2015; Riverdale Country School & IDEO, 2012; Stanford University, 2010). Design thinking can help organizations innovate, solve complex problems and create differentiation from their competitors (e.g. Boland Jr. & Collopy, 2004b; Brown, 2008; Brown & Wyatt, 2010; Liedtka, 2013; Martin, 2009). Design thinking can be used by a variety of types of organizations, such as business, health care, government,

non-profit organizations, and education (Body, 2008; Brown, 2008; Brown & Wyatt, 2010; IDEO, 2015; Martin, 2009; Riverdale Country School & IDEO, 2012; Zenke, 2014). Design thinking is an approach to designing products, services, processes, organizational strategy, and systems (Brown, 2008; Buchanan, 2001; Holloway, 2009; Liedtka, 2013; Liedtka & Ogilvie, 2011; Martin, 2009). A variety of toolkits, courses, and training seminars exist to support the use of design thinking (Brown, 2009; Liedtka & Ogilvie, 2011; Liedtka et al., 2017; Riverdale Country School & IDEO, 2012; Stanford University, 2010).

Much of the literature in this category is propositional or based on anecdotal experience and often found in the business genre rather than journal-based academic discourse (Howard, 2015; Johansson-Sköldberg et al., 2013). Books, articles, and toolkits are often published as professional resources in trade books and through professional journals, websites, and magazines. Resources in this category often do not reference the scholarly literature on design thinking (Badke-Schaub et al., 2010; Howard, 2015; Johansson-Sköldberg et al., 2013; Kimbell, 2011). It is difficult to determine if the authors are unaware of the scholarly discourse or if they have chosen to omit it for the sake of the publication genre. Some discourse and empirical research exists and has focused on how organizations have used design thinking approaches to problem solving in government and business (Body, 2008; Howard, 2015).

Who are Design Thinkers? Design thinking may be used by professional designers and professionals in other fields (Body, Terrey, & Tergas, 2010; Brown, 2008; Liedtka & Ogilvie, 2011; Martin, 2009; Porcini, 2009). Porcini (2009)

differentiated between designers (people trained in design professions) and design thinkers (people who have a number of attributes such as being synthetic, dialectical, intuitive thinkers). Design thinkers may or may not be classically trained designers (Porcini, 2009). Many have argued that design thinking can be conducted by organizational leaders and managers as an approach to innovation and solving problems (Boland Jr. & Collopy, 2004a; Brown, 2008; Brown & Wyatt, 2010; Fraser, 2009; Liedtka & Ogilvie, 2011; Lockwood, 2009; Martin, 2009, 2013). Design thinking may also be used by teachers, leaders, and staff members in education (Bell, 2008, 2010; Morris & Warman, 2015; Riverdale Country School & IDEO, 2012; Weerts et al., 2015; Weerts, Singh, Horn, & Taylor, 2015; Zenke, 2014).

Multidisciplinary Design Team Roles. Many authors and design thinking toolkits address collaboration in multidisciplinary teams as a component of design thinking (Brown, 2008; Brown & Wyatt, 2010; Dunne & Martin, 2006; Holloway, 2009; Kimbell, 2011; Liedtka & Ogilvie, 2011; Lockwood, 2009; Owen, 2007; Riverdale Country School & IDEO, 2012). Design thinking may be used by groups of people from a variety of disciplines working together (Body, Terrey, & Tergas, 2010; Kimbell, 2011; Sanders & Stappers, 2008). Within these groups, designers and team participants may operate in one or more roles. Body, Terrey, and Tergas (2010) identified four role perspectives in the design process.

> The holder of the intent. This perspective is the champion of the change. Without this perspective being strongly emphasised, the chances of success are significantly reduced;

User. The user perspective, whilst a central consideration, is often not brought into the conversation. In some design exercises, there is a reluctance to involve the very people that are most affected by the change. An assumption is often made that the user perspective is known by the other people involved. Successful design exercises have authentic involvement from the user community;

Specialist. There are specialist disciplines involved in developing design solutions. These include people with expertise in the law, in information technology, in learning and development of staff, and in the operational systems and processes of the organisation. These specialist disciplines are most effective when they can be brought together in multidisciplinary teams to solve design challenges together; and

Designer. The design facilitator role is a required discipline because this function balances and coordinates all perspectives. Others in the design discipline include those with specialisations in conducting user research or in visualisation of the progressive design (Body, Terrey, & Tergas, 2010, p. 68).

Sanders and Stappers (2008) identified three roles of user, researcher, and designer in their work on co-design.

- Users may be involved in the design process at a variety of levels and some may become involved to the degree that they are co-creating as a part of the process.

- Researchers may conduct interviews and literature research in co-design, but may also act as facilitators, leading, guiding, and providing scaffolds for participants in the design process.
- Designers contribute to the design team with specialized skills in design practice, visual thinking, creative processes and technical knowledge. In co-design teams, designers bring expert knowledge that other participants do not have.

Howard (2015) identified four roles that people enact as design-led professionals.

- Facilitator of the Process. The facilitator role is to create the environment for participation, to help people navigate the process, and to facilitate a group toward an outcome.
- Design Lead. The design lead provides expertise in design and design thinking to help the team create design solutions.
- Educator in Design and Participation. The Educator role is to help people to learn about design thinking and to be prepared to participate in design thinking work.
- Composer of the Design Experience. The Composer role structures the coordination of the project and how the client experiences it.

Howard (2015) also discussed the role of the client as the person or group for whom design led professionals are working. Clients may be involved in the design thinking project.

Characteristics of Design Thinking. Consensus does not exist in the literature regarding the characteristics of design thinking as it used as an approach to solving problems, however, some common characteristics exist (Howard, 2015). Some of these characteristics are related to designer-behavior themes in the research-based design thinking discourse. Other characteristics are propositional or based out of professional experience (Howard, 2015; Johansson-Sköldberg et al., 2013). Howard (2015) identified eight characteristics of design thinking:

1. Optimism and comfort with ambiguity.
2. Abductive thinking.
3. Creative thinking.
4. Systems thinking.
5. Empathy and human centredness
6. Collaboration
7. Visualisation and prototyping.
8. Iteration (p. 52).

Howard grouped the characteristics using Dunne and Martin's (2006) three aspects of design thinking: cognitive, attitudinal, and interpersonal. She added a fourth aspect, methodological characteristics occurring in the literature. There are four additional characteristics that appear in the literature but are not in Howard's list: comfort with ambiguity and uncertainty, divergent and convergent thinking, problem framing, ideation and brainstorming. I have added the following four characteristics to the table below. I have also modified Howard's iteration category to include testing

concepts with users, work commonly associated with the iterative cycles identified in design thinking.

Table 2

Characteristics of Design Thinking

Characteristic	Aspect	Key Concept	Example Literature
Optimism	Attitudinal	Design thinkers cultivate optimism in facing challenging problems.	(Brown, 2008; Brown & Wyatt, 2010; Dunne & Martin, 2006; Owen, 2007; Riverdale Country School & IDEO, 2012)
Comfort with ambiguity and uncertainty	Attitudinal	Design thinkers are comfortable working with uncertainty when engaging a problem and with the ambiguity of engaging with diverse views.	(Body et al., 2010; Dym et al., 2006; Liedtka & Ogilvie, 2011; Martin, 2009; Owen, 2007)
Abductive thinking	Cognitive	Design thinking uses abductive thinking to imagine solutions to a problem.	(Cross, 2007, 2011; Dunne & Martin, 2006; Liedtka, 2004; Martin, 2009)
Systems thinking	Cognitive	Design thinking takes a systems view, seeking to understand how a problem exists as a part of complex systems.	(Brown, 2008; Buchanan, 2001; Dunne & Martin, 2006; Dym et al., 2006; Owen, 2007; Senge, 1990)
Creative thinking	Cognitive	Design thinking is a creative process that seeks to invent solutions to challenging problems.	(Brown, 2008; Brown & Wyatt, 2010; Owen, 2007)
Divergent and convergent thinking	Cognitive	Design thinking uses divergent thinking—thinking that creates	(Body et al., 2010; Brown & Wyatt, 2010; Dym et al., 2006; Lawson, 2006;

		many ideas and concepts—and convergent thinking—thinking that narrows concepts to select the best options.	Liedtka & Ogilvie, 2011; Riverdale Country School & IDEO, 2012)
Empathy and human centeredness	Interpersonal	Design thinking focuses on human needs, using qualitative and quantitative research methods to understand and empathize with user needs and preferences in order to design solutions based on those needs.	(Brown, 2008; Holloway, 2009; Kimbell, 2011; Liedtka & Ogilvie, 2011; Lockwood, 2009; Owen, 2007; Riverdale Country School & IDEO, 2012; Stanford University, 2010)
Collaboration	Interpersonal	Design thinking brings together multidisciplinary teams working together to solve problems.	(Brown, 2008; Brown & Wyatt, 2010; Dunne & Martin, 2006; Dym et al., 2006; Holloway, 2009; Kimbell, 2011; Liedtka & Ogilvie, 2011; Lockwood, 2009; Owen, 2007; Riverdale Country School & IDEO, 2012)
Problem framing	Methods	Design thinkers frame the problem and choose the aspects of the problem that they are going to attempt to solve.	(Riverdale Country School & IDEO, 2012; Stanford University, 2010; Warman & Morris, 2014)
Ideation and brainstorming	Methods	Design thinking uses brainstorming and other ideation practices to generate many possible solutions to a problem.	(Brown, 2008; Brown & Wyatt, 2010; Morris & Warman, 2015; Riverdale Country School & IDEO, 2012; Stanford University, 2010)
Visualization and	Methods	Design thinking uses visualization and the	(Brown, 2008; Brown & Wyatt, 2010; Holloway,

prototyping		creation of prototypes as ways to develop and test solution ideas.	2009; Kimbell, 2011; Liedtka & Ogilvie, 2011; Lockwood, 2009; Morris & Warman, 2015; Owen, 2007; Riverdale Country School & IDEO, 2012; Stanford University, 2010)
Testing and iteration	Methods	Design thinking is an iterative process that involves testing prototypes with users and updating concept solutions based on user feedback.	(Kimbell, 2011; Morris & Warman, 2015; Riverdale Country School & IDEO, 2012; Stanford University, 2010)
Adapted from Howard (2015)			

Comparing Design Thinking Models and Toolkits. Many models and toolkits have been developed to support the use of design thinking. These include models describing the process for design and innovation from the design firm IDEO (Brown, 2008, 2009; Brown & Wyatt, 2010; Kelley & Littman, 2001), toolkits that give step-by-step support for doing design thinking using IDEO based models (IDEO, 2015; Riverdale Country School & IDEO, 2012; Stanford University, 2010), tool kits designed for business managers (Liedtka & Ogilvie, 2011), a proposal for a design thinking model that uses a number of working modes (Lindberg, Gumienny, Jobst, & Meinel, 2010), and models that provide conceptual maps for design thinking as a part of design in business (Clark & Smith, 2009; Fraser, 2009; Porcini, 2009).

The *Design Thinking Toolkit for Educators* (Riverdale Country School & IDEO, 2012) was developed by IDEO and the Riverdale Country School as a

resource to address challenges in their schools. The toolkit describes design thinking as a human-centered approach that can be used to approach any challenge. It emphasizes collaborative, optimistic, and experimental themes also discussed by Brown (2008). The toolkit provides educators with a how-to guide for approaching a challenge in a design thinking way as a framework to identify a challenge that an individual or a team would like to address. It divides design thinking into five phases:

- Discovery, in which teams interview and observe users and stakeholders, and collect ideas for inspiration.
- Interpretation, in which teams identify actionable insights based on their research.
- Ideate, in which teams brainstorm and generate ideas for addressing their challenge.
- Experiment, in which teams develop solution prototypes and gather feedback from users and stakeholders.
- Evolution, in which teams refine their concepts and share their concept for addressing the challenge.

In each phase, the toolkit provides guidance for how teams of educators might do the various tasks in the process. It makes recommendations on the number and types of people who should be involved, what teams should plan to do, what materials they might need, and how long they could expect the activity to take.

The Stanford "d.school" has developed a design thinking toolkit (Stanford University, 2010) that is very similar to the *Design Thinking for Educators Toolkit*

(Riverdale Country School & IDEO, 2012). The d.school tool kit also uses a five phase design thinking process that perform the same types of tasks in each phase, although some of the phases go by a different name. IDEO.org, a non-profit founded by IDEO using human-centered design to alleviate poverty, has created a toolkit for supporting a design thinking approach to support their mission. This toolkit, *The Field Guide to Human-Centered Design* (IDEO, 2015), is similar in its approach as the *Design Thinking for Educators Toolkit* (Riverdale Country School & IDEO, 2012), as it provides a step-by-step guide for implementing a design thinking approach. *The Field Guide to Human-Centered Design* (IDEO, 2015) uses a three-phase approach of Inspiration, Ideation, Innovation—the three-phase approach articulated by Brown (2008).

- Inspiration, in which people learn about user needs and wants through research and observation.
- Ideation, in which people generate new ideas, develop prototypes, test ideas with users, and iterate on concepts based on user feedback.
- Implementation, in which solutions are brought to life and brought to market.

Kelley and Littman (2001) developed a resource articulating IDEO's process for developing innovations. They outlined a five-stage process.

- Understand, in which people seek to understand the market, clients, technology, and problem constraints.
- Observe, in which people seek to understand people's needs that are not addressed by current products and services.

- Visualize, in which models and prototypes are developed.
- Evaluate and refine, in which prototypes are tested and refined in a series of quick iterations.
- Implement, in which the product is developed for commercialization.

Liedtka and Ogilvie (2011) developed a toolkit to support business managers in using design thinking as "systematic approach to problem solving" (p.5). They provided a design thinking model divided into four stages that are identified by a primary question, with each stage including sub-processes.

- What is?, in which people conduct journey mapping, value chain analysis and mind mapping.
- What if?, in which people conduct brainstorming and concept development.
- What wows?, in which people test assumptions and rapidly develop prototypes.
- What works?, in which people co-create with customers and conduct a learning launch.

They also described visualization as design activity that spans each of the stages.

Liedtka, Salzman, and Azer (2017) also developed *Design Thinking for the Greater Good* a toolkit for innovation in the social sectors that uses these same four phases.

Fraser (2009) proposed a three-stage model for business design as applying the concepts of design thinking to the design of businesses.

- Empathy and deep user understanding, in which businesses work to deeply understand user needs.
- Concept visualization, in which businesses use ideation, prototyping, and user evaluation of prototypes to envision new products and services to meet unmet user needs.
- Strategic business design, in which businesses create and integrate the business models and processes needed to create the new product and service idea. In this third phase, businesses use design thinking approaches such as visualization, and prototyping as a part of the process to design and create the business model and processes of the business.

Porcini (2009) proposed a three-stage design thinking model:

- Design in R&D, the creative process in which new products and business opportunities are identified.
- Design of products, in which products are developed with a focus on aesthetics, performance and experience.
- Design in business, in which design is involved in marketing and business strategy.

Clark and Smith (2009) discussed thinking as a means to help businesses innovate and achieve strategic business objectives. They described a five-stage experience design model used at IBM.

- Understand, in which people seek to understand what is known about the problem.

- Observe, in which people conduct observational research to understand client needs and wants.
- Conceptualize, in which concepts are created.
- Validate, in which concepts are tested and concept iterations are developed.
- Implement, in which the product is created and brought to market.

The model has an iteration loop that moves from validation back to observation.

Lindberg, Gumienny, Jobst, and Meinel (2010) proposed a design thinking workflow model that includes eight working modes:

- (Re)Framing the Design Problem, in which the goal is to frame and reframe the problem that is to be addressed.
- Grasping External Knowledge, in which the goal is to collect knowledge that is not a part of the designers' current expertise. This may be accomplished through research, observation, interviews, and gathering feedback on prototypes and visualizations.
- Knowledge Pooling, in which the goal is to combine gathered knowledge into a mutual knowledge base. This may be accomplished though storytelling and sharing of insights.
- Synthesizing, in which the goal is to synthesize information and to create basis for moving forward. This may include creating artifacts such as concept maps or user personas.

- Path Selecting, in which the goal is to determine how a project should move forward, given limited time and resources. This may be accomplished through discussion or voting.
- Ideating, in which the goal is to create a large number of ideas for possible solutions. This may be accomplished through activities such as brainstorming or mind mapping.
- Concept Specifying, in which the goal is to bring more detail to certain ideas.
- Making it Tangible, in which the goal is to visualize solutions in order to share them with users and stakeholders and receive feedback. This may include a variety of high- and low-fidelity prototypes.

Additionally, they provided six working rules to guide how modes may be combined in a design thinking workflow and suggested mode orders based on the experience level of the designers. While their model has many similarities to other models and toolkits, the use and order of the modes may be flexible. Because of this, their workflow model is not included in Table 2.3.

While there are some differences in the models, there is a significant amount of similarity. Some of the models describe for a three-stage process; other models describe a four- or five-stage process. While many of the models are presented in a linear fashion, many authors discuss flexibility and porousness between the phase stages. Most models advocate for designers gaining understanding and developing empathy for user needs, interpreting gathered data on what users want and need, and defining the problem that is to be solved. In the three-stage models, this work is

categorized in a single stage. In the four- and five-stage models, the work is separated into one or two stages. This group of stages is labeled Discover and Define.

Most models also advocate for brainstorming to develop multiple concept ideas, and using visualizations and prototypes to develop and communicate ideas, building prototypes and testing prototypes and ideas with users. In the three-stage models this work is categorized into a single stage. In the four- and five-stage models, this work is separated into two or three stages. This group of stages is labeled Ideate, Prototype, Test. Some models include an implementation phase where the design concept is produced; other toolkits omit this stage. This group of stages is labeled Implement.

Author	Perspective	Design Thinking Stages				
		Discover and Define		Ideate, Prototype, Test		Implement
Brown (2008)	CEO and president of the design firm IDEO.	Inspiration		Ideation		Implementation
IDEO.org (2015)	A toolkit developed by IDEO.org to support human-centered-design work.	Inspiration		Ideation		Implementation
Fraser (2009)	Director of the Business Design Initiative at the Rotman School of Management.	Empathy & Deep User Understanding		Concept Visualization		Strategic Business Design
Porcini (2009)	Was Head of Design, Consumer & Office Business Worldwide at 3M.	Design in R&D		Design of Products		Design in Business
Clark & Smith (2009)	Leaders at IBM writing about IBM's experience design model in the context of design thinking for organizational use.	Understand	Observe	Conceptualize	Validate	Implement
Kelley & Littman (2001)	Kelley was general manager of IDEO. This is his representation of their process.	Understand	Observe	Visualize	Evaluate & Refine	Implement
Liedtke and Ogilvie (2011)	Liedtke is an academic in management, Ogilvie is a consultant in innovation strategy.	What is?		What if?	What wows?	What works?
Riverdale School and IDEO (2013)	A toolkit developed by a school and IDEO to support design thinking in education.	Discover	Interpret	Ideate	Experiment	Evolution
Stanford University (2010)	A toolkit to support using design thinking developed by the Stanford d.school.	Empathize	Define	Ideate	Prototype	Test

Adapted from Howard (2015).

Figure 1. Comparing design thinking toolkits and models. This figure illustrates the similarities and differences in design thinking models and toolkits.

Are Design Thinking Toolkits and Process Models Useful? Research suggests that designers who follow a structured process are more successful than those that do not (Cross, 2007). Design thinking toolkits and process models may provide designers with a structured process. However, research also suggests that expert designers are aware of—but may not strictly follow—design process models (Ertmer et al., 2008; Kali et al., 2011; Rowland, 1992). Lawson (2006) argued that design is far too complex of an activity to be fully represented by a diagram, yet many of the design thinking toolkits are far more than a diagram, providing guidance on process, activities, and frameworks for how to think about design thinking (Liedtka & Ogilvie, 2011; Riverdale Country School & IDEO, 2012; Stanford University, 2010). It is not clear if any research exists that tests the effectiveness or perceived value of using design thinking toolkits or process models.

Design Thinking and Higher Education

Research and Theory on Design Thinking in Higher Education. Within the definition of design thinking as research and theory of how designers think and work, many researchers have studied the design of learning experiences in higher education. Rowland (1993) connected instructional design research with research on the design thinking of designers in other fields. Stefaniak and Tracey (2014) explored the decision-making processes of designers in several fields, including instructional design. Several researchers have studied the differences in design practice among expert and novice instructional designers (Ertmer et al., 2008, 2009; Rowland, 1992). Kali, Goodyear, and Markausaite (2011) studied the design cognition of teachers

developing design technology-assisted learning experiences. Lattuca, Stark, Briggs, Rowland-Poplawski and others (Briggs, 2007; Briggs, Stark, & Rowland-Poplawski, 2003; Lattuca & Stark, 2009; Stark et al., 2002) explored how faculty, department chairs, and university leaders describe their curriculum planning work. While they use the term *curriculum planning*, not design, they are describing the process of conceiving and planning (designing) curricula. A variety of models have been developed for guiding the work of instructional designers and curriculum planners (Diamond, 2008; Dick et al., 2009; Fink, 2013; Lattuca & Stark, 2009).

Designers and leaders in higher education have produced work describing their own design work. Yamagata-Lynch and Leudkehans (2014) used a design case methodology to describe their own thinking and process through an instructional design project. Michael Crow, President of Arizona State University, wrote about his work with other high-level leaders at the university to design what they call the New American University (Crow & Dabars, 2015; Gilbert, Crow, & Anderson, 2017). John Maeda (Maeda & Bermont, 2011) discussed design and leadership in his work as President of the Rhode Island School of Design.

Design Thinking as an Approach to Solving Problems in Higher Education. There is an interest among higher education institutions to engage in design thinking within the second definition, design thinking as an approach to solving problems and creating innovation. Several authors have expressed interest in design thinking as an approach to help higher education institutions to solve problems and create innovation. Bell (2010) discussed design thinking as an alternative to

business-as-usual thinking that can help higher education to change and thrive. Zenke (2014) argued that higher education leaders should act as designers to address complex challenges. Morris and Warman (2015) discussed design thinking as an approach to solving complex problems in higher education. They provided a definition of design thinking that is based in the five stages of the Stanford d.school toolkit model (Stanford University, 2010). For each stage of the model, they provided an overview of what designers do in that stage as well as an example of a higher education institution that has used that stage in a project. Warman and Morris (2015) also developed a two-page introduction to design thinking for use higher education with a short discussion on how it can be used by higher education institutions to address challenges and how it may be useful in teaching and learning.

Weerts, Singh, Horn, and Taylor (2015) argued for design thinking as an approach to solving challenges in higher education policy and discussed the work at the re:design initiative at the University of Minnesota between from 2010 to 2015 (University of Minnesota, n.d.-b). The initiative worked with a number of schools to take a design thinking approach to solving challenges at each institution. Martinez, Sorensen, and Weerts (2013) used innovation theory and research to create a framing document for the work of the University of Minnsota's Jandris Center. They discussed the design thinking approach that was used in the re:design initiative to develop significant innovations in higher education institutions. This article is one of the few examples that explicitly connects design thinking to the literature on innovation.

A number of centers, events, and projects have been developed to support and explore the use of design thinking in higher education. The Laboratory on Design Thinking in Education, or dLab, at the University of Kentucky has supported the use of design thinking in P-20 education (University of Kentucky, n.d.). The Jandris Center at the University of Minnesota developed research and support materials for innovation in higher education. Among their works is discussion around design thinking as an innovation approach (University of Minnesota, n.d.-b). The Academy for Innovative Higher Ed Leadership (Arizona State University & Georgetown University, 2016) embedded principles of design into an eight month program that helps higher education leaders to innovate in higher education. Boston College worked with a design firm to take design thinking approach to redesign their core curriculum (Berrett, 2015). Melles (2010) stated that curriculum design could be considered a wicked problem.

There is interest in how design thinking can be used by students to solve complex problems. At an event hosted by Wired Magazine, Sarah Stein Greenberg, Executive Director of the Stanford d.school, discussed a student project that used design thinking redesign aspects of higher education (Greenberg, n.d.). The University Education Fellows program (University Innovation Fellows, n.d.) trained and supported student leaders to foster innovation in higher education where students worked to create and support events, courses, and activities supporting creativity, entrepreneurship, innovation, and design thinking on their campuses. Several authors have identified interest in creating courses that teach design thinking in universities

help students learn design thinking as an approach to solving complex problems. (Donar, 2012; Dunne & Martin, 2006; Dym et al., 2006; Melles, 2010; Razzouk & Shute, 2012).

Concerns and Critique of Design Thinking

Kimbell (2011) expressed concerns about design thinking as a generalized concept that is divorced from real contexts of design practice. Collopy (2009) discussed concern that the term "design thinking" does not adequately describe the embodied, drawing intensive work of design. Nussbaum (2011) lauded how design thinking raised interest in design within organizations but expressed concern that process-based approaches to design thinking have ossified as mechanistic processes in organizations that may not be delivering on the innovative promise of design thinking. Several authors have expressed concerns over how the organizationally-oriented design thinking literature is often disconnected from the scholarly discourse based in theory and research and that the examples given are anecdotal rather than research-based (Badke-Schaub et al., 2010; Johansson-Sköldberg et al., 2013; Kimbell, 2011).

Summary

This chapter reviewed the design thinking literature, addressed theoretical issues in design thinking, themes in designer behavior, roles in design thinking work, characteristics of design thinking, design thinking models and toolkits, design thinking in higher education, and concerns and critiques of design thinking.

Chapter 3: Methodology

Introduction

This chapter outlines the methodology for this study. This study is a qualitative case study exploring how design thinking has been used as an approach to solving problems at Western University, a large public university in the Western United States. Western University has created a design team that has intentionally used a design thinking approach to solving problems and has used the approach in many projects. Studying the work of Western University provided insight into how design thinking is enacted and valued as an approach to solving problems at a university.

Research Questions

1. How do designers, leaders, and clients at Western University enact design thinking?
2. How do designers, leaders, and clients at Western University perceive the value of design thinking?

Research Framework

This study followed a pragmatist approach. Pragmatism is an approach that emphasizes how knowledge solves real-world problems (Creswell, 2014; Crow &

Dabars, 2015). “Pragmatists contend that thought and action are indivisible and that ideas should lead to practical action. Pragmatism is thus characterized by its emphasis on the practical application of knowledge understood within the context of social practice” (Crow & Dabars, 2015, p. 215). Pragmatists holds that the meaning of ideas and actions are drawn from the real-world consequences of those ideas and actions (Melles, 2008).

Design and design research have epistemological grounding in pragmatism (Melles, 2008, 2010; Romme, 2003).

> Design is based on pragmatism as the underlying epistemological notion. That is, design research develops knowledge in the service of action; the nature of design thinking is thus normative and synthetic in nature—directed toward desired situations and systems and toward synthesis in the form of actual actions. (Romme, 2003, p. 562)

Pragmatism is also a productive approach in higher education research oriented toward professional practice. Crow and Dabars (2015) discussed how pragmatism related to their work in designing what they call the New American University: “The pragmatist contention that thought and action are indivisible and realized in social practice corresponds to the assumptions undergirding the New American University, which advocates use-inspired research with societal impact” (Crow & Dabars, 2015, p. 218).

Pragmatism is an appropriate research framework for this study because it focuses on design practice in a higher education context. Hopefully, this research will inform professional practice in higher education.

Research Design Strategy

This research is a qualitative case study. "Qualitative case studies share with other forms of qualitative research the search for meaning and understanding, the researcher as the primary instrument of data collection and analysis, and an inductive investigative strategy, and the end product being richly descriptive" (Merriam, 2009, p. 39) Case studies are a method to understand and provide a description of a bounded system. A bounded system is "a single entity, a unit around which there are boundaries" (Merriam, 2009, p. 40). The bounded system studied in a case study could be a person, an group, an organization, or a university (Merriam, 2009; Stake, 2005). Case studies are focused on the particularity of a phenomenon as it occurs in a given bounded system (Stake, 2005).

> Ultimately, we may be interested in a general phenomenon or a population of cases more than the individual case, and we cannot understand a given case without knowing about other cases. But while we are studying it, our meager resources are concentrated on trying to understand *its* complexities. (Stake, 2005, p. 444, emphasis in original)

In qualitative case studies, researchers collect data in the form of interviews, observations, or documents (Merriam, 2009).

Stake (2005) identified three types of methodological orientations toward case studies: 1) an *intrinsic case study* in which a researcher focuses on a case because the case itself is interesting to the researcher; 2) an *instrumental case study* in which a case is studied to "provide insight into an issue or to redraw a generalization" (2005, p. 445); 3) a *multiple case study* or *collective case study* which is an instrumental case study that examines several cases. As this study has provided insight into how design thinking has been enacted and valued at a large public university, it is an instrumental case study. As a component of a Doctor of Education in Higher Education Leadership degree, this study is oriented toward informing professional practice in higher education leadership. The purpose of this study is to understand how design thinking has been used and valued as an approach to solving problems at a university. The findings may be transferable to inform professional practice for higher education leaders, though practitioners wishing to use the findings will need to determine transferability to their contexts. The methodological orientation of this case study as an instrumental case study because of my orientation toward transferability for professional practice (Stake, 2005).

Western University is the bounded system that is the case in this study. This case study explored how Western University has used design thinking as an approach to solving problems. This research addresses the lack of empirical research exploring the use of design thinking in higher education.

Setting

Using a design thinking approach to solving problems is a new phenomenon among colleges and universities and there are few colleges and universities that have been identified as having used this approach to solving problems (Berrett, 2015; Morris & Warman, 2015; Weerts et al., 2015). Western University is a large public university in the western United States with a Carnegie Classification of R1: Doctoral Universities – Highest Research Activity. Western University was chosen for this study because it has created a design team of staff members who have intentionally used a design thinking approach for solving problems. This team has used a design thinking approach on several projects working with other people at the university to solve problems. Western University has an established practice of using design thinking; studying their work will provide insight into how design thinking has been enacted and valued at a university.

Participants

The researcher interviewed 16 people at Western University who have been involved with using design thinking to solve problems at the university. People within the Educational Technology Group at Western University are intentionally using design thinking in solving problems. The researcher interviewed people from two teams within the Educational Technology Group at the university: the Design Team and the College Educational Technology Team. The Educational Technology Group is a part of the Information Technology organization at the university.

The Design Team is a group of people who design experiences to solve high-impact learning problems at the university. The Design Team worked on projects such as the redesign of large courses, the redesign of student experiences such as the new student orientation, and testing technologies for use in teaching and learning.

The College Educational Technology Team provided services to advance teaching and learning through technology within one of the colleges at the university. The College Educational Technology Team provided consultations, training sessions, workshops, and special interest groups to support faculty in pedagogy and using technology in teaching.

The researcher interviewed Learning Experience Designers from the Design Team and Academic Technology Consultants from the College Educational Technology Team. Learning Experience Designers and Academic Technology Consultants were grouped under the label of "Designer." The researcher interviewed people in leadership roles in the Educational Technology Group. These people are grouped under the label of “Leader.” The researcher also interviewed people from Information Technology, Continuing Education, a museum at Western University, and a center for learning who collaborated with members of the Design Team or College Educational Technology Team on at least one project, event, or training session that used design thinking. These participants are grouped under the label of “Client.” Table 4.1 provides a code for each participant and identifies his or her role classification in this research.

Table 3

Participant Codes and Roles

Code	Role	Code	Role
L01	Leader	D07	Designer
L02	Leader	C01	Client
L03	Leader	C02	Client
D01	Designer	C03	Client
D02	Designer	C04	Client
D03	Designer	C05	Client
D04	Designer	C06	Client
D05	Designer	C07	Client

Data Collection Procedures

The researcher traveled to Western University and interviewed Designers, Leaders, and Clients who used a design thinking approach to address one or more problems at the university. The researcher conducted semi-structured interviews and recorded the interviews using digital audio recorders. The researcher conducted one interview following the visit to Western University using a web-based video conferencing tool, which was recorded using digital audio recorders. The researcher used an interview protocol organized around my research questions. At times, the

researcher asked different questions from those in the protocol in the interviews based on participant responses to follow up on topics brought up by participants through the discussion. The recordings were transcribed using a transcription service. The researcher visited workspaces used for design thinking and took photographs of the spaces, materials, and tools used in design thinking using a smartphone camera. The Western University Design Team published materials on its website describing their design thinking process as well as descriptions of projects that have used a design thinking approach; these pages have been used as data in the study. Participants identified several documents that provided information about their design thinking process; the researcher collected those documents and included them as data for the study. Physical documents were digitally scanned. The researcher provided a copy of the interview transcript to participants before the data was used so that they had an opportunity to correct or amend their statements if they desired.

Data Management. Any physical documents or artifacts that were collected were digitized through scanning. Following the research, any physical documents were recycled. Digital files, such as audio recordings, photographs, or documents, are stored on my personal laptop computer in an encrypted password protected folder. There is a backup of the data on the researcher's desktop computer in an encrypted password protected file. Data is also stored on an encrypted password protected off-site backup computer.

Data Analysis

The measures in this study are analysis of the data collected at Western University. The data is information gathered through interviews conducted with participants, documents that were collected, and photographs of workspaces, materials, and tools that participants use in their work. The researcher performed an in-depth analysis of interview transcripts, documents, and photographs. The researcher categorized the data into themes and I developed codes that were used to label and retrieve data in my data analysis (Bogdan & Biklen, 2007; Merriam, 2009). The researcher used the MaxQDA software to analyze and code the data.

Field Test

A field test was conducted and four subjects were interviewed to test the interview protocol and data capture process. Interviews lasted about an hour. Each interview was recorded. One interview was transcribed using a transcription service to test the transcription process. The researcher reflected on the questions in the interview protocol and made minor changes to the protocol. The data collected in these interviews was not included in the research data.

Limitations of the Methodology

Case studies provide a rich description of one particular bounded system, however, case studies do have limitations (Merriam, 2009).

Generalizability. Because case studies are not grounded in representative random sampling, findings from case studies are not broadly generalizable. However, the findings of this study address a gap in the literature and provide insight into how

design thinking has been enacted and valued at a university. The findings may be transferrable to contexts to inform research and professional practice. Transferability will be need to be determined by the person or persons wishing to transfer the findings (Merriam, 2009).

Validity, Reliability, and Trustworthiness. As a form of qualitative research, case studies do not strive to attain validity and reliability measures that are common in quantitative research; rather, case studies seek to develop trustworthiness in the findings (Creswell, 2014; Merriam, 2009). Qualitative researchers may use variety of strategies to support credibility and trustworthiness of the findings (Creswell, 2014; Merriam, 2009). In this study, I have used triangulation and have identified my positionality in the research as strategies for building the trustworthiness of findings in this study.

Triangulation. I have used triangulation as a method for developing trustworthiness (Creswell, 2014; Merriam, 2009). Qualitative researchers "triangulate different data sources of information by examining evidence from the sources and using it to build a coherent justification for themes" (Creswell, 2014, p. 201). I have used multiple methods of data collection including conducting interviews, reviewing documents and artifacts, and observing workspaces. I gathered data from multiple sources by interviewing 16 people at the university.

Researcher Positionality. This is a qualitative study and so I am the primary conduit for collecting and analyzing data (Creswell, 2014; Merriam, 2009). I am declaring my positionality through my roles and interests in higher education as they

impact my data collection process and analysis (Creswell, 2014). I am an academic administrator and learning design leader and have worked in both public and private higher education systems. I have worked as both faculty and staff in higher education institutions. I am interested in how to design academic programs, learning environments, and learning systems. I am interested in how design thinking may be a useful approach for designers and leaders in higher education to address complex problems we face. As a candidate for the Doctor of Education—a professionally oriented degree—I am interested in how my research findings can inform my own professional practice and the professional practice of others. Prior to this research, I became aware of Western University's work with design thinking and spoke with them about their work through professional conversations.

Ethical Considerations

Participant Anonymity. Using a design thinking approach to problem solving in higher education is a relatively new phenomenon. While university leaders may be employing design thinking in their work, the number of institutions that have been publicly identified as using design thinking is small. A simple Internet search for design thinking and higher education will identify many of them. In order to maintain participant anonymity, I have been careful to not provide information about the university, the design teams, and their projects that would identity the institution and the research participants. Unfortunately, this also limits the transferability of the findings as information that could be very useful to other leaders and organization has been left out of the findings in order to protect participant anonymity.

Chapter 4: Results

Introduction

This chapter contains the findings of the study and provides insight into how designers, leaders and clients at Western University enacted and perceived the value of design thinking. The data related to each of the research questions are presented in summary form and verbose-coded form following each research question.

Findings for Research Question 1

This section provides the findings for Research Question 1: How do designers, leaders, and clients enact design thinking? Participants described enacting design thinking in three primary ways:

1. Design Challenges – Design Thinking as an Event. The Design Team hosted Design Challenges, events in which the Design Team worked with other teams or clients to address a problem by going through a design thinking process over the course of ninety minutes to four hours.
2. Design Thinking as an Approach to Projects. Designers and Leaders used design thinking as an approach to guide their work in projects such as the redesign of a large course or the redesign of student experiences using the student portal.

3. Design Thinking as a Flexible Framework of Activities. Participants used design thinking as a flexible framework of activities from which they would select activities to use in a given situation without going through an entire design thinking process. Designers described design thinking as a toolbox or a buffet table where one can select practices or activities as needed.

To address Research Question 1, this section addresses how participants described definitions and characteristics of design thinking; practices participants used in design thinking; spaces and tools used in design thinking; how participants described enacting Design Challenges; how participants described enacting design thinking as an approach to projects; how participants described enacting design thinking as a flexible framework of activities; organizational aspects of the university important for design thinking; attitudes and skills helpful in design thinking; and connections between design thinking and other design and process improvement frameworks.

Definitions of Design Thinking

Participants did not identify a shared definition of design thinking. Several defined design thinking as an approach to solving *wicked problems*, some defined design thinking as a process, and some defined it as a mindset. Some participants defined design thinking using more than one of these broad categories such as both a mindset and a process.

Design Thinking as an Approach to Solving Wicked Problems. Design thinking is an approach to solving *wicked problems*. "Design thinking is a **creative**

approach to **solving wicked problems** by understanding **people's needs** and finding **insights** to meet those needs" (Design Team Slide Presentation. Emphasis in original). Participants described *wicked problems* as complex, indeterminate problems that do not have one right answer. Two leaders referenced Buchanan's (1992) articulation of *wicked problems*.

Design Thinking as a Mindset and a Process. Many participants described design thinking as a mindset, or a process, or both. The Design Team described design thinking as both a mindset and a process in a presentation used as a part of Design Challenges.

Design Thinking as a Mindset. Several participants described design thinking as a mindset that emphasizes traits such as empathy and experimentation. A presentation document developed by the Design Team described aspects of a design thinking mindset, "Be empathetic, reflect regularly, ask why, ideate and experiment, seek feedback, fail early, fail often, and learn, be optimistic" (Design Team slide presentation).

Design Thinking as a Process. Participants described design thinking as a process with a structure that provided phases in which certain activities were enacted such as gathering and representing data, engaging with students and stakeholders, brainstorming, and the development, testing, and iteration of prototypes.

Design Thinking Process Model

The Design Team visualized their design thinking process in a diagram as a series of stages as two connected diamonds (Figure 2).

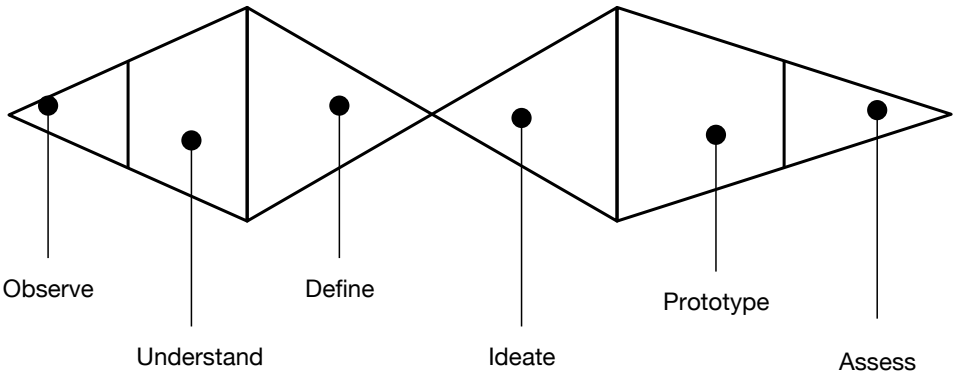


Figure 2. The Design Team's design thinking diagram. This diagram provides a visualization of the Design Team's design thinking process.

The labeled segments identify the phase of the design thinking work. The diamond shapes identify the phase as either a divergent phase, in which many ideas are created, or a convergent phase, in which concepts are reduced and selected in order to move forward in the process. This diagram has been shared by the Design Team in presentations as a part of the Design Challenges and in other public presentations.

The Design Team described the following phases of a design thinking process on their website, however these phase descriptions are different than the phases used in the presentations.

Framing. Identifying a problem and framing it as an opportunity to design and innovate.

Discovery. Empathizing with end users and collecting data from them and other stakeholders. This data informs the initial challenge.

Reframing. Synthesizing the data collection to rethink and reframe the initial challenge. Sometimes the initial challenge you identify isn't the challenge that needs to be solved. For example, your team had identified a challenge around collaborating with others. You collected data about this challenge (discovery) and as you and your team members were synthesizing the data, you realized that others may not know what services your team provides. As such, you reframe your collaboration challenge to an awareness challenge and how might you raise awareness about the services your team offers.

Ideation. Generating a lot of solutions to the reframed challenge and deciding on which idea to prototype.

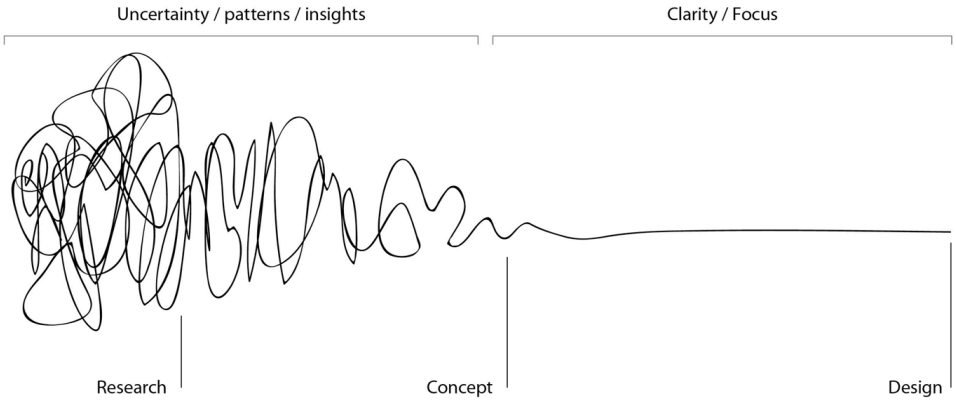
Prototyping. Designing a quick prototype (or proof of concept) of your solution.

Testing. Gathering quick feedback about your prototype and using the feedback to improve your prototype, inform your challenge, or elicit new ideas. (From a Design Team website describing their process).

Other Design Thinking Models. Some designers and clients discussed their awareness of design thinking models developed by IDEO, however, the primary model that participants discussed was the diagram developed by the Design Team (Figure 2).

Leader 02 discussed how the Design Team has worked to create their own design thinking model for use at the university.

[L02] But what we're really trying to do, at least what I experienced the past two and a half years that I've been here is that context really, really, really matters. So to try and come up with our own design thinking framework that really fits our context would be good, I think better, than trying to just use one off the shelf. Yeah. So I think we're kind of mashing, trying to mesh together different tools and different frameworks and come up with our own.



The Process of Design Squiggle by Damien Newman, Central Office of Design

Figure 3. The Process of Design Squiggle. This diagram, created by Damien Newman, provides a visualization of the design process

The Design Team has also shared a diagram of the design process created by Damien Newman (n.d.) as a part of their presentations in Design Challenges. Designers used this diagram to describe how the design process feels.

> [D03] We have this one image where it's a line, and then it goes crazy, and then it's a line again. And we kind of explain to them, "That's how you're going to feel in the next hour and a half. It's going to be— it's like controlled chaos, and we walk them through it, and they know that nothing's going to explode, nothing's going to leave the room that's going to incriminate them. But the idea is basically to think about anything and everything just to come up with some sparks of ideas because your crazy idea could lead me to come up with another crazy idea, and it just kind of feeds.

Characteristics of Design Thinking. Participants described a variety of characteristics of design thinking.

Empathetic and Human-Centered. Design thinking is empathetic and human-centered; it can help designers to understand and focus on the needs of students, faculty, staff, and other stakeholders.

Understanding Context. Designers and Leaders explained the importance of understanding contextual issues within a design project; they discussed that design thinking helps them to understand the context where they are working.

Inclusive of a Diversity of Voices. Design thinking is inclusive, involving a diversity of voices into the design process such as the perspectives of students and stakeholders.

Collaborative and Participatory. Design thinking is a collaborative, participatory process brings people together to solve problems. The Design Team has involved students, faculty, and staff stakeholders as participants in design thinking

activities. In some cases, students were hired by the Design Team to work as team members on design projects.

Creative. Design thinking is a creative approach to problem solving that supports expansive thinking.

Strategic. Design thinking can support strategic thinking and projects with strategic impact. Designers and Leaders discussed how the Design Team focused their work on addressing strategic problems with projects that have significant impact for the university; their use of design thinking helped them in this strategic work.

Data-Driven. Design thinking is a data-driven approach that helps people to make data-informed decisions through the design process.

A Buzzword. Design thinking is sometimes seen as a buzzword or fad and is sometimes negatively perceived by faculty and leaders as a fad, a buzzword, or not a serious approach to work.

Definitions and Characteristics of Design Thinking Coded Data

Design Thinking as an Approach to Solving Wicked Problems. Participants described design thinking as an approach to solving *wicked problems*. This section contains a compilation of the most important verbatim statements from that theme:

> [L03] So my group is involved particularly through two areas. One is…the Learning Experience Designers. And so they take a design thinking and really that includes wicked problem-solving because when I came to design, I was very much influenced by Richard Buchanan and his essay, Wicked Problems in Design Thinking. And in that essay, he really articulates that design is a

liberal art. Design is really part of problem-solving. It's a rhetorical art. And so he sort of provided a foundation that I used to grow [the Design Team]. And so the idea was that-- what we found before when that group was working with faculty-- they were very reactive, and their focus was limited. And I think part of it was the problems they were solving were very determinate and rote. And so there was an answer you could get to fairly quickly. And once you had solved those problems, you just kept repeating the same answer. And making an impact, but it was a thin impact across a lot of people… And that's what I kind of organized it around, was wicked teaching and learning problems and then using design methods, design thinking being one of them, to approach those problems. And [the Design Team] really takes on a long-term support with faculty who have these wicked teaching and learning problems. And by long-term, it can be up to two-years sometimes.

[Interviewer] So are there particular types of challenges that you think design thinking is a really good approach for?

[L03]: Yeah, when you're stymied. When there's a wicked problem. When the problem is so difficult that there's just not going to be one right answer and you're probably never going to solve it. And those are often the kinds of meaty problems we're dealing with in higher ed. That's what design thinking's perfect for because it sort of honors the fact that you're not going to have a complete solution, it looks at everybody is a source of inspiration and innovation and

movement forward. It gives you a roadmap for how to deal with that new way forward.

[Interviewer] How are you defining wicked problems?

[L03] Indeterminate, that there's no one right answer. And they're so big that you're not going to solve the problem. You're just going to relieve the tension inherent to the problem.

[L01] And then when I came back to the university here in my current role a few years ago we hired somebody else in our team who had a lot of design thinking background. And so from her efforts, and my effort, and our manager's effort, we decided that design thinking was a good model for us to think about trying to implement, a way to think about and frame our work, particularly as we moved from doing more transactional work to these larger things project-based work where it was really around what we call wicked problems, so sort of indeterminate problems without a clear answer. Design thinking seemed to be a nice mode for thinking about those kinds of problems. And the colleague who came on board was really interested in the design aspect. She particularly comes from more of a design background than I do, and she really started pushing us to-- let's do some design thinking experiments, and let's bring in people and run them through a design thinking experience. And so that's how it really started to take hold in our team. And now we use it, I think, in a variety of ways. We're not strictly design thinkers, I'd say, and we follow the procedure or the process all the time. But it

definitely is infused in a lot of the way we think about our work and the sort of project processes that we have in place. So it's kind of filtering into being part of the DNA for most of the projects that we do in some ways, some kind of parts of design thinking.

[Interviewer] You've mentioned wicked problems and indeterminate as one of the characteristics. So are there other characteristics that stand out for you in wicked problems?

[L01] Can't remember what the actual definition is that we've used, but yeah, indeterminate. I think we think about them as solutions that don't have a quick or an easy, or a clear answer. So to me, there might be multiple answers. There might be multiple approaches to the problem. There's not going to be one single right answer and typically something, or at least, part of that mix for us is that often these people come to us, and they'll say, "Here's what's going on." And we try to step back and say, "Are you sure that's what's going on? Let's tease that for a little while and make sure that before you put a whole bunch of resources and energy into the solution you think you have, to what you think is your problem, that you actually know that the problem you think your problem is your problem is actually your problem."

[L02] And one of the things that I hope to introduce this week to our folks-- so we've really done a lot of work in understanding design and design thinking and creative problem-solving in terms of complex or wicked problems. But one of the things that I want to introduce to the group this week is around the

complexity of the context itself and using activity theory to help us understand or unpack the complexity that exists within the context that we're designing for. So historically, we really focused on, "What is the problem that we're trying to solve? And let's use design thinking to come up with a solution to that particular problem." So designing for that problem. But really, there's other contextual things, like the politics that exist within the department or kind of the historical context of this course, how it evolved over the years. Or maybe the role of teaching assistants or the role of-- or where this course is within the curriculum. So kind of understanding and unpacking the context around what we're designing for and see if we can better design solutions that aren't specific to the object that we're designing for. So not just designing a class or a learning experience, but also designing maybe structures within the department to help the course succeed and sustain itself over time.

[D03] So now as a Learning Experience Designer, my group and I we help, originally we started helping faculty, but now we're actually working with nine academic groups which is refreshing because it's all related. Helped them solve, you might have heard wicked problems, so basically, problems that are not black and white and that don't have a clear answer or solution and not necessarily one solution. And so we kind of actually help them go through the process of defining, what is their goal? And working creatively to find out what kinds of solutions we could approach, and from there how might be able to actually build a solution for them.

[D02] But almost everyone looks similar to this: the creative approach, human-centered is what we're trying to do. We're focusing on wicked problems, and then finding insights to meet those needs. Just here's that same setup again. So we're trying to have some similarities and consistencies across the group, and as we approach different wicked problems in different ways, that's been kind of our flow.

Design Thinking as a Mindset. Participants described design thinking as a mindset. This section contains a compilation of the most important verbatim statements from that theme:

[D01] So I think our team really has adopted just the mindset of design thinking. Things like fail early, fail often, don't be afraid to fail. We really try to embrace failure, and learn from it, and see it as a positive. We really see the role therefore of prototyping things and getting a lot of user feedback. That's one thing that I realized was really absent from our work originally was the student-- the feedback and the experience of the students. We were designing for the students but we were designing for them not with them necessarily. And so that was a challenge that took us a while to really kind of figure that out. And [a leader], who's with our team, has brought in-- or at least year, brought in a number of students that we were able to really lean on a lot for that support. So that student informed design has been a lot of what we do. We try to really-- in that realm too, we try to really design for stakeholders. So we really try to understand and take some time at the start of our projects to

get the lay of the land, which is really hard to do in higher ed because everybody wants to do things quickly, and they all think they know the solution, everything, but we really try to take time at the start of the projects to really figure out what the problem is if that problem is really the one that the people brought to us, who all was involved, who were all actually designing a solution for, those sorts of things. So it's a lot of the mindsets I think of design thinking that we're using.

[D01] So if we had outsiders, we would start off into a little bitty explanation of what design thinking is and why we're embracing that mindset today. And it always starts off with, "We're here to hear from you and we want this to be a positive and inviting space. No idea is bad," kind of a thing. And we would show them, this was always really impactful for people, is the design thinking kind of flow where you come up with a lot of ideas and then you've got to constrain down to one to just want to go forward with. And then you come up with a lot of ideas again, and then you got to constrain again. And that, talking with people about, "Okay, you're about to go through this, and you're going to hate how it feels because you're going to get really excited about some ideas that we're going throw out. We're only going to move forward with one of them." And so that, I think it's beneficial when more people had to tell me about those stages. So then we would go through and we would, sometimes, we'll do like a warm-up activity to get people into the mindset.

[L02] I'm not a big fan of design thinking, just because it's just so intuitive. I don't know. Maybe just, some people reacted negatively thinking it's a buzzword. It's just really a mindset. So I wish we can just call it design, good design, and then that'd be good.

[D02] I think of it as a mindset, and it's kind of-- I think of it as, you take apart what some people think is the issue with a barrier to what they're trying to do to look for underlying elements, and then try to rebuild a focus forward. And so it's not trying to come up with the answer that people want to have or where they think they should be going, but really taking time to rethink what they're trying to do. And the way we do a lot of design thinking is around, "Well, if there's lots of different issues that are going on, what's one that we can focus in on at this moment?" And we can kind of focus our attention on one place, and then from there, iterate a bunch of different options, and then close down. So it's like a whole bunch of diamonds, in my mind, of different work and different movement as we go. But the idea is, we're not going into it with one particular answer. We're trying to see, and help people see, all the different parts of what they're trying to do. So kind of it's a mindset, in my mind. Kind of a way of looking at what they're doing and what problems are out there for their work.

[L01] I think about design thinking-- I mean, there's clearly some structured processes and approaches. But for me, I guess, I think about it a little bit more as a mindset than I do as a set of prescribed steps or processes. So sort of a

mindset away from absolutes, and clarity, and the taken-for-granteds and sort of more into the uncertainties and some of the, "what can we do to expand different possibilities than the ways we typically go at problems?" That being said, definitely a lot of things that we do or how I think about it is lots of discovery work, lots of empathetic work, and sort of trying to do the expand and contract work too. So honing in on something, spending some time there, and then seeing what comes of that, and then kind of expanding again to bigger ideas again, and then picking something and going. So that expand and contract seems to work pretty well for us as part of a process. So definitely gets us thinking about the student experience much more, gets us thinking about design much more. Like I said, yeah, sort of creative problem solving. So I think even in our brainstorming sessions, we still tend to go with these very tried and true tracks. Even when you try to say, "Let's be really creative and get outside the box," the ideas tend to recycle. So I think design thinking has pushed us to do a little bit more of that kind of off the tracks, try to push us outside our boundaries a little bit. But we still struggle with that a little bit too. But I think the idea, and the process, and the mindset has gotten us to be more creative.

Design Thinking as a Process. Participants described design thinking as a process. This section contains a compilation of the most important verbatim statements from that theme:

[D03] It's a defined process but not a tight one and so there's wiggle room depending on the different kinds of situations that we're applying it but it kind of gives us a little bit of a structure to follow in order to basically get at the best of the brainstorms that we can to involve users as well as customers, clients, people who are affected by the problem at hand and come up with a solution, or solutions, that seem to really speak to the challenge itself.

[C04] So, design thinking is an approach to solving problems. And so, it takes individuals through a process of coming up with solutions to an issue that they're having, and it's usually collaborative, so it's not just one person sitting at the table, though I'm sure that there are some models that that might be totally appropriate. But it's taking a group of individuals through a series of activities which may vary to help them think creatively and outside of the box with addressing a problem that they have. And I like the idea of it being iterative, so it's always-- it's a constant state of revision, so you try to solve the problem, it doesn't work, let's think about how we might do this differently given the additional data that we have. And so, it's continuous.

[C03] It makes a lot of intuitive sense. But the jury's still out about the destination and the product. I mean, I'm one of those it's all about the journey, it's all about the process kind of people. I believe in the importance of process and journey. But my concern is always, maybe I'm not destination and product oriented enough. Maybe I should be more that way. Whereas a lot of people are pure product destination and don't give a shit about the process, or

journey, or how the sausage is made, so to speak. So it makes me wonder, is design thinking more about those of us who love processes and journeys? I mean, that's a great guiding question.

[C06] It's an approach to solving problems that is very intentional in outlining different activities that need to be done by a team at each stage of the process. It breaks down a project or the solution to the problem into chunks that help the team along in their process, and it's done beforehand. It's done before you start-- You outline it in advance. You design it in advance.

Characteristics: Empathetic and Human-Centered. Participants described design thinking as empathetic and human-centered. This section contains a compilation of the most important verbatim statements from that theme:

[D01] It's nice to feel open, and inclusive, and empathetic. I mean, my background is in Latin American studies, and Spanish, and development, and sustainability, and stuff and so I really like thinking of my work now doing course design as having some connections to that. Still very human-centered and really getting at what people really need rather than what other people think that they need. I think there's a lot of crossovers. People are always surprised to hear that I went from teaching Spanish to doing the work I do now, but it makes a lot of sense to me if you think of how I got into Spanish was really working with people in the countryside in Latin America and trying to figure out how to fix the challenges that they were dealing with and if

somebody comes in and says, "You need something," that's not always what they need. So it's kind of an interesting crossover.

[L02] Long story short, I think, for me, design thinking, regardless of who we're designing for, is just about empathy and being able to put ourselves in our users' shoes.

[L02] I think it's challenging at times when you're trying to design for a diverse set of users or stakeholders. I think it's valuable in the sense of being empathetic and really supporting or promoting a user-centered, or student-centered, or even human-centered approach but it takes a lot of time.

[C01] I would say that-- I thought design thinking is a systematic way to solve complex problems with an empathetic lens to the end goals. So the kind of formal steps of empathizing, and defining the problem, and kind of collecting information, and infusing the ideation into the process I think are just the right way to approach problem-solving. But, yeah. I'm trying to think if I have a more elaborate definition. Yeah. I think it's just an intentional investigation to solving complex problems with a broad lens for who is going to be affected by the problem, and by the solution, and by the process.

[C03] Oh, I think it's extremely valuable, especially anytime you're leading with empathy and thinking into the others' experience. I mean, to me, it's traveling in instructional design circles, we're kind of a tribe, and I look at the kind of tribe we are and look at certain characteristics of the tribe, but part of what we are as a tribe is that sort of empathetic-- an effective instructional

designer is always really good at empathizing, maybe not on an explicitly emotional level, but thinking into where the other person is coming from and what their experience is like, what their interior might be like.

Characteristics: Understanding Context. Participants explained that design thinking helped people to understand the context of the design work. This section contains a compilation of the most important verbatim statements from that theme:

[L02] So historically, we really focused on, "What is the problem that we're trying to solve? And let's use design thinking to come up with a solution to that particular problem." So designing for that problem. But really, there's other contextual things, like the politics that exist within the department or kind of the historical context of this course, how it evolved over the years. Or maybe the role of teaching assistants or the role of-- or where this course is within the curriculum. So kind of understanding and unpacking the context around what we're designing for and see if we can better design solutions that aren't specific to the object that we're designing for. So not just designing a class or a learning experience, but also designing maybe structures within the department to help the course succeed and sustain itself over time.

[L02] But usually, [a Design Challenge] starts with the initial client/designer meeting where we spend 30 to 45 minutes, really understanding what the problem is, their context, their culture, their politics, and then how can we help them? Do they want, at the end of our engagement with them, a solution

identified where they can kind of take that on and pilot it or do they just want some ideas to get over where they're stuck?

[D04] And then I like to do a lot of research into context, basically, because I think there's other universities doing stuff around these same problems. We're not unique snowflakes. Or, I mean there are specific things about our population that need to be addressed, but-- so I like to listen, and then do lots of research, and start to feel like I have a grasp on what that context is. And that amount of research is usually merited, too, because we work with faculty in all different-- you know what I mean, in lots of disciplines and with lots of different concerns, and in different course levels, too. And so, that research is usually necessary because it's-- they're the subject matter experts but they're not always talking about-- they're not always the experts about their own context. You know what I mean, you can kind of come at it with fresh eyes and so-- so yeah. Listening, research, and then you kind of come up with a plan and see what would be most useful. But even that plan is such a-- we have what we call the discovery phase. And I feel like the first few months of a project are so informative, and things can change kind of on a dime based on what you discover. So that can't really be that regimented. It's so much about context.

Characteristics: Inclusive of a Diversity of Voices. Participants described design thinking as inclusive of a diversity of voices. This section contains a compilation of the most important verbatim statements from that theme:

[D01] I like a lot of the very positive ideas and openness of the process and inclusivity of the process. And then I love the idea of, in principle, of iterating-- prototyping and iterating, I think there's a lot to that.

[C01] I think that for me it's hard to imagine doing work without this kind of approach, but I certainly have worked with people that do not have this kind of approach and I think, design thinking, allows just broader perspectives. There's an intentionality and there's a creativity that are brought to the process that I think are-- underpin progress. It's like we cannot make progress without having a wide lens to understand a complex problem first. Okay, what are we trying to make progress on? Why? And then hopefully the work that we're all doing impacts other people and other ecosystems and if we're not taking the time to understand who it is that our work is impacting, why are we doing it?

[Interviewer] So was it particularly important for people to have, on the team, specific attitudes or ways of thinking?

[C04] No. I wanted them to come in in their diversity of thought because, otherwise, if we're all-- that's not where innovation happens. That's why it was important for us to have other people that didn't do our work in this space. I valued having the diverse opinions on my team because it helps you consider things that you would not have considered if everyone is on the same page or doing the same work, etc.

[C04] I do like the-- and I mentioned this previously having multiple voices and perspective in the room. And what happens in the moment is people are

listening and light bulbs are going off. And there's something about collaborative aspect of design thinking that I enjoy.

[C02] And so looking at [Design Team members] who were participating there. That was ideal because you had a whole bunch of people who had that high-level understanding of not just teaching and teaching tools, but also a broad base of things that they're interested in or working on. So I think that kind of diversity of opinion coming in was really helpful too, because stuff would come up that we would never think of.

Characteristics: Collaborative and Participatory. Participants described design thinking as collaborative and participatory which involves students, faculty, and stakeholders in the design process. This section contains a compilation of the most important verbatim statements from that theme:

[D01] That's one thing that I realized was really absent from our work originally was the student-- the feedback and the experience of the students. We were designing for the students but we were designing for them not with them necessarily. And so that was a challenge that took us a while to really kind of figure that out. And [a leader], who's with our team, has brought in-- or at least year, brought in a number of students that we were able to really lean on a lot for that support. So that student informed design has been a lot of what we do. We try to really-- in that realm too, we try to really design for stakeholders.

[D01] But then we actually crafted the assignment with a student team that helped us actually write it up, think about the logistics for it, because if-- you really need-- it's really easy to, I don't know, create an assignment in the wrong way, so it's not going to be successful. But this assignment was incredibly successful, and I think one of the reasons is because we kept asking the students, "Okay, should we say it like, or should we say like this? Should we put this kind of requirement in, or will the students be mad that we are telling them to dress appropriately the day of their skit?" And then student team would be like, "Well, that's crazy. They'll dress appropriately." Just little things like that. So that went through a lot of drafts with the students and came out really great.

[D03] Well, I mean, I think as part of our process, we involve the team or the person who's approached us with the problem that they want us to help look at and I really like that part actually because it's not like they tell us their problem, then they go away, and then we solve their problem and then present it to them. It's very collaborative and so all along the way, we might have weekly meetings with the…team and learn more about their processes, get their input, walk away with action plans for the week, get those done. And so a lot of that is really-- I mean, what's really great about the process is that it involves those other folks from the get-go, throughout the whole entire time, they have input. And so they own it--they feel like they also own it, which is a really good thing because you don't want to own it and then hand it off to

them necessarily. But it's like-- they own it. And then they'll feel like they're part of the solution, too. And it really makes it a lot easier for transition once we've finished with our part of the project and the transitioning off, and then they can go ahead and do, take the baton and run with it, basically. Yeah. I mean, I really love that idea of the collaboration, the collaborative part. Because if we can involve instructors or people at the admin level and students, then I think we get to a more effective solution.

[C04] So, design thinking is an approach to solving problems. And so, it takes individuals through a process of coming up with solutions to an issue that they're having, and it's usually collaborative, so it's not just one person sitting at the table, though I'm sure that there are some models that that might be totally appropriate. But it's taking a group of individuals through a series of activities which may vary to help them think creatively and outside of the box with addressing a problem that they have.

[D04] We will also sometimes have-- we'll also bring other students to the course, and get their feedback on it a little bit. That's much less formal. Sometimes, they're the ones doing the actual observation protocols. But sometimes, they're just there to sit and watch. It can be interesting to see their takes on it.

[C03] To me, one of the aha moments was when that undergraduate told me about how much she loved the McGraw-Hill Connect product when she had taken that same course, how wonderful that product was. And for me, you

start mentioning the big publishers and I'm starting to think axis of evil kind of thing. But if somebody is disabusing me of that, saying, "Okay, yeah, I paid a bunch of money for it, but it was a great learning experience and it really worked for me," so I have to kind of shed my own reflexive disdain for big publishers in that moment and say, "The most important priority is that students have a rich and effective learning experience.

Characteristics: Creative. Participants described design thinking as creative and supporting expansive thinking. This section contains a compilation of the most important verbatim statements from that theme:

[D03] I really love how-- because I'm thinking it gets to the heart of what are we trying to accomplish as opposed to coming in with what we think is the problem and coming out of it with what we think is the solution. And so it really gives the latitude to really explode our brains and think about the creative ways to really look at, what is it that we're trying to solve, and how can we do it in a really fun way?

[D02] I do because I think it's important for people to step out of the daily workflow that they have. I do these tasks everyday. This is what I do for work and be able to think a little larger picture about how that fits into the organization, is that really the best way that they can spend their time? Are we chasing an answer to a problem but it's the wrong problem? Just a chance to step back. And I think that's something that's hard to do in general is just to take the time to step away and step back from the day to day and take a

bigger, wider view of what's going on. But that's why I think it's important to have these challenges. And even us as a group, we'll have our own internal Design Challenges to keep us going, and to try to iterate what we're doing, and not get stuck in a rut. That's one thing is if we do the same thing too much, always, the same way, it's going to lose its effectiveness after a while, so we've got to adapt, iterate on what we're trying to do.

[D05] I would define design thinking as a method of approaching problems in a big picture kind of way. Trying to not jump to solutions but trying to better understand what the problem is and trying to really get the creative juices flowing to think about that problem and potential solutions in more creative ways.

[L01] So I think design thinking has pushed us to do a little bit more of that kind of off the tracks, try to push us outside our boundaries a little bit. But we still struggle with that a little bit too. But I think the idea, and the process, and the mindset has gotten us to be more creative.

[L01] And I think in higher ed and in working with faculty and administrators, we get pretty set in our ways. We go at things. People are really smart. But they're really set in their ways and their thinking tends to kind of go back to these very traditional patterns. And so I think design thinking can be a way to really try to get them out of some of the well-worn tracks of how to go at problem-solving or how to think about what a problem is and if this is their problem.

Characteristics: Strategic. Participants described design thinking as strategic. This section contains a compilation of the most important verbatim statements from that theme:

> [D04] I'm a strategic type of thinker so just going through those scenarios like what if we do this, what might happen, if we do this, what might happen? That sort of design thinking kind of lives in that… I think it just makes people responsible in whatever role they're in. Responsible meaning did you do all the research, like is this really the right thing to do?
>
> [D06] So things like when we do strategic planning. So about once a year we do a retreat. And then we look at: okay, so where are we now, where do we want to be, what do we do well, what don't we do well, where are the gaps? And so we use a lot of sticky notes, we use a lot of these brainstorming ideas.
>
> [L01] And now we're a much more, I think, strategic in the work that we do, and more kind of thinking about wicked problems across campus as opposed to just going on a meeting with a particular individual faculty member and helping them with the LMS problem they're having. That is still a need on campus, but it can be met by other ways. So now we're trying to do more kind of problem-based, project-based work.
>
> [L03] And so they take a design thinking and really that includes wicked problem-solving because when I came to design, I was very much influenced by Richard Buchanan and his essay, Wicked Problems in Design Thinking. And in that essay, he really articulates that design is a liberal art. Design is

really part of problem-solving. It's a rhetorical art. And so he sort of provided a foundation that I used to grow [the Design Team] And so the idea was that-- what we found before when that group was working with faculty-- they were very reactive, and their focus was limited. And I think part of it was the problems they were solving were very determinate and rote. And so there was an answer you could get to fairly quickly. And once you had solved those problems, you just kept repeating the same answer. And making an impact, but it was a thin impact across a lot of people… And that's what I kind of organized it around, was wicked teaching and learning problems and then using design methods, design thinking being one of them, to approach those problems. And so [the Design team] really takes on a long-term support with faculty who have these wicked teaching and learning problems. And by long-term, it can be up to two-years sometimes. So we're really investing significantly in a project that should pay off, well, hopefully.

Characteristics: Data-Driven. Participants described design thinking as data-driven. This section contains a compilation of the most important verbatim statements from that theme:

[L02] But the value is definitely in collecting good data, so making data, informed, and evidence-based decisions, and it's about really partnering with our end-clients, usually students creating that partnership, making the students feel heard as well

[C05] I like the user-centered approach. I like the data-driven approach. And I like that it tries to strip away barriers, too. So letting people freely generate ideas and without fear that someone's going to say, "Oh, that idea is just insane." It kind of opens it up to receiving those off the wall ideas.

Characteristics: Buzzword. Participants described design thinking as being a buzzword. This section contains a compilation of the most important verbatim statements from that theme:

[D04] I don't like how jargony it feels right now. I don't like how it is attached to this sort of innovation fad. And by that I mean people are caught up in a lot of words and chasing innovation, but they're not really thinking deeply about--like in that context it means sexy, right? It doesn't mean what would really be innovative in this context or what's really going to be a good decision.

[C03] I mean, to me, I'd heard a lot about design thinking as a buzzword and so on. Personally, I come from an instructional design background, and so I think about that word design a lot separately and distinctly from whatever the trend is to say it's all about design thinking.

[L01] I think maybe the biggest challenge with design thinking is similar to lots of things that I've run through is that higher education faculty don't like something that seems faddish. Faddishness seems to be something folks just have a really strong reaction to. So I think as design thinking pops up and people read about it and see it and they're like, "Oh, the latest fad is design thinking and design thinking in higher education. I think people sort of, before

having even had an experience with it, kind of put the breaks on it because they don't want to be seen as being faddish or on the latest trend.

[L02] And then sometimes people have a negative reaction to kind of buzzwordy stuff, so we've heard from a few faculty members that design thinking is just a fad, is just buzzwords. We don't believe in that. So simplifying it and calling it design or user experience research sometimes helps.

Design Thinking Practices

Problem Framing and Reframing. Many participants described the importance of framing and reframing problems as a part of design thinking. Clients or groups have started a design process with the Design Team with a particular problem and sometimes a solution identified, but Designers emphasized the importance of reframing the understanding of the problem based on insights from data gathered in the design thinking process.

How Might We Questions. Designers worked with clients to create How Might We Questions. How Might We Questions are an explicit formulation of the problems or challenges to be addressed in a particular Design Challenge or project. For example, the Design Team worked with a client to develop this How Might We Question for a course design challenge: "How might we enhance outside-of-the-classroom activities to improve student engagement and preparation for class" (Design Team Presentation)? During design work, designers and clients may decide to change the How Might We Question based on what they have learned in the design

process. Within Design Challenges, designers have worked with clients to frame a How Might We Question to begin the challenge which will be tested and reframed and possibly edited during the event.

Divergent and Convergent Modes of Thinking. Many participants emphasized the importance of moving between divergent and convergent thinking modes within design thinking. In divergent thinking modes, the goal is to generate many different ideas. In convergent thinking modes, the goal is to select ideas to move forward with in the design work. The pattern of divergence and convergence is visualized in Design Team's design thinking diagram (Figure 2). Where the lines diverge, it represents divergent thinking modes, where the lines converge it represents convergent thinking modes. Many participants mentioned the diamond shapes of the diagram were helpful. Several participants discussed that the move to converging thinking modes were be challenging for people as they have developed many good ideas in the divergent modes but now needed to select only a few ideas.

> [C01] I'm very inspired by the double diamond diagram of design thinking… So that kind of broadening and then narrowing and doing that multiple times I think helps me emotionally feel more okay with the process and I love the broadening time and then turning at corner is always so hard or it's like, "Well we can't do everything and we've got to narrow our focus."

Research Methods. Participants reported a variety of research methods that they used to gather data as a part of design thinking. Participants reported they had:

- Conducted interviews with students and staff members.

- Created surveys and gathered data from students and other people.
- Used data from existing surveys such as faculty surveys.
- Conducted focus groups with students or teaching assistants.
- Conducted classroom observations in which designers visited courses, reviewed course materials, and recorded their observations. The Design Team also hired students to conduct classroom observations.
- Conducted literature reviews to better understand what peer institutions were doing.
- Looked for analogous situations to a given problem. For example, the Design Team worked on a challenge in taking attendance at a large non-required student event. To gather ideas from analogous situations, they invited people who worked with sporting events, concerts, and taking attendance in large classes.
- Gathered written responses to questions that designers had written on whiteboards and large pieces of paper posted in a variety of locations. People were invited to write responses to the questions on the paper and whiteboards.
- Worked to understand what students experience. For example,

  [D01] So we're working on one project around campus resource centers where we went out and visited a ton of campus resource centers and tried to put ourselves in the mindset of new students walking in the building for the first time, and not knowing where to go, and not finding any signs anywhere.

> And so that's kind of one aspect is trying to see the problem or the situation through the eyes of the students or through the eyes of who's dealing with it.

Representing and Interpreting Data. Participants reported a variety of practices they have used for representing and interpreting gathered data.

Personas. Personas are aggregate representations of characteristics of groups of people such as students or faculty. For example, Client 07 discussed personas that describe department chairs: "there was the scared chair who's scared of being— his department's going to be closed for low student enrollment. There's the strategic chair who's just trying to make his administrators happy." The personas were used as a reference point representing the needs and attitudes of various people within the design process.

Visualizations. The design team worked with others to visualize data in a variety of ways, such as:

- Infographics printed on large poster boards that represented various aspects of collected data.
- Journey maps that represented a person's journey through a process.
- Visualizations of complex processes or systems such as how money flows through the IT organization or a visualization of the student experience as they interact with a variety of portal and web platforms across a number of offices at the university.

Data Gallery. Many participants reported using a data gallery as a means to display and interpret data.

> A data gallery is similar to an art gallery where data is displayed on walls and other surfaces and folks can interact with the data in different ways. We use the data gallery as a quick, fun, and collaborative way to analyze data with stakeholder. The purpose of a data gallery is to bring together a group of individuals from diverse perspectives (usually stakeholder and end users) and have them interact with and make meaning from the same data. The outcome of a data gallery activity is to derive insights from the data presented and use those insights to inform the next phases of the work (Design Team website)

Design Gallery. A Design Gallery is similar to a data gallery as visual design concepts were posted on the wall and project members and others are invited to post comments regarding the visual design concepts.

Tuning Protocol. The Design Team has used an activity known as a Tuning Protocol.

> [L03] We do something called the Tuning Protocol, which came out of a former employee's experience with middle-school education. In the Tuning Protocol, I think they borrowed that from surgeons where the surgeons get together, and they talk about a patient's case, and they kind of come at it from all their different perspectives. In this case, we talk about a learning situation, and then we give each of our perspectives as an expert on education to the professor about that situation… people really like the Tuning Protocol, especially early on where you're not quite sure what the space is yet that you're working in, and the professor kind of articulates some problems they're

having, and then you're like, “Well, did you consider this? Did you consider this?” So if you do that in a way that’s supportive of the professor and not critical, it can be a good experience.

Brainstorming. Many participants described using brainstorming activities as a part of design thinking. “The goal of brainstorming is to harness the creative energy of the entire team” (Design Team Presentation). Brainstorming has included verbal generation of ideas or writing or drawing ideas, the writing of ideas technique was also referred to as brainwriting. Ideas were written on sticky notes so that they could be moved and clustered as a part of the brainstorming process. The Design Team’s Design Challenge Guide encouraged generating a large quantity of ideas rather than emphasizing quality of ideas in the brainstorming session.

Brainstorming Rules. The Design Team shared a set of brainstorming rules during Design Challenges to frame the brainstorming experience.

1. Defer judgment
2. Build on ideas. Yes, and…
3. Encourage wild ideas
4. Visualize ideas
5. Stay focused (Design Team Presentation).

Post-It Tips. The Design Team also provided tips for capturing ideas on sticky notes as a part of the design thinking experiences.

1. One idea per post-it note
2. Write big

3. Any idea is welcome!
4. Draw a visual if that's more effective
5. Build on the existing solutions or be totally new
6. Be prepared to share your ideas (Design Team Presentation).

Clustering. Ideas on sticky notes have been posted to a large piece of paper or foam core boards. The team has clustered sticky notes with similar ideas together. From the clusters, the team has focused on certain ideas to move forward on in the design process.

Engaging with Artifacts. For one Design Challenge, the client and the designer both discussed how they had brought in various artifacts such as a stuffed animal or an anatomical arm as a way to help people generate ideas in the brainstorming process.

Decision Making Techniques. Participants discussed techniques for selecting ideas and making decisions to move forward.

Dot voting. In dot voting, participants have been given a certain number of sticky colored dots that they stick next to a concept or an idea that they think is important. These dots were counted as votes which helped to identify the concepts or ideas that participants were interested in.

Fist of Five. One participant discussed the Fist of Five technique, which has been used to check for consensus on an idea within a group using a show of a number of fingers on one hand.

[C06] [As the facilitator] you say, “It seems like we’re all— we may all be agreeing on this. If you agree, give us a fist of five— or let’s just do a fist of five to see.” And then zero is like, “I really do not agree.” Five is like, “I enthusiastically agree.” Three is like, “Okay, that can go on. We can do it.” And if everybody’s over three, you go on. If anybody’s under three then you say, “We need to pause because we have some— we’re not all in consensus.” And I think it’s good because it shows that you don't have to be in full consensus like three, four, and five can involve different ideas or disagreements.

Prototyping, Testing, and Iterating. Participants described prototyping, testing, and iterating on concepts as a part of their design thinking work. Prototypes within Design Challenges have included very quick mock-ups made with items such as sticky notes, modeling clay, or pipe cleaners. Within design thinking based projects for courses or student experiences, prototypes have included short videos, a TA training program, and a spaceship that could be used as a part of a course on space.

Designers discussed developing prototypes and iterating on the prototypes to develop the concepts. Leader 03 discussed how prototypes help communicate ideas and concepts in ways that are difficult to do through words alone.

[L03] I think we lack the ability with oral language to be specific enough and to evoke in someone else’s mind what we really mean. It’s really until you get something form that we can kind of go, “Woah.” And even then, there’s—

you don't always have everything you need, but it's this sort of iterations that move closer to development of what you're finally producing. And I think they're necessary. I think you've got to create these prototype, these representations. And if you forestall it, you're just forestalling productive discussion that has to happen at some point. If you put it in too early, it might not be too bad. Then I guess the problem you have is you might intend for it to be much more fluid than it seems to be, because form gives a sense of finality. And you might be, "No. It doesn't have to square. It could be round," or, "No. It doesn't have to have that switch. But it has the switch because I just tossed it in there." So you have those kinds of tension if you're too early. So I guess if I'm theorizing, there's probably a nice golden mean place where you can do it.

Student Feedback and Involvement. Several designers and leaders described how the team worked to involve student voices in their work on a more frequent basis.

[D04] I remember … two years ago, and they were designing a course, and I was part of one of those early meetings. And there was all this stuff on the board about faculty, and here's the problem… And I was like, "Students aren't listed anywhere up there." You know what I mean? And we're getting way better at that as a group, but it's like even three years ago, we were never in touch with students. There was no student perspective that was informing our designs.

The Design Team worked with students and stakeholders in a variety of ways including testing and asking for feedback on prototypes and involved students in developing assignments as a part of a course redesign project.

Assessment. The design team has conducted assessments of their design interventions to measure the effectiveness and the impact of their work.

> [D03] And so when we do the implementation, there's also a plan for assessment. And so we also make sure that what we're doing is going to make a difference, and we hope that it does make a difference. And so we might put together surveys and have other focus groups and interviews and things like that with them.

Construct Mapping. Leader 03 said the Design Team has been encouraged to map and measure constructs within a project as a means to demonstrate and measure the impact and value of a design intervention.

> [L03] But we try to do a pre- and post-assessment. So we try to do a baseline assessment of whatever constructs— and so this is another thing that I've tried to keep a rigor around with the Learning Experience Designers. And they're really starting to pick up on it. But to map out all the constructs before the project gets going, at least the ones you think you're going to care about, and then to create an assessment to measure a baseline of those constructs and then an after the intervention. And so just that level of rigor, I think, is well respected among social scientists. I think it's well respected inside our IT group.

Pre-Mortem and Post-Mortem. The Design Team has conducted exercises known as pre-mortems and post-mortems. In post-mortems, the design team explored what happened in the project in order to learn from the experience.

> [D03] The lessons learned at the end and then a postmortem, those are really great things because— we'll learn something from every single project that we've ever done and it helps us with subsequent projects or projects that happen to overlap but are just right behind. And so all of our projects have informed us for the subsequent projects.

In pre-mortems, the Design Team has gathered before a project begins to imagine ways in which the project might fail so that potential failures may be avoided.

> [D03] And then on the front end, we might do a pre-mortem like, "What could go really wrong?" And so then that's a— it's a proactive way to thwart anything bad that could happen. And you can't predict everything, but it's fun. Our group really likes doing those because it could be anything… one thing we didn't anticipate that we kind of laugh about in a way because it's sort of funny, but it's kind of not funny, was, "What could go wrong?" And apparently, you could have bed bugs in a classroom…so during the semester they had to find an alternate room to house, I don't know how many, a few hundred students, while they were doing the bed bug abatement.

Design Heuristic. The Design Team developed a design heuristic as a means to provide guidance and check the quality of any design artifacts that are produced by

the Design Team. The design heuristic measures artifacts on the categories of information design, visual design, video design, and universal design.

Project Hand-Off. Participants described how once a design solution is implemented, the Design Team has handed off the solution to the care of the client. Participants also said that the members of the design team have met with clients for a wrap-up meetings or follow-up consultations.

Documentation. Design Team members described a variety of forms of documentation that they produced as a part of their project process. For design thinking based projects, they have developed project charters used as a part of the IT organization's project management process. The Design Team has created public web pages to communicate their work on design thinking based projects and for their work with Design Challenges. The Design Team also created reports including recommendations for the project sponsors.

Design Thinking Practices Coded Data

Problem Framing, Re-Framing, and How Might We Questions. Participants described problem framing, re-framing, and generating How Might We Questions as practices of design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [L01] So there's a lot of work kind of going into those areas but for us, I think design thinking is a way for us to do a lot of problem clarification to make sure that when we are advocating change that we're hopefully doing it around things that are the right things as opposed to change for change sake. Or

throwing a Band-Aid on something that is the wrong place to spending our time. So again, as I said, a couple of these projects we've had people come to us and say, "Here's our problem. Here's what we think we want to do." And we've said, "Cool. Let's spend three months actually gathering more data, talking through that." And they figured out, "Oh, our problem actually wasn't this. It was more complex than that and this idea we wanted to was kind of one solution but it actually isn't really the solution we should have been looking for." So I think that made sense. If they had just come to some other group and said, "Hey, here's our problem. We have a solution. We just need you to help us take the solution and put it on the problem." They probably would have done okay but we were trying to think more complexly, more systemic than that. So I'm hoping that's where the design thinking impact is kind of teasing out those problems and the potential solutions a bit more. [L01] part of that mix for us is that often these people come to us, and they'll say, "Here's what's going on." And we try to step back and say, "Are you sure that's what's going on? Let's tease that for a little while and make sure that before you put a whole bunch of resources and energy into the solution you think you have, to what you think is your problem, that you actually know that the problem you think your problem is your problem is actually your problem." So we do a lot of that work where we try to kind of poke at the assumptions of what people think is really going on for them and just-- I mean it maybe that it's verification that they're right on track where they know really

well. But sometimes it also just raises the fact that they have a pretty clear problem, and they're just the easiest answer, or something they heard somebody else is doing. They're just, "Let's take that, and we'll just do that too because it worked for those other people on a similar problem," when in fact, as we talk to them, and explore, and gather some data, there's something else going on. And what they really thought was the issue is a whole much more, and it's much more complex, so.

[D02] what I keep seeing, a lot of the time, is to help people reframe what they're doing, to take a step back from their perspective and try to see it from other people's perspectives. Find those hidden gotchas that normally come up at the end of a project in the front. So that's kind of how I look at it.

[D04] So I just really-- you listen first. And it kind of depends on their personality too because some people come and they're like, "This is what I'm thinking but I really have no idea," and some people are really set in, "I've already come up with the best idea," and you have to be a little bit more roundabout so that it doesn't seem like you're talking them out of their idea. But you basically just listen and it's almost like a therapist. I just try to zero in in and poke and prod to get to where I think their real concern is or what's the real challenge for them? What's the real issue?

[L03] [Design thinking] tends to be these, How Might We Questions that follows that diagram of convergence and divergence that uses a number of exercises to get you to reposition the way you see the problem, sort of

reposition your take on the problem. But, yeah, sorry I don't have a formal definition.

[Interviewer] What makes for a good How Might We statement or question?

[D03] I think the How Might We Question doesn't suggest a specific problem, and it doesn't suggest any specific solutions, but it's open, and it kind of gets at what are you ultimately trying to achieve? I'll have to see if I can remember the How Might We we came up with this morning. It was “how might we improve students' legal analysis skills in creative and engaging ways that scale?” So it's just kind of-- you could do lots of different things. But those kind of-- the different things hint at what she's going for. So she wants the students to develop these specific skills. She wants to do it in a fun way. She wants to do it in a way that can be scaled so that she's not just a one-on-one facilitator. She would love to do that part afterwards where the students start off with this other thing, whatever it would be, and then if they have any questions, or if she wants to follow up with them, then she can do a one-on-one after that. But she wants that first part to be whatever that would be.

Divergent and Convergent Thinking. Participants described divergent and convergent thinking as a part of design thinking. This section contains a compilation of the most important verbatim statements from that theme:

[D01] And it always starts off with, "We're here to hear from you and we want this to be a positive and inviting space. No idea is bad," kind of a thing. And we would show them, this was always really impactful for people, is the

design thinking kind of flow where you come up with a lot of ideas and then you've got to constrain down to one to just want to go forward with. And then you come up with a lot of ideas again, and then you got to constrain again. And that, talking with people about, "Okay, you're about to go through this, and you're going to hate how it feels because you're going to get really excited about some ideas that we're going throw out. We're only going to move forward with one of them." And so that, I think it's beneficial when more people had to tell me about those stages.

[C06] This is one of the design thinking ideas. Divergent, convergent. Divergent, convergent. Divergent, convergent. That's a really good concept for people to have. How I work would be, get some ideas, and then go down my own path. That's convergent, convergent, convergent. Especially when a team is trying to work on it and people are going to have different ideas at different times, you have to allow that divergent and encourage that divergent.

[C07] I think a lot of it for me is the value of thinking about these progressively opening up and closing down the spaces like that. It's a framework that's useful for me and thinking about the process of having discussions and coming to decisions in general but in particular-- in relationship to trying to come up with a product or program or something that you're going to then go out and do. So, it's a useful facilitation mechanism for me.

[L01] That being said, definitely a lot of things that we do or how I think about it is lots of discovery work, lots of empathetic work, and sort of trying to do the expand and contract work too. So honing in on something, spending some time there, and then seeing what comes of that, and then kind of expanding again to bigger ideas again, and then picking something and going. So that expand and contract seems to work pretty well for us as part of a process.

Research Methods. Participants described research methods they used in design thinking. This section contains a compilation of the most important verbatim statements from that theme:

[C03] There was a lot of first of all, there was just a lot of interviewing me. A lot of sort of a needs assessment. And so then we kind of-- I think we kind of tried after a lot of hearing me out to move towards sort of a definition of the problem.

[L01] We try to get them to have some data, either if that's interviewing each other or doing something in the moment, so they have a little bit of data.

[D01] We do some work-- we do a lot of-- sometimes this involves surveys, of course, of students in previous semesters of the course to better understand what their experiences were in the course previously. And also, that lets us contrast their experiences with the future design.

[D02] We use Qualtrics a lot. And so we do a lot of surveys through Qualtrics. Sometimes Google forums. We do have this big Tableau tool. And don't know

if I can pull it up. But Tableau just gives us data back to, I think, 2005 on any courses ever offered and a bunch of things depending on the project. Some projects we've really gone into… looking at those faculty surveys at the end of a course to see what's been going on and that. And one of my favorite parts is I really like doing focus groups. So any time that we can take an assessment that drives some basic understanding that we can get some buy-in to then run a focus group to better understand, that's something-- I really enjoy those pieces.

[D04] But while you're developing a proposal, there is some informal discovery happening, too, about-- you might even sometimes be observing a classroom with the class is already underway. But that sort of is outside. And then the true discovery, I think, also incorporates a lot of that research but the formal stuff is like, okay, we're in an educational setting also doing course observations or we're reviewing all the course material, right, and doing external research, too.

[C05] One thing I forgot to tell you is we set up these - as another data collection tool - we set up whiteboards with questions in … the kitchen area, there's a big whiteboard with post-it notes, and pens where people could throw out some ideas to answer some survey questions. We wanted to supplement the traditional digital survey with something tactical-- or tactile. But yeah, more or less, it was just everybody chipped in to help out wherever they could.

[L01] We're thinking about doing a lot of empathetic listening and data gathering through an early stage. So that might be focus groups with students that might be classroom observations, all kinds of ways to try to get at the various experiences going on particularly if it's a class experience.

[D01] So this office in campus needed a new way to take attendance at a non-required event, and so we're, in the planning stages, we're like, "Okay, who else has analogous situations like that?" "Okay, well actually, athletics does because they have football games and they need to take attendance at a football game. The …concert series needs to take attendance at a concert. We've got clickers in class that are used to take attendance in class." So we invited all those people to the brainstorm. And so they were able to inform the brainstorm, and we really made a lot of progress there. But then also, one of the other benefit we realized was if that client reaches out to any of those people in the future with a question, those people have already spent two hours of their life thinking about this problem from the client, and so they can already help them.

[D04] And then I like to do a lot of research into context, basically, because I think there's other universities doing stuff around these same problems. We're not unique snowflakes. Or, I mean there are specific things about our population that need to be addressed, but-- so I like to listen, and then do lots of research, and start to feel like I have a grasp on what that context is.

Representing and Interpreting Data: Personas. Participants described creating personas. This section contains a compilation of the most important verbatim statements from that theme:

> [D03] And then putting together-- we might do a design-- or a data gallery that kind of shows-- we put together of all the data that we collected, which could be surveys, interviews, personas. That kind of thing. And then share them with the group. And we found that that's a lot more helpful than having a PowerPoint presentation and just throwing slides at them with visualizations, but just to kind of have different ways of visualizing the different data that we've collected.
>
> [D05] So those, so a couple of different times we've developed personas. For the critical thinking one, I kind of borrowed them, actually. Different groups, the [Design Team] had developed personas out of a big project that they worked on for Psych 1001, which is a big entry-level course that the university identified as being a gateway course. If students succeeded in that course, then they persisted. Or if they had trouble in that course, they had a higher chance of dropping out, I guess. I don't know exactly what-- higher success level if they stayed in that course. And I don't know everything they went through to develop those personas for that course, but because we thought that was a pretty typical student population to look at, I kind of adapted those personas myself for this particular activity with the critical thinking SIG. But we just recently developed more personas for a different

project around students in large lecture courses. And we're doing a lot of discovery work for that. And we did student surveys, and focus groups, and canvassing on campus, all of that. And what we ended up doing for those personas was we started looking at the percentages of what students said and tried to break it up so we had all the different voices represented in the persona.

Representing and Interpreting Data: Visualizations. Participants described creating visualizations. This section contains a compilation of the most important verbatim statements from that theme:

[L03] And the one that's really gotten a lot of grip to it was a unified student experience. Actually, it rose out of one of her visualization because she was trying to-- with one of the visualizations, she was trying to show all the different portals that students can enter to get services, and it was just astounding number of entry points. And she showed it through this circle diagram that people called the Mandala. And when they saw it, they were like, "Oh my God, we have really got to deal with this problem." And it was sort of the beginning of movement towards trying to unify one sort of analogous or metaphorical thread for students to sort of give them a conceptual thread to understand their experience.

[Interviewer] So you mentioned the visualization of complex processes. Could you give me some examples of things she's done to-- things she's visualized? The student experience being one of them.

[L03] Yeah. Organizations, so trying to show our IT organization and how it fits in with the rest of the campus, and particularly, how governance works. So inputs that come to us from faculty governance and administrative governance. She spent a lot of time on our financial information, visualizing that. And I don't know how many-- so we have a word called speedtype which means kind of a budget account and we have so many of those. I'm not even sure I know but it's probably in like the 50 range or 60 range of accounts. And there's flows of money in and out of those. And so she created a visual that tracked the flow of money into our IT organization, and then in some cases, from one group to another because we consume resources from each other. And then a part of [IT] to the faculty, to the students, to the staff and back. So it had these sort of arcs of flows. That's one. I don't know. Even something as simple as research data. So we often, for each project, we try to measure the impact of what we're doing and then we gather data, and then she'll work with her visual designer to create an infographic. That's on a smaller scale, but it's still taking lots of data and giving it a simple picture to show. So there's a poster downstairs that she worked on that's the large lectures.

[D01] I think it's important for the person to first reflect on how-- well, breaking down an experience, right? Which is hard for people to do because they're not used to seeing things in such minutiae. So I think, first of all, it's encouraging somebody to go through something with you but really to dive into it and understanding the whys, and the hows, and the specifics about what

they're doing, and then relaying that somebody else. So that's, I think, kind of in a nutshell what I think journey mapping is. So a goal of it would be to help you really better understand the way they experience a specific journey, a specific thing.

[D06] With the design thinking elements that we use, so we use the journey mapping, we use the sticky notes, we kind of tweaked the would statements for them. It actually allowed us to sustain this level of engagement and energy in the room that I haven't seen.

Representing and Interpreting Data: Data and Design Galleries. Participants described creating data galleries and design galleries. This section contains a compilation of the most important verbatim statements from that theme:

[D01] They did a survey, we worked together on a survey for their staff, and then we also-- I forget what it's called, but we had put up a big 3M Post-it paper at several of their locations with a few questions that people can go ahead and answer. So we collected a lot of data and then we met several times to plan the activity. And at the end, we structured the activity where because we had a lot of data, we did a data gallery. The data that they gave us; we printed it out, and we put together a data gallery prompt with guiding questions and what to look for and gave people post-its, and dots, and markers, and let them go wild on the data, keeping in mind kind of the initial, How Might We-- I forgot the exact prompt, but improve our communication or whatever.

[L02] We brought people who manage the [student one card]. We brought people from Financial Aid, Bursar. We had all of the data up on the walls and we had another design gallery, data gallery activity where we had them look at the data from their own perspectives, talk through it in smaller groups, etc. and at the end of that two-hour session, they had put together design principles for Unified Student Experience. That kind of took-- created a shared outcome, a shared product that we're all involved in designing student-facing technologies or experiences, so we should all work together to put together principles for what the student digital experience should be like. So was a fun, non-threatening way to get people work together using good data, so it's really evidence based when we put together design principles. So, yes, so sometimes we use kind of different parts of different design thinking activities in our projects.

[D03] That kind of thing, kind of what perspective are they coming in from. And then putting together-- we might do a design-- or a data gallery that kind of shows-- we put together of all the data that we collected, which could be surveys, interviews, personas. That kind of thing. And then share them with the group. And we found that that's a lot more helpful than having a PowerPoint presentation and just throwing slides at them with visualizations, but just to kind of have different ways of visualizing the different data that we've collected. And then letting everyone just kind of walk around the room sort of like in a reception setting. So there's food, and beverages, and stuff like

that and they can kind of just absorb the information at their own pace and then we might have them have little stickies and kind of mark what resonates with them, which is kind of neat because when you start seeing clusters of different-colored dots and stuff like that, that's something that we might want to talk about and hone in on. And then from there, we might want to put together some recommendations and then they'll review them. And they might walk away with those recommendations and do their own thing or they might ask us to engage and so we'll work on a project with them to implement some of the recommendations that we've done.

[L03] What else do we have? Data galleries. So we gather data, and then we slap them up on the walls, and then we have people walk by. And we'll even have a meeting where everybody's invited, and then we'll say, "Now get up and walk around." And then they take stickies and the put comments about the data. So what does the data suggest to you? Is there a question? Is there a critique? And then they just stick them up there. We also do design critiques that way, so we'll design something like an infographic, and we'll just toss it up there, and then we'll write please comment. And it'll be up there for a whole week. And just someone's having their coffee, they're like, "That bugs me." And they'll put a little sticky and be like, "What about this?" Or, "This is great." And then the person at the end of the week grabs it and goes, "Man, I got some critiques of this one artifact."

Brainstorming. Participants described brainstorming practices they used in design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [C03] So I felt like their systematic approach executed on the empathizing and the looking into the client's experience, into the user's experience, into the learner's experience. I think it was very explicit. That's what we want to start with. It was very explicit about let's throw out ideas and let's do brainstorming right and well. Let's do it in a way that doesn't inhibit people, but instead just really kind of gets their creative juices flowing and let's have an energy and excitement about that.
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> [D01] We got pretty good at the just general two waves of brainstorming with-- we're finding kind of specific-- let's see here. We would host like one-and-a-half-hour, two-hour design challenges on very specific things, and go through two waves of brainstorming with everybody. And so that's kind of something that we got into.
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> [D01] And so then we present the challenge, have a stakeholder present any constraints or requirements. We would typically do one wave of brainstorming on your own. Everybody then shares out their ideas, and then we would cluster, and then we would figure out one-- the stakeholder would figure out one way forward. So let's further ideate on this solution. And then we would dive into that one a little bit more.

[D02] We go through a very basic discovery kind of work. We're using a lot of 3M stickies and other things you've seen floating around our office to try to get everybody that's in the room, those stakeholders, to give their perspective on things. And then from that, we kind of try to brainstorm possible solutions from what they've discovered or what they've come up with and focus in on one thing to be able to prototype forward.

[L01] So I think even in our brainstorming sessions, we still tend to go with these very tried and true tracks. Even when you try to say, "Let's be really creative and get outside the box," the ideas tend to recycle. So I think design thinking has pushed us to do a little bit more of that kind of off the tracks, try to push us outside our boundaries a little bit. But we still struggle with that a little bit too. But I think the idea, and the process, and the mindset has gotten us to be more creative.

[C01] And then we brought objects from the-- so children's books or like looking at this anatomical arm. Or, I think, we had a prairie dog. We had a plushy. I guess we didn't bring any real specimens of prairie dogs. But being able to have these kinds of inspiring objects I think is helpful.

Decision Making Techniques. Participants described decision making techniques they used in design thinking. This section contains a compilation of the most important verbatim statements from that theme:

[D03] And then putting together-- we might do a design-- or a data gallery that kind of shows-- we put together of all the data that we collected, which

could be surveys, interviews, personas. That kind of thing. And then share them with the group… And then letting everyone just kind of walk around the room sort of like in a reception setting. So there's food, and beverages, and stuff like that and they can kind of just absorb the information at their own pace and then we might have them have little stickies and kind of mark what resonates with them, which is kind of neat because when you start seeing clusters of different-colored dots and stuff like that, that's something that we might want to talk about and hone in on.

Prototyping, Testing, and Iterating. Participants described how they developed prototypes of ideas, tested prototypes, and iterated on concepts in design thinking. This section contains a compilation of the most important verbatim statements from that theme:

[D01] We try to then take those learnings to then inform the prototyping of a solution or redefining the problem and then prototyping a solution. And then we try to iterate a little bit.

[D01] I like a lot of the very positive ideas and openness of the process and inclusivity of the process. And then I love the idea of, in principle, of iterating-- prototyping and iterating, I think there's a lot to that. It's definitely hard though when you've got 20 different projects on your plate or whatever, so.

[D01] We prototyped the spaceship downstairs. It looked really great in our minds and in our prototype. We even had an environmental design student

actually make a real prototype of it on paper. Then we handed it off to the engineering students who were supposed to build the spaceship over Christmas break. Well, they got started on the spaceship, but we ended up with three walls that were huge and nothing on the walls yet. And that's how we started the semester when we were supposed to be filming at that point. And so we had to just hit a big pause button on that project. And now the walls are still sitting in the basement of engineering, and now summer just passed. We didn't use them, so I think that's probably dead. So you've got big ideas, but then sometimes it's hard to make it happen on our academic schedules and stuff.

[D02] And then one thing to follow up with is-- it normally comes back in at the end as we're iterating or if we're prototyping. We normally revisit the design thinking to see, "Are we really doing what we meant to do? Are we hitting the goals that we had with a scope that's out there?" And so it's a way of kind of, at the front, looking at any projects, but also revisiting any prototypes we're trying to do just to see if there's something that's missing or we've just been too close to the fire to know what's going on.

[C03] And then this idea of the rapid prototyping. So, I mean, to me, that's the essence of design thinking process as a complete amateur, somebody from the outside looking in, but somebody with that word design very important to me to begin with.

[L01] And then we've kind of just built in so there's some discovery work and there's some prototyping. So we think about how we take the data we've learned and start to prototype what design might look like whether that's a course or whatever that artifact might be, oftentimes it is a course. Prototype it test it with folks, iterated on it for a while, all the while trying to do a good amount of assessment as we are building these prototypes. And then launch something and continue to revise, and iterate, and assess. And then we try to also then build in that process, kind of what the handoff or transition would look like.

[L03] So it basically looked like there's a How Might We Question, there's a lot of data gathering. You come back, you sort the data, you look through the data, you look for patterns, and you narrow down on one particular thing you want to work on. You do a prototype of it, you critique it and refine it. And so we have time set aside to do that. You've seen the LEGOs down there. We've got all kinds of materials, modeling clay and post-its and sometimes you'll see us go all the way to prototype. Usually, we don't, we often go, "Oh, we should have." But I think in the actual LXD projects, they definitely prototype because what they're prototyping is a new class. So the arc of that expansion contraction and happens over a semester, maybe a semester and a half, two-semester period of time.

Student Feedback and Involvement. Participants described how they involved students in design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [D01] We really see the role therefore of prototyping things and getting a lot of user feedback. That's one thing that I realized was really absent from our work originally was the student— the feedback and the experience of the students. We were designing for the students but we were designing for them not with them necessarily. And so that was a challenge that took us a while to really kind of figure that out…[we] brought in a number of students that we were able to really lean on a lot for that support. So that student informed design has been a lot of what we do. We try to really— in that realm too, we try to really design for stakeholders.
>
> [D01] So for instance, in this class, the faculty member wanted the students to do a skit. Every day, he wanted a new team of students to do a skit in front of a large lecture course… So we really got behind the teacher and tried to figure out what the teacher thought the skits should be and what the assignments should be like. But then we actually crafted the assignment with a student team that helped us actually write it up, think about the logistics for it, because if— you really need— it's really easy to, I don't know, create an assignment in the wrong way, so it's not going to be successful. But this assignment was incredibly successful, and I think one of the reasons is because we kept asking the students, "Okay, should we say it like, or should we say like this? Should

we put this kind of requirement in, or will the students be mad that we are telling them to dress appropriately the day of their skit?" And then student team would be like, "Well, that's crazy. They'll dress appropriately." Just little things like that. So that went through a lot of drafts with the students and came out really great.

Assessment. Participants described assessing the outcomes of design thinking based work. This section contains a compilation of the most important verbatim statements from that theme:

[L03] And I always add to the design thinking sort of an assessment loop so … And so I try to have them make sure we always have an assessment around it so that it's not just-- well, the worst thing I heard in critique of design thinking was one of our senior vice-chancellors said that our research dean, or vice-chancellor, had people go on a day-long retreat to do design thinking and what they did was they planned a party. And that pissed that guy off so bad. He's like, "You wasted a day of my time to make me plan a party." And what the person was trying to do was use a non-threatening focus to learn the methods, but what he got out of design thinking was it was a bunch of fufu goofy stuff. And so that's why I always had that assessment piece that we're aligned with. We have good outcomes. We don't experience as planning a party. We're actually improving teaching. We're changing teaching, at least.

Pre-Mortems and Post-Mortems. Participants described pre-mortems and post-mortems as a part of design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [L03] Then we have a thing called a pre-mortem where we get together with the professor and we say, "All right. You're going to work with us on this project. Envision the end of it and you failed. And then let's explain why you failed. And we work backwards. And we come up with all these sticky notes about fail because of this, fail because of this, fail because of and then we cluster them into groups, and then we say, "What can we do to try to stop that failure from happening.
>
> [D03] But part of the design thinking thing we do the whole entire process-- which one thing that I didn't include was, part of it is after the implementation phase we do also do a lessons learned and a postmortem. And then on the front end, we might do a pre-mortem like, "What could go really wrong?" And so then that's a-- it's a proactive way to thwart anything bad that could happen. And you can't predict everything, but it's fun…one thing we didn't anticipate that we kind of laugh about in a way because it's sort of funny, but it's kind of not funny, was, "What could go wrong?" And apparently, you could have bed bugs in a classroom. So that actually made us-- so during the semester they had to find an alternate room to house I don't know how many, a few hundred students while they were doing the bed bug abatement, things like that. So, yeah. The lessons learned at the end and then a postmortem,

those are really great things because-- we'll learn something from every single project that we've ever done and it helps us with subsequent projects or projects that happen to overlap but are just right behind. And so all of our projects have informed us for the subsequent projects. And so it's been a really great learning experience and because our iterations-- I mean, all these projects they happen pretty quickly, that you can apply what you learned right away to the next project.

Design Heuristic. Designer 03 described a design heuristic the Design Team created. This section contains a compilation of the most important verbatim statements from that theme:

[D03]And so, we have this design heuristic where when we create something we have to compare it to this design heuristic and make sure that the content, the layout, everything is sound. And that includes accessibility and that kind of stuff. And aesthetics… So the whole idea is basically to define- if you create an artifact for a project, this is the purpose of what those artifacts would be. And so, they're broken into different categories. The first one being the content that's on there. And so, here we have the information design. So this is looking at that the content is relevant, it's organized and logically presented, chunking- you know. Things are chunked together like modules or units and things like that. And then the contrast and proximity. We're looking at clarity and comprehensiveness. So these things, they inform the design of our artifacts, but what's interesting is that in the process right now this is one of

the closeout activities that we need to do. But we just decided- well, we really didn't decide. We brought up the fact that this really actually should be on the front end to inform how we develop our artifacts. And then, go back and make sure that we designed it in a way that actually fits this. So this should be more on the proactive. And then, did we do this on the back end? So this- it goes with concession, correctness. Then we have legibility of text. Then it moves into visual design. So it depends on what it is that you're creating.

Project Hand-Off. Participants described handing off a project once the design thinking project is complete. This section contains a compilation of the most important verbatim statements from that theme:

[D02] And the goal at the far end is after we get the implementation, we get some lessons learned out of an iteration or so, then we'll hand this off to that group that came to us originally for them to move forward. And we might do maybe a 10-hour consult the-- after the project has ended to give some ongoing support. Normally it becomes something technical that they need a little extra help with. But that's certainly how we seem to roll with it. So it's kind of like big discovery phase, then we kind of narrow down to one thing, then we prototype, and then we kind of implement, and then we get to the handoff at the end has kind of been our pattern so far, so.

Documentation. Participants described documentation they produced as a part of design thinking. This section contains a compilation of the most important verbatim statements from that theme:

[D03] We document all of our design thinking-- I'm sorry, design challenges. So we have a agenda that's kind of like a-- it's a Google, whatever the presentation that they use. So we have that. We'll have a notetaker. So we've got all that. And that's more internal to our team, but if we end up doing a project then we'll create a charter. We have members of our team read through it to make sure it makes sense before we send it out to the [IT] project people to-- well, the directors to read and approve. And then once we get started on the process we do a web page, a [Design Team] web page that kind of highlights what's the design challenge, what's the problem, and how does it align with our strategic initiatives or our goals, and then who are the project partners. And then everything we document in our Google drive. And so some of the things we-- I mean, we make them available to anybody who asks for them, but some of them are internal, for internal tracking. But the web page, obviously, we want to be transparent with what we're working on. And then at the end, the project you might include creating a report or a set of recommendations, which are shared out to our business sponsor, the project partner, that kind of stuff. And all of these- all of our- everyone on our team communicates. So we all know what's going on with all of the projects. And then at the end when we do lessons learned in a post-mortem, those are shared up to the project management office. So it's part of our process.

Spaces and Tools used in Design Thinking

Participants used a variety of spaces on campus including a space in the Design Team office area, the Exploratory, which was set up to support design thinking activities. The Participants valued and worked to create spaces for design thinking were welcoming, supported people in being collaborative and creative, were easy to move around in, and helped people to get out of their normal routine. Participants discussed features they sought in spaces such as moveable furniture, rolling chairs, whiteboards, a video monitor, a large amount of wall space to hang things on, and the presence of natural light.

The Exploratory. The Design Team created a space, the Exploratory, which they have used as a space to support design thinking work. The Exploratory is located in Design Team office area on campus. It has a video monitor, rolling tables and chairs, open space surrounding the tables, and a beverage station in the space.

> [L02] What we try and do with [the Exploratory]…is, you go in and it's fun, it's non-threatening, there's always food, something to drink, so it's really meant to be comfortable. But then also, the mindset that you have when you're in that space, so kind of the open mindset and flexibility, trusting the people that you're working with in that space.

In the Exploratory, the Design Team gathered materials to support design thinking work such as a large timer, many different colored sticky notes in varying sizes, markers, tools for quick prototyping such as LEGOs, modeling clay, and pipe cleaners. The Design Team used large foam-core boards as a space for gathering

sticky notes or for presenting data. The boards were stacked when not in use to save space.

> [D03] We purposely designed [the Exploratory] to be this creative space where if you need to be tinkering with something to think, we have LEGOs, and we have lots of different kinds of things to play with to kind of promote really broad thinking… It's fun. It's nonthreatening. It's colorful. Yeah. It's kind of funny because that space is sort of a corridor and so we have people walking in and out that aren't even related to our group, they might just be walking through a meeting and stuff like that. And so it's a very informal space.

Figure 4. The beverage station in the Exploratory. This photograph shows the beverage station of the Exploratory.

Figure 5. Furniture in the Exploratory. This photograph shows furniture in the Exploratory.

Figure 6. Furniture and tools in the Exploratory. This photograph shows furniture and design thinking tools in the Exploratory.

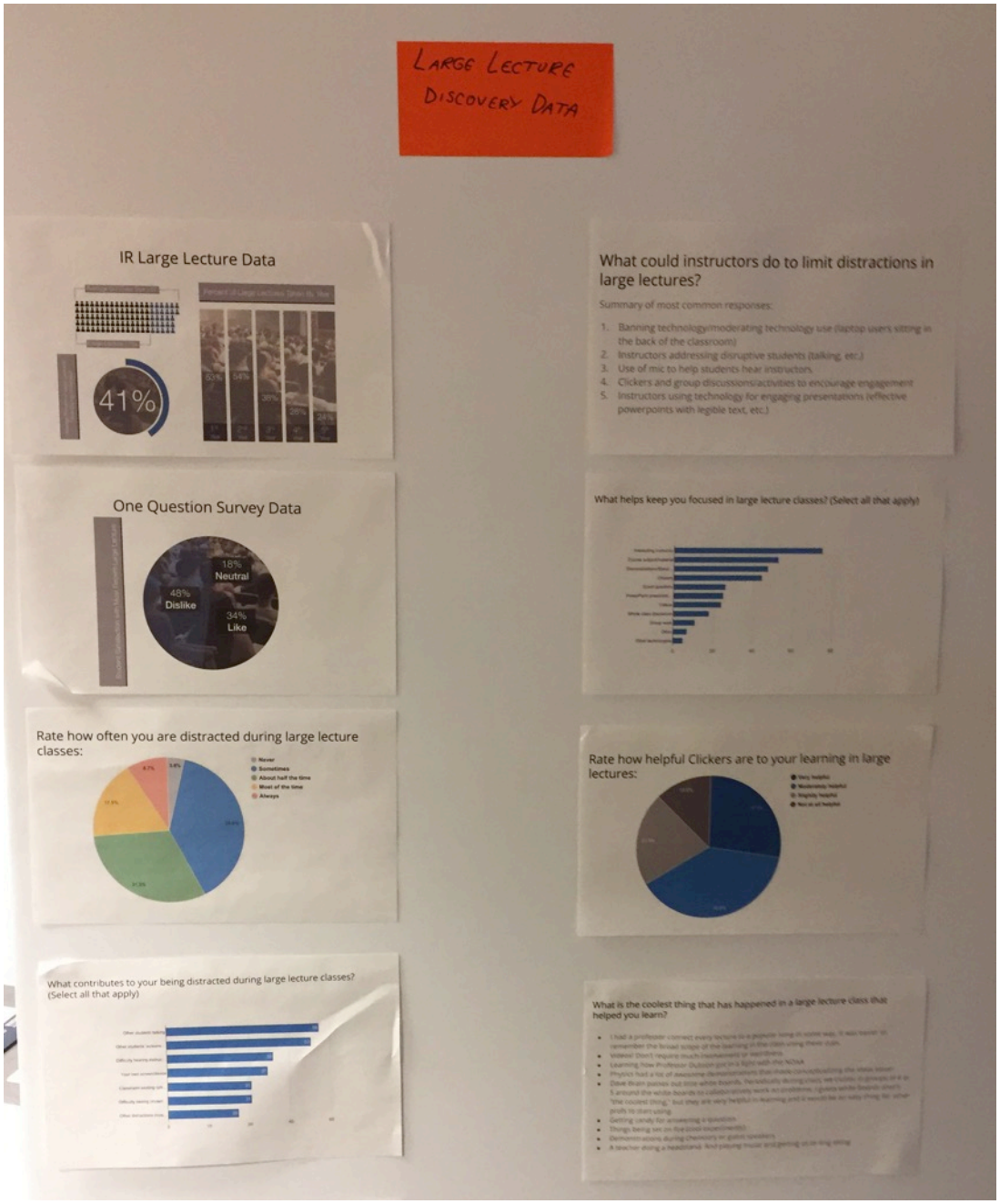

Figure 7. Data on foam core boards in the Exploratory. This photograph shows data printed on sheets and attached to foam core boards in the Exploratory.

Figure 8. Clustered sticky notes in the Exploratory. This photograph clustered sticky notes on foam core boards in the Exploratory.

Participants used a variety of materials and tools as a part of design thinking. Items included sticky notes of various sizes and colors, notebooks, markers large pieces of paper hung on walls and large foam core boards as places to collect ideas and sticky notes, foam core boards for holding sticky notes and data printouts, a large timer, whiteboards, video display monitors, and items used in prototyping such as LEGOs, modeling clay, and pipe cleaners. Designers discussed using the collaboration software, Trello, survey software tools through Qualtrics and Google, and the data visualization software, Tableau.

Spaces and Tools used in Design Thinking Coded Data

Spaces and Tools. Participants described spaces and tools they used for design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [Interviewer] Do you have a dedicated space where you do your design thinking work?
>
> [L02] Outside. And yes, we have what we call the Exploratory, which is this collaborative space with a lot of prototyping tools like LEGOs, and Post-its, and just stuff that we-- like sticky - how do you call them - playdough, and stick little cords, whatever, shoelaces, things like that. So we have a lot of these kind of fun prototypy tools. So we have that dedicated space. But what we also like to think about is, is taking that space on the go. So we actually have a sign that says exploratory, and we have a smaller sign that's printed so

we can actually, literally, take it. Take the Exploratory with us wherever we go. So if we end up going to a client space, we usually bring-- I've never brought this before, I don't know, but that's the idea behind it, to take it wherever we go. But we usually hold our prototyping tools and when we-- we did a ton of design thinking experiences last year and one of the things that we decided that we really need to figure out a good solution for is just, how can this portability for going to that client space across campus, we don't want to deal with two car trips to get our stuff. We we're trying to look at a cart or something where we can easily take our prototyping tools with us. So there's a dedicated space but then we try to take that space with us, where we go.

[D03] And then we have-- we even have a beverage bar, like coffee and tea and whatever. And I think that helps. I mean that kind of gets people at ease. So I think a lot of different things make it a comfortable space to just hang out, be productive, think, that kind of thing.

[Interviewer] So what's it important for a space to have or to be able to do for you in support of design thinking?

[D02] Tables that can be moved. That's always what I'm looking for. Walls that we can put stuff on and hang stuff on. And there's a couple of classrooms that are really, really useful. But we spend most of our time on sticky notes and big sheets of paper. So we spend so much time planning things out, doing stuff with those sticky notes and big sheets of paper that as long as we have a spot to put all that stuff, we're in pretty good shape. If we don't have that then

we try to find a different space. It's useful to have a monitor to be able to project what we're working on. And we always have that intro presentation to keep us on time, make sure that we're not getting too off track, that kind of stuff. And me, personally, I always like to have kind of like a parking lot, a place for ideas that we're not going to act on right now. But they're great ideas we can revisit at a later date. And so I think having some space we can put ideas that don't quite make it to the top that we're going to prototype or either or iterate on.

[C01] So I'm always on the hunt for the perfect space for different things and sometimes it doesn't always happen. So we were in a conference room that was part of the rec center. So, unfortunately, it did not really have windows. But it did have walls which is really helpful for chart paper and things like that. And there were some shelf spaces. So it was a space where we could set up tables and chairs in small groups and kind of move the furniture around pretty feasibly and easily. So it worked just fine. Maybe not the most inspiring room. Although they did have a graphic of [mountains] in there. But, yeah, I guess my ideal space has whiteboards and windows as well. But just for the kind of openness and inspiration of natural light and seeing outside and whiteboarding for just being able to kind of express ideas fluidly and change them up, so.

[L01] So outside of my office and kind of our offices ring this open space and that's where most of our design thinking tends to happen. So we kind of have

a table in the middle. We have a lot of wall space around the outside and so we will use that space as kind of-- we call it the Exploratory. And then we have a space upstairs which is kind of a bigger open-office space, which used to be our main open space and that was called the Colloboratory. So that tended to be our space where we would do some design thinking. But this downstairs space is more true now. So when we have these design thinking experiences, we tend to bring people over here. Not exclusively, sometimes we'll do it in their space, but their spaces tend to be the typical conference space or something like that. So here, we like it because we have all the sticky notes. We tend to put up big white sheets of paper, some of the more traditional design thinking artifacts. We have wall spaces. We have a big monitor. We can display and, yeah, it's a big open freeform space. So that's where we tend to most of our work. And I've definitely heard from people outside of our group that-- and especially from our kind of up-the-line supervisor, when we talk about doing these things, she's like, "Yeah, you should definitely bring them over to your space though. Have them come to your space instead of doing it in their space." Because she feels like this space is kind of different, the energy there is different. And it helps to get people outside of their usual office routine and come over here.

[D04] I mean, people love Post-its. I don't really like them. Those are a little too fragmented for me. I just like a notepad, honestly, where I can just sketch stuff out. That could even be a throwaway. A big board is nice too. Just a

whiteboard here is really nice, especially if you're with a group to kind of start displaying what's kind of emerging as the group talks.

[D03] Well, so we do use Post-it notes and we purposefully have a whole bunch of different colors, I mean a lot different colors. So even if we're going to do a brainstorming session, we say, "Hey, grab some Post-it notes." Chances are you're going to pick a color that works for you and they're not going to be all yellow, that kind of thing. And then we have different color Sharpies. We have LEGOs. We have these weird-- they're gross to me because I don't like touching them, but these wax sticks that you can bend and mold to different things. And… these abstract squiggly pieces that can interlock with each other, but they're made in such a way that you can't make anything symmetrical, it has to be-- I mean it ends up being really abstract. But I think those kinds of things-- I mean we have a lot of kinesthetic learners, so those kinds of things, once you see someone doing it, like, "I want to play, too." And then everyone starts with them, so. That really helps.

[D01] I've also got a Trello board of design thinking stuff that I've come across. So tips for doing specific activities, just to get people kind of in a creative mindset or just feeling comfortable. I'd throw those sorts of things on there. How-tos for journey mapping, cool-- yeah, any cool activities like that, I've thrown onto this Trello board. So if I know I need to do a kind of activity, like we're about to meet with a new group, and we're like, "We're looking for

something, and I'm not exactly sure what. This kind of thing is too much." So I'll just hop on there and see if I've forgotten anything.

[D02] We use Qualtrics a lot. And so we do a lot of surveys through Qualtrics. Sometimes Google forums. We do have this big Tableau tool. And don't know if I can pull it up. But Tableau just gives us data back to, I think, 2005 on any courses ever offered and a bunch of things depending on the project.

Design Challenges – Design Thinking as an Event

The Design Team hosted Design Challenges, ninety-minute to four-hour events, in which the Design Team worked with a client group to go through a design thinking process to address a problem the client group identified. Client groups have included teams from other parts of the university including IT, a campus museum, and Continuing Education. Designers described the Design Challenges as having a standard structure that has been modified based on the needs of the client.

Initial Client Meetings. Prior to an event, the Design Team identified designers to take on the role of Leads for the challenge. The designer Leads met with members of the client team for an initial meeting. During the initial meeting, Designers provided an overview of the design thinking process to be used in the Design Challenge and worked with the client to draft an initial How Might We Question that was used as the initial framing of the problem to be addressed in the challenge. Designers also asked clients to gather some data to be used during the Design Challenge.

Design Challenge Event. During Design Challenges, members of the design team met with members of the client teams over periods of ninety minutes to four hours. During events, groups went through a structured design thinking experience to address the How Might We Question developed in the initial meetings with the clients. Design Challenges have taken place in the Exploratory and also in other spaces on campus. To guide Design Challenges, the Design Team prepared side presentations that provided an agenda for the event, the problem statement to be addressed, an overview of design thinking, the Design Team's design thinking process diagram, the design thinking stages that will be addressed during the event, and tips and guidelines for participation in the various activities. Design Challenges followed the Design Team's design thinking process diagram (Figure 2).

Some Design Challenge events focused only on certain portions of the design thinking process during the Design Challenge event. For example, one Design Challenge focused primarily on the Ideate and Prototype stages of the process (Figure 9).

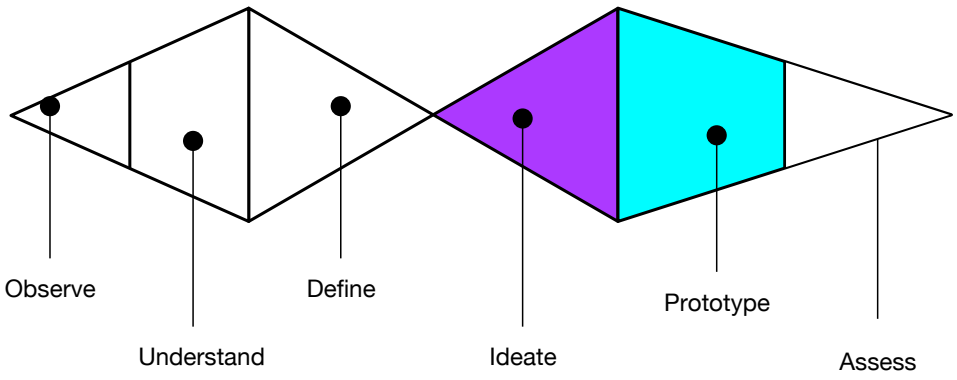

Figure 9. The Design Team's design thinking diagram highlighting a portion of the process. This diagram shows the Design Team's design thinking diagram with highlighted portions of the process.

Design Challenge Agenda. Based on participant descriptions and Design Team presentations and documents, a Design Challenge might follow the following structure and timeline. Some documents and participant descriptions structure the events by the phases of the diagram, other descriptions and documents do not explicitly use the diagram phases. I have included the diagram phase titles hear for clarity. I have also included sample time allotments for activities as listed in a Design Team Design Challenge guide document.

Introductions. Participants are invited to share their name, their connection to the Design Challenge, and their role in the Challenge.

Overview of Design Thinking. The Design Team provides an overview of the Design Thinking process using the Design Thinking diagrams (Figures 2, 8)

OBSERVE

Hearing from the Clients: The Challenge (3 min). The Design Team invites the clients to share the problem they are trying to solve, describe their surrounding context, any knowns and unknowns in the situation and any constraints they are working with.

Stating the Design Opportunity (2 min). The How Might We Question is shared with the group.

UNDERSTAND

Asking Clarifying Questions (5 min). Participants ask clarifying questions to better understand the problem.

Data Gallery. If the clients have data to share and examine, they may conduct a Data Gallery exercise as a part of the Design Challenge.

Brainstorming Possible Solutions (10 min). Participants are invited to brainstorm possible solution ideas to the problem. Participants may be encouraged to follow the brainstorming rules or guidelines for capturing ideas on sticky notes provided by the Design Team.

Identifying Patterns (5 min). Participants look for patterns that may have emerged in the brainstorming. Participants cluster the post-it notes into similar groups and organize the solution space.

DEFINE

Focusing the Problem (3 min). The Participants and Decider are asked to select which solution concepts they would like to move forward with in the Design Challenge.

Reframing the Problem: How Might We…(2 min). Participants are asked to reframe the problem statement and rewrite the How Might We Question.

IDEATE

Brainstorming Round 2 (10 min). Participants conduct a second round of brainstorming generating ideas for solutions to the reframed problem statement.

(Re)Focusing on One Idea (5 min). Participants and the decider are invited to select a single promising, feasible, or helpful concept to focus on going forward.

PROTOTYPE

Proposing a Strategy / Designing a Prototype (10 min). Participants develop prototypes to envision the solution. Participants are also invited to describe how they would measure success.

ASSESS

Reflecting (5 min). Clients are invited to share their feedback on the solution concepts. They are asked if they think the solutions would work and if there were there any ideas that were shared that sparked insight?

Post-Challenge Follow-Up. Following Design Challenge events, Designers have connected with clients either by email or an in-person meeting to provide notes,

documentation, and resource recommendations for learning more about design thinking.

Design Challenge Roles. Participants described several roles that people have taken on during Design Challenges.

Co-Leads. Two members of the Design Team were assigned as Co-Leads on Design Challenges. Co-Leads worked with the client to identify the problem addressed in the challenge, structured the Design Challenge event, and facilitated the activities of the Design Challenge. Designers and Leaders said that having two people to be Co-Leads on the Design Challenges helps to share facilitation work, creates redundancy in case someone gets sick, and helped build the facilitation capabilities within the Design Team.

Clients. Clients were the people or person who requested support from the Design Team for a Design Challenge.

Decider. Deciders were identified in the Design Challenge as the person who made decisions for the clients or client group during the challenge.

Note-Taker. The Note-Taker was a person responsible for taking notes during the event and capturing ideas.

Time-Keeper. The Time-Keeper was a person who watched the time during a Design Challenge.

Participants. There are many other people who participated in Design Thinking Experiences that are were not identified as performing one of the previous roles. These people may have been members of the client team, members of the

Design Team, students, or members of other teams asked to participate in the event because of particular types knowledge or experience they brought to the event. I labeled this group of people as Participants.

Design Challenges – Design Thinking as an Event Coded Data

Design Challenges. Participants discussed how they enacted design through Design Challenges. This section contains a compilation of the most important verbatim statements from that theme:

> [L02] So when people come to us and say, 'Hey, we're stuck on this problem. We really need your help. Can you facilitate some sort of design thinking experience for us?' So typically, our process starts with identifying different leads, we're going to take it on... And then next is really about sitting down with our clients and learning more about them. Ideally, we'd love to go check out their space, maybe meet with them and their team members, or if they have any data, we'd love to hear, get some of their data. Like if they're wrestling with a communication problem, for example, if it's appropriate, we ask for them to share some data that they have so we can better understand the context a little bit more. But usually, it starts with the initial client/designer meeting where we spend 30 to 45 minutes, really understanding what the problem is, their context, their culture, their politics, and then how can we help them? Do they want, at the end of our engagement with them, a solution identified where they can kind of take that on and pilot it or do they just want

some ideas to get over where they’re stuck? And that really dictates how long of an engagement we have with them.

[Interviewer] So when you were doing the 90-minute sessions with people, could you just take me through what would happen in a typical session?

[D01] So if we had outsiders, we would start off into a little bitty explanation of what design thinking is and why we're embracing that mindset today. And it always starts off with, "We're here to hear from you and we want this to be a positive and inviting space. No idea is bad," kind of a thing. And we would show them, this was always really impactful for people, is the design thinking kind of flow where you come up with a lot of ideas and then you've got to constrain down to one to just want to go forward with. And then you come up with a lot of ideas again, and then you got to constrain again. And that, talking with people about, "Okay, you're about to go through this, and you're going to hate how it feels because you're going to get really excited about some ideas that we're going throw out. We're only going to move forward with one of them." And so that, I think it's beneficial when more people had to tell me about those stages. So then we would go through and we would, sometimes, we'll do like a warm-up activity to get people into the mindset. So maybe they'll go through a journey mapping activity, or we'll lead them through-- we worked with the museum and we have them think of analogous, really fun museum experiences that they had been in the past and they had homework. It was kind of a lightning round, is I think one way this approach is called. But

they would bring in something, an artifact, to show us. And so then we would start to brainstorm with all these artifacts from other museum exhibits that had inspired those people, and then we laid out the challenge that we were dealing with that day. So that day's How Might We. And so then we present the challenge, have a stakeholder present any constraints or requirements. We would typically do one wave of brainstorming on your own. Everybody then shares out their ideas, and then we would cluster, and then we would figure out one-- the stakeholder would figure out one way forward. So let's further ideate on this solution. And then we would dive into that one a little bit more. And then that's where I wish we would often have more time for a prototyping of what we were all coming together to think about because one thing I'm realizing that people, it's hard to communicate exactly what you're thinking to somebody. And so if we have four people at the table that have a similar kind of an idea or similar approach, it's really beneficial to get them through that prototyping stage where they're actually spelling out what they're thinking in their heads because people are thinking such different things. And so it's only when you really have them go through and build it, or map it out a little more that you really understand what's in their head, if that makes sense. So that's normally what the design challenge is, like the hour and a half or so flows like.

[D03]: So this morning I met with two of the folks. One of them was the one who has the design challenge. And then the other person is the director of IT.

So since a lot of our work has to do academic technology, it's kind of nice to have him involved as well… So when we come to the Design Challenge, [a person from the law school] will probably, she'll be the decider person. She'll be the one that kind of explains to everybody with fresh ears, why are we here. Part of her committee who their challenge with increasing academic success for their students and providing support for their students to do well on the Bar Exam. And so yeah, that team, they will kind of-- it'll be a learning experience for them, but they'll also contribute to a better understanding about what the problem is. Because a lot of them have been at the law school longer than this decider person. But the decider person, she's going to have the main role of with kind of moving the design challenge along. We put together a How Might We Question this morning and then I'll send it back to her for her to kind of mull it over a little bit. And if that's what we're going with, that's what we'll start our Design Challenge with. And then, once we do the design challenge, then we do our brainstorming, and then come up with-- refine the How Might We Question. And then if we-- when we do a more refined brainstorm, then she'll be the one to kind of decide which idea she wants to go with.

[D02] Each time we do a Design Challenge, there's a basic road map of what we're trying to do, but it's different every time. It really depends on the audience, and who we're working with, what they're looking for, so I think

there is a lot of variation dependent on the group they have and where they're at when they're coming into it, so.

[D02] So normally if we have a block of time. Let's say we have three hours. Sometimes it's only an hour and a half, sometimes it's four hours. But let's say we have a three-hour Design Challenge that's out there. We normally have overview of what design thinking is. We go through a very basic discovery kind of work. We're using a lot of 3M stickies and other things you've seen floating around our office to try to get everybody that's in the room, those stakeholders, to give their perspective on things. And then from that, we kind of try to brainstorm possible solutions from what they've discovered or what they've come up with and focus in on one thing to be able to prototype forward. So a lot of our Design Challenge is sometimes we don't get much past the prototype stage, truthfully, because just getting everybody to talk is one thing. And then once you come up with a prototype, sometimes groups want to just stop for a moment and reflect before moving forward with that prototype. So that would be a block of time Design Challenge that we might have for a group.

[L01] One thing we've done is try to offer design thinking as a sort of-- we've facilitated some design thinking experiences for people. So we've found that not a whole lot of folks on campus know of design thinking. I mean, even if I just say, "Who cares about design thinking?", not very many people on campus are kind of thinking about, "Let's help an entity kind of problem-solve

in a new and different way," or even problem-solve at all. So everyone on campus is facing different problems, but they're often kind of stuck with, "We don't really know what to do or even come up with next steps or resources on campus that would be really helpful." And so we've found that design thinking or these kind of design thinking experiences were a cool opportunity to bring in different part of campus and then see and just run them through an experience without a whole bunch of long-term commitments so we're not saying we're going to help you fix your problem or we're going to design whatever comes out of this but we're going to give you an opportunity to kind of really-- zero in on the problem and invite some people from all over campus who might not talk to you otherwise. And so that's been a really cool way to learn more about what other people on campus are doing. So oftentimes we'll find somebody who's got a particular problem. We'll meet with them, talk through kind of what they think the challenge is, maybe get to How Might We kind of statement. And then also try to brainstorm who are the other key players related to that problem on campus. Then we try to invite those folks in, see if they can get a decent amount of people from other parts of campus and then our team, and we'll just do a two-hour design thinking kind of run through with them, and then send them out on their way. We don't do any kind of much longer commitment to them in those cases.

Design Challenge Roles: Co-Leads. Participants described the role of Co-Leads as a part of Design Challenges. This section contains a compilation of the most important verbatim statements from that theme:

> [L02] I've done it by rotating, so this is this past year, who co-leads a design thinking experience with me. So I've taken the lead on the first one and then purposely asked someone else to come and tag team with me… So trying to establish like a lead, co-lead situation, then the co-lead turns around and can lead a design thinking experience. So, yeah, it's about setting-- initially, it was about setting up that initial structure like how could a one-hour design thinking experience look like. And we actually have a guide for that. I can share that with you. And then over time, that's really evolved. So we have now a standing kind of presentation. We have a standing protocol, design thinking protocol. So we usually take that and adapt that to our specific context.
>
> [D03] So for the design challenge itself, I might be the co-facilitator on it, but a lot of times what we want to do is since I'm working with them on it, it might end up being one or two of the other LXD's so I can participate from that perspective as opposed to a facilitator perspective. So I might be able to kind of come at it with those eyes. We'll have… our LXD graduate assistant. She'll probably help out with note-taking for us. And then there might be a timekeeper, but that might also be the facilitator person or the note keeper. It depends on how many people can attend. And so yeah, we actually try to spread the load to make it to optimize the time that we all have together.

[L01] And usually, we try to get a couple people to be the leads. And that can be across the whole [Design Team]. And so those two people will typically--either the two people or the two people in tandem with [Leader 02] because she's done a bunch of this work, will then kind of be the lead. They'll reach out to the partners. They'll kind of do some sort of follow-up conversation with them to learn more about what they're interested in and then they'll kind of start to move that whole process forward. And typically, that results in scheduling some kind of, "Hey. A month from now in one of these design-thinking experiences we've already have scheduled on the calendar, we're going to meet with X and we're going to run through their thing." So the whole team will come in and it's facilitated by the two people who wanted to lead. So we tried over the last year, year and a half, to get almost everybody on the team to either lead or co-lead one or two of those experiences just to get some of the experience of running one under their belt.

Design Challenge Roles: Clients and Deciders. Participants described the roles of Clients and Deciders as they were enacted in Design Challenges. This section contains a compilation of the most important verbatim statements from that theme:

[L01] So what we try to do and we're getting better at, it's still tricky, is to try to define somebody on the partner team who can be what we're calling a decider or at least can be somebody who we can look to to make decisions for that group of people. And we hope that's not a sort of autocratic, I'm just the decider and I'm going to make decisions, but does it based on lots of input

from the team. But if we don't have a decider we've sort of recognized that sometimes things just defuse out. They're not sure who's responsible and for us then we struggle a little bit because the buy-in can be variable with most folks on the team. And we usually propose lots of possibilities and solutions and so we need somebody to say, "Yeah, I'm going to take that and work with my team to decide what we want to do."

[D02] I forgot to mention one thing in our design challenges that we do is we normally have a decider. So one person in the room that's going to make the final decision on what we're going to iterate. And it's not us. It's somebody, that's one of our stakeholders. And the case of some of the projects that we've been working on is that guy. And so he was the decider in our mind for a lot of the challenge that we were trying to undertake. But we normally have one person that's the decider that can take a look at everything that we've collected on stick notes, all of the ways that we've categorized that are found similar themes through what we're trying to work on, and then decide let's go in that direction. Let's go that way. And so we provide a place to have the communication and the collaboration. And then they can decide on which action they want to take next.

[L02] So the first step [in a Design Challenge] is really identifying who wants to work on this. It's usually me and then one or two other folks. And then next is really about sitting down with our clients and learning more about them.

Design Thinking Note-Taker and Time-Keeper. Participants described the roles of Note-Taker and Time-Keeper as a part of Design Challenges. This section contains a compilation of the most important verbatim statements from that theme:

> [D01] We don't always have a note-taker, but we've learned that that's really beneficial because that's one thing the clients want afterwards is they wish that they had notes from all of those ideas. And so we would take pictures of the stickies, but we wouldn't have had anybody there to have actually jotted down what was going on. And so we started including a student into those design challenges to take notes for the people.
>
> [D02] We always have kind of a main facilitator and a back-up facilitator, somebody that's going to be there to help. We normally have somebody that's more of a time-keeper and note-taker. That seems to be a really useful piece of it is to make sure that we're capturing things that need to happen, and then it kind of depends on who's in the room and what the project is.

Design Thinking as an Approach to Projects

Participants described design thinking as an approach projects conducted by the Design Team. The Design Team has used design thinking as an approach to projects including the redesign of large courses, the design of an online orientation for new students, and redesigning the student experience with the student portal. In these projects, Design Team members have used design thinking as an approach to their work.

Participants explained that many of the same processes and activities used in Design Challenges were also used in design thinking based projects. Participants said they conducted the following processes and activities as a part of design thinking based projects:

- Worked to frame and reframe their understanding of problems.
- Used the research methods listed above to form a better understanding of student and stakeholder needs.
- Displayed and interpreted data through Data Galleries, Design Galleries, and visualizations.
- Conducted Brainstorming activities to generate ideas.
- Developed and tested prototypes.
- Worked with students as a part of the design process.
- Conducted assessments of interventions.

Design Thinking Stealth Mode. In some cases members of the Design Team may not have been explicit about the use of design thinking in projects as one Leader described using design thinking in stealth mode.

> [L02] Now in projects, it's a little different just because the people that we work on with projects, at least the projects that I've worked on, folks don't really know exactly what design thinking is. So I feel like we do it like stealth mode, where we're not telling people that we're using design thinking. And I usually like to frame it as just good design that helps people understand things a little bit better. So an example of ways in which I've applied design thinking

on projects is really pairing it up with user experience research. So framing it as collecting data from us and end users or stakeholders to really understand what the challenge is and better designing for them.

Project Management. Participants explained that the IT organization has a formal process for managing and design thinking based projects follow the project management processes of the IT organization. The IT project management process required specific documentation and oversight within the IT group. Leader 03 described how using the project management process brought visibility to Design Team projects. Learning Experience Designers shared that project management is an aspect of their roles.

Design Thinking Project Roles. Participants described several roles that people will play as a part of the design thinking based projects.

Lead Designer and Second (Co-Lead). Designers from the Design Team have worked in pairs on projects with one designer as the Lead and the other designer as the Second or Co-Lead. The work of the project has been shared across both the Lead and the Second, though specific duties may have been divided based on a particular designer's skills and interests. Designers have been paired with different Designers for different projects, for example on one project Designer 03 and Designer 04 were paired together and on another project Designer 02 and Designer 03 were paired together. Additionally, the role of Lead and Second will change among designers by project so as to not create a two-tiered system within the Design Team. One Leader explained that though the pairing is resource intensive, it is valuable for designers to

have a dialog partner as a part of the process. Additionally, having a second designer on a given project has created redundancy of knowledge within the Design Team.

Clients and Deciders. In course redesign projects, faculty members have been identified as project clients, and one designer described a faculty member as having the role of decider on a course redesign project. In other projects, the client role is more diffuse as many groups on campus have a stake in the process. In the student portal redesign project, there were many groups on campus that had a portion of ownership of the tool and process.

Sponsors and Endorsers. Leader 01 described the roles of sponsors and endorsers. Sponsors were identified as an upper level leader in the IT organization, either a Director or the CIO. Sponsors granted approval for resources from the IT organization to be dedicated to a project. The Endorser was identified as a person in academic leadership, such as an Associate Dean, who provided approval for faculty time and resources to be dedicated to a project.

Students and Stakeholders. Designers described how students and stakeholders were brought into design thinking based projects. In the design project for a large course, a team of students was hired to help develop and test prototypes of activities and assignments for the course. In another course redesign project, the Design Team discovered that the teaching assistants for the course felt unprepared and disconnected from one another and that the faculty members did not feel confident in the teaching assistants had the skills to fully support the faculty members. Following that discovery, the Design Team worked with the faculty

members and the teaching assistants to develop a training program for the teaching assistants.

Design Thinking as an Approach to Projects Coded Data

Design Thinking as an Approach to Projects. Participants explained how they enacted design thinking as an approach to projects. This section contains a compilation of the most important verbatim statements from that theme:

> [L01] So [the Learning Experience Designers] are doing these bigger campus wide projects that might last anywhere from 6 to 12 to 15, 18 months. And they tend to, again, be somebody who comes to us or approach to us a problem or a challenge, maybe in their teaching, maybe curricular design and we'll work with them for a chunk of time. And so in that we've sort of taken some of the design thinking ideas, processes, mindset, and built that into our process of thinking about discovery. We're thinking about doing a lot of empathetic listening and data gathering through an early stage. So that might be focus groups with students that might be classroom observations, all kinds of ways to try to get at the various experiences going on particularly if it's a class experience. And then we've kind of just built in so there's some discovery work and there's some prototyping. So we think about how we take the data we've learned and start to prototype what design might look like whether that's a course or whatever that artifact might be, oftentimes it is a course. Prototype it test it with folks, iterated on it for a while, all the while

trying to do a good amount of assessment as we are building these prototypes. And then launch something and continue to revise, and iterate, and assess.

[Interviewer] So could you tell me a bit about your design thinking process?

[D01] So it depends on what we're working on but for big projects, they always start with a discovery phase where we are really trying to learn that lay of the land and-- because we don't always work with these same offices, we'll often work with a totally new group on campus that we've never worked with through a projects. And so a lot of starting up that process is getting to know who else's involved in the process, what the opinions of the students are. And so we really try to take some time to learn the landscape that we're dealing with. So we do a lot with discovery work. We try to then take those learnings to then inform the prototyping of a solution or redefining the problem and then prototyping a solution. And then we try to iterate a little bit.

[D01] So the design of this pathway of this most recent course was pretty-- we tried to follow a lot of the design thinking principles throughout. And one thing we really did a lot with was we designed with students. So we worked with students to figure out what they wanted, but then we also built everything with that student team, because we realized that we could only-- we didn't know exactly what the students would want in activities. So we're creating activities we had never-- we didn't really think they would want to do.

[Interviewer] So could you take me through kind of some examples of how you enacted design thinking? How you use it in your daily work?

[D03] Well it's hard to kind of focus it into a daily work because we kind of use design thinking along the process of an entire project that might be, you know, maybe three months long, it could be a semester long, it could be a year long, that kind of thing. But we always actually try to think about things from that perspective I think. Whether we are approaching, what it is that we have to do today versus what it is that we are trying to accomplish in the whole bigger picture, in the long run. But what design thinking has done is really brought us closer to learning more about a lot of the problems that we're trying to all have to do with helping learners get the most, the best experience out of their time here, whether that is in a classroom, outside of the classroom, academic, non-academic. And so it's been really great to involve those students in our processes and get a better understanding of where they're coming from and what their needs are.

[D02] And in design thinking for our work, thinking about an overall project that might be, let's say, three to nine months. Sometimes they're longer than that depending on what we're undertaking. Then we really try to use that design thinking up front to better understand what we're doing, collect as much data as we possibly can. Then we'll regroup normally with our group and a couple of other stakeholders that are involved with this project, whatever it might be, and then be able to start saying, "Well, here's what we've learned so far. Which parts of it should we prototype? Which things do you want to move forward with?" And sometimes it's an entire course. Let's

rebuild an entire course. Sometimes it's a program. Let's talk about a brand new program or a minor, let's say. And then sometimes it's something smaller like a couple course elements. We want to do this differently with our students. Normally because we work with larger classes, a couple of them are 14-, 16-hundred people classes that we're working with right now, there's always kind of a little block or a stop point every once in a while where we're kind of checking in before moving to the next phase of doing those different elements.

Project Management. Participants explained how project management was an aspect of their design thinking work. This section contains a compilation of the most important verbatim statements from that theme:

[D04] There's a lot of project management that comes into our roles… you have to be the one who's responsible for the project timeline and who's doing what and when.

[D02]…The LXD is really more project manager. We're deputy PMs for the university. We go through training to get that certification or whatever they call it, all these little badges on some people's computers. But yeah, basically what we do is we try to solve problems.

[D03] So at the front end, we have that charter. We document all of our design thinking-- I'm sorry, design challenges. So we have a agenda that's kind of like a-- it's a Google, whatever the presentation that they use. So we have that. We'll have a note-taker. So we've got all that. And that's more internal to our

team, but if we end up doing a project then we'll create a charter. We have members of our team read through it to make sure it makes sense before we send it out to the [IT] project people to-- well, the directors to read and approve. And then once we get started on the process we do a web page, [a Design Team] web page that kind of highlights what's the design challenge, what's the problem, and how does it align with our strategic initiatives or our goals, and then who are the project partners. And then everything we document in our Google drive. And so some of the things we-- I mean, we make them available to anybody who asks for them, but some of them are internal, for internal tracking. But the web page, obviously, we want to be transparent with what we're working on. And then at the end, the project you might include creating a report or a set of recommendations, which are shared out to our business sponsor, the project partner, that kind of stuff. And all of these- all of our- everyone on our team communicates. So we all know what's going on with all of the projects. And then at the end when we do lessons learned in a post-mortem, those are shared up to the project management office. So it's part of our process. So those- there are things that we have to do with every single project.

[D03] I mean, I really can't say anything bad about design thinking because the thing that I actually don't like that has come out of this is more project management. All of us are educated. We're not project manager per se. But having kind of-- the cat herding thing is the hard part, but that's not really

design thinking. I mean, it's just-- when you're collaborating with other folks, the part I think that would hard is you come to the table. We have action items. Everybody has to do different things by a certain date. And while this is our focus-- I mean, this is our primary work. Well, for a faculty member, this is one of the things that they're working on. And they have a bazillion other things that they're working on. And so it's hard to keep them on track when you have absolutely no control over that. And so we've learned to just okay-- And do what we can to do the cat herding.

[Interviewer] And could you please describe the work that you do as a Learning Experience Designer?

[L03] And luckily, we stumbled upon the idea of— so one good thing about IT organizations is they're usually pretty good at project management. So we said, "Okay. Any project that comes out off of our group has to be a chartered project" And so it goes through this robustness that everybody else goes through and accountability. And so each week, we report on status and say what we're doing. And we report to the directors. And if there's a need for resources, we can ask for resources. If there's a need for people inside of [IT], we can ask for that. And so that's the way I inform my manager who then informs the rest of the organization what we're doing because all of our projects have visibility all the way up to the directors and CIO.

Design Thinking Project Roles: Lead Designer and Second (Co-Lead). Participants described the roles of Lead and Second or Co-lead people played as a

part of the design thinking based projects. This section contains a compilation of the most important verbatim statements from that theme:

> [L03] One of the thoughts I had was pairing people up. I thought they need a dialog partner. They don't want to just be in this echo-chamber all alone working on these design problems. So we made the choice consciously to make pairs and have one be the lead…but they needed a dialog partner. And so I think that was just an intuitive thing in my part. But I think it ended up being a good choice. And we've kept that up now. Usually, most projects have two people. It's an expensive thing. But I don't know how else you can do design without being able to have dialogs.
>
> [Interviewer] Thanks. When you're doing these projects, are you working as a part of a team? On let's say a course redesign project?
>
> [D04] Typically, but I think-- I mean, yes. Yes. Typically the way we work is there's two co-leads. If not, if the project doesn't merit that, then there's a lead and sort of a support. You end up doing a lot of the same work together, but yeah. Always in a team, for sure.
>
> [Interviewer] What Do the co-leads do on the project?
>
> [D04] It really depends on someone's individual interests and skills. I think the person who's designated as the lead-lead, they take a responsibility for organizing all the meetings we have to meet, being the primary contact for everything. But other than that it really divvies up based on individual skills. For us, I mean we're a really small group, so we're not the super-regimented

project management group. So it really is pretty flexible based on whoever is strongest at what or most interested in what about a particular project. That might not be a useful answer but it really is totally dependent on. So, for instance, I probably seem really disorganized when I'm talking to you, but in my work process I'm pretty organized, and so, when I'm working with someone like [Designer 02] who's a much more people-orientated person. He's much less structured than I am. I'll do some of that work related to structure and related to well, don't we have to test these eight aspects of this thing? Not, just this thing, this one thing. So I'll tend to take on that role with someone like [Designer 02], but if I'm working with someone like [Designer 03]. [Designer 03] is super organized and far more regimented about things than I am and far more process oriented than I am. She'll be in command of that and I'll do whatever she throws at me, so deeper testing around one particular area or since she's part-time if there's research involved in a product. I'll do that since I've time for some of that deeper reflection. It really depends, so those are a few examples, but it's really not super specified I think for us.

[L01] So actually, I hadn't really thought about it but it sort of works out somewhat similar within the LXD team, which is a pretty small group. There's only four LXD individuals. For projects, we've tended to go with a model of a lead and a second on each project. So what we've found is that it really helps to have a lead because it gives us a point of contact for the partner and somebody to kind of own the project. But the projects tend to be significant

enough because they're lasting anywhere from, yeah, 3 to 15 months and sometimes they're pretty complex that a second person's really great to have. Both just for workload but also for idea sharing and that kind of work and to cover the-- what do we call the-- Ebola. What happens if the one person who knows all the information is hit with Ebola then we have a second person. So we do a lead and second model, essentially, and that's worked pretty good. We tend to give a pretty good leeway though, for them to determine how they want to manage the lead and the second. It doesn't mean that both of them have to be at every single thing. Sometimes it can be the leads at most everything and the second is-- there's a particular part of the project that makes sense for that person to focus their attention on, so they'll kind of carve off a little piece of the project and do more of that. Sometimes it really is significant enough of a project that really, it's sort of like they're co-leading through the whole thing and attending most of the meetings together and doing most things. We try to divvy up tasks and work with them, the lead and the co-lead. So far it's worked pretty well. We've toyed with different approaches like would it make more sense to have that based on strengths or areas of expertise? Like, "Hey, this project really is going to call for somebody who's got X ability. Let's have that person-- pull them in when we need to and not have it be just the lead and the co-lead." So we're toying around with that a little bit. But so far the lead co-lead has worked pretty well and tends to give us pretty good success. Occasionally, it's just the single

person if the project is pretty small. And then I can also help be the second on some projects if it's needed.

Design Thinking Project Roles: Clients and Deciders. Participants described the roles of clients and deciders that people played as a part of the design thinking based projects. This section contains a compilation of the most important verbatim statements from that theme:

> [L01] We've got another project where it's a very very large intro course in biology and there's the lead faculty member, but then he's part of a team with eight people that teach the course, the sub-course sequence, which is two courses. So there's eight people that we're working with on that one. So what we try to do and we're getting better at, it's still tricky, is to try to define somebody on the partner team who can be what we're calling a decider or at least can be somebody who we can look to to make decisions for that group of people. And we hope that's not a sort of autocratic, I'm just the decider and I'm going to make decisions, but does it based on lots of input from the team. But if we don't have a decider we've sort of recognized that sometimes things just defuse out. They're not sure who's responsible and for us then we struggle a little bit because the buy-in can be variable with most folks on the team. And we usually propose lots of possibilities and solutions and so we need somebody to say, "Yeah, I'm going to take that and work with my team to decide what we want to do."

[D02] That's a good one, so one thing we've run into is we normally have in-- when we do these challenges or long-term projects, we normally have one person that's the decider. I kind of mentioned we have decider person.

Design Thinking Project Roles: Sponsors and Endorsers. Leader 01 described the roles of Sponsor and Endorser. This section contains a compilation of the most important verbatim statements from that theme:

[L01] And the other thing I would just mention on the side of that too is that with all of these projects when this model is put in place, we also decided it made a whole lot of sense to have sponsorship for our projects. Sponsorship and endorsement, I should say. So sponsorship tends to come from our up-the-line supervisor in [IT] and we charter these projects within [IT]. So they go through our project charter process. And the project charter, they didn't have a sponsor so that tends to be our academic director-- director of academic technology or our CIO or somebody who will say, "Yep, we're going to put resources into this and we support this within [IT]… So that's the sponsor and then the endorsement comes from somebody who's either what we typically say is at the associate dean level or higher. And that, the goal, is just to make sure that if we're working with one of these faculty members or a teaching team, that they've kind of surfaced the issue that they're working on with somebody in a strategic location and that person says, "Yeah, this is a problem that is important we support putting resources there too." So it just helps us make sure that we're kind of tacking to strategic goals within the college or

within a particular place and it's not just one faculty member who's kind of taking us far afield from where the resources should really be going kind of strategically.

Design Thinking Project Roles: Students and Stakeholders. Participants described the roles of students and stakeholders that occur on design thinking based projects. This section contains a compilation of the most important verbatim statements from that theme:

[D01] That's one thing that I realized was really absent from our work originally was the student-- the feedback and the experience of the students. We were designing for the students but we were designing for them not with them necessarily. And so that was a challenge that took us a while to really kind of figure that out…So that student informed design has been a lot of what we do. We try to really-- in that realm too, we try to really design for stakeholders.

[Interviewer] So how are some ways that you're involving students in the process?

[D03] So a lot of times-- for instance, I'm working on a project with [Designer 02], I think you've met him already. And we're on [a biology course project] together. And so in the fall of 2016, we had focus groups with students. We had asked students what do they do-- how do they study, that kind of thing, so we can get a better sense of where they're at and what they're trying to accomplish, what their hopes are for taking the [biology] class. We also

actually got to talk with TAs as well. And they were focus group discussions and we learned a lot from talking with those students. And so those conversations helped inform recommendations that we made for choosing the instructional team in spring, some of which we're implementing actually this year.

[L02] So on the Unified Student Experience Project where we design the student portal and other stuff, it can get pretty political, especially when you have-- no one really owns the student experience, even though student-facing portal [IT] manages it, but at the same time, different business services contribute to it differently, so like Financial Aid, and the Bursar's office, and an office that deals with kind of the orientation, new student orientation on campus. So they have different kind of co-owners of this portal. So on that project, the way we used design thinking is we kind of wrapped it up as user experience research. Let's collect data from our students. Let's talk to the staff members who have to interact with different parts of the portal on a day-to-day basis. Let's collect their pain-points, their delights, and figure out how we might improve their experience, so kind of masking it as user experience research.

Design Thinking as a Flexible Framework of Activities

Several Designers and Clients described design thinking as a flexible framework from which they draw on and use various activities such as brainstorming, creating personas, or creating journey maps, to meet a need in a given project,

without going through an entire design thinking process. Designers described design thinking as a toolbox or a buffet table where one can select practices or activities as needed. Some Designers also described selecting and integrating design thinking activities such as brainstorming with Backward Design practices in designing courses. One Client said she wanted to know more about design thinking techniques that could be applied to various challenges when working with groups.

Design Thinking as a Flexible Framework of Activities Coded Data

Design Thinking as Flexible Framework of Activities. Participants described design thinking as a flexible framework of activities. This section contains a compilation of the most important verbatim statements from that theme:

> [D03] It's actually kind of nice. [Design thinking is] a defined process but not a tight one and so there's wiggle room depending on the different kinds of situations that we're applying it but it kind of gives us a little bit of a structure to follow in order to basically get at the best of the brainstorms that we can to involve users as well as customers, clients, people who are affected by the problem at hand and come up with a solution, or solutions, that seem to really speak to the challenge itself. I really love how-- because I'm thinking it gets to the heart of what are we trying to accomplish as opposed to coming in with what we think is the problem and coming out of it with what we think is the solution. And so it really gives the latitude to really explode our brains and think about the creative ways to really look at, what is it that we're trying to solve, and how can we do it in a really fun way?

[D03] I do really like [design thinking] because it provides this really neat structure. And by that, I mean, very loosely because it's not rigid. But it provides a framework to really creatively get at the heart of a problem and innovative solutions.

[Interviewer] And do you use design thinking as a part of your work?

[D05] In varying degrees, yes. And thinking of-- when we're trying to come up with new programs and new things we want to do with [The College Educational Technology Team], sometimes we do that. Maybe not go through the whole process all the way to Ideate, but we'll use some of the beginning stages. And then I've incorporated-- tried to incorporate bits and pieces of design thinking into our workshops and things like that.

[D06] I'm an opportunist so I kind of take things-- I look for things that would help strengthen whatever I'm trying to deliver. So I take parts of design thinking that I think would help to strengthen or to help elicit the results that I want from my participants. Or I use parts of it to fill in gaps. So yeah, kind of take what you want. I feel like it's more of a buffet table. And if it isn't working, I mean, I just don't use it.

[Interviewer] Thank you. Do you think design thinking is valuable? Why or why not?

[D06] Yes. I think it's valuable because of the flexibility that it provides. The way that I use it may not be the correct way but I think it's flexible enough where you can integrate it into constructs. Like, backwards design or

instructional design. You can take that idea, you can take what you need - infuse it into what you're doing, use it to your advantage.

[D04] I think I really like a sort of toolbox of processes or whatever and you pick one that's either new or interesting that you haven't used yet or something that was used in a similar context, right? And then you can sort of refine it. But I'm not a super-- I mean I'm not a super-- yeah. I like to have a range of things to choose from and then either-- yeah. Pick one that seems appropriate to the situation.

[C06] What we need is matching up problems that we're trying solve with the group, with activities. And knowing what the variety of design and thinking activities that you can apply to those problems are. So we want to come to a consensus on this, and it's a vision like level consensus, you did this activity. We want to come to a consensus on that and it's an implementation-level decision, we do this kind of activity. Somebody's dominating the conversations, is there a design thinking activity that we can use here?

[C07] But design thinking has helped me think about that a little bit more strategically like, "Where is it we're trying to go?" Think about, this is part of a brainstorming activity and trying to coalesce towards some decisions. In that design thinking workshop, they showed one of the many versions of this graphic of that process of design thinking, like opening up the idea space and converging to solutions, and then brainstorming, like these multiple converging steps. And I think that that was just sort of a really-- it was really

> illuminating for me because I've been working a lot and trying to have these more participatory structures, but without sort of overarching framework for what that was about. So that having that framework helped me think about brainstorming as either opening or converging, and I think it's helped me be a better facilitator and helped me give better feedback to the people that I watch facilitating things.

Important Attitudes and Skills for Design Thinking

Participants described many attitudes and skills that are important for people to have as a part of doing design thinking work.

Adaptability and Flexibility. Designer 04 described the importance of adaptability and flexibility in design thinking based projects.

> [04] I also think you need to really be able to adapt with a really short time frame…You need to not feel a strong sense of ownership over what it is that you're developing because the faculty might change their mind or something might happen like, Oh, this course isn't offered anymore… So I think the flexibility, not feeling super-- a huge level of ownership over things because they're so much in flux and can change.

Openness to Failure. Two designers described that it is important to be comfortable with failure as a part of design thinking. "You have to be comfortable with a certain amount of [failure] because it's inevitable if you're trying new things that some things aren't going to work" (D04). Another designer described failure as a

part of a design thinking mindset. “We really try to embrace failure, and learn from it, and see it as a positive” (D01).

Comfort with Tension. Leader 03 explained how in the hiring process, he looks for people who are comfortable with tension.

> [L03] I try to find out if they’re comfortable with tension… part of design thinking is not rushing to a judgment. I try to find that in the hiring…I sometimes will ask, like if I call the reference, “Does this person move to a solution quickly?” Because we really want someone that’s more able to just kind of sit with the tension and the problem.

Creativity, Curiosity, Openness, and Exploration. Participants used a variety of words to describe important attitudes in the creative, exploratory aspects of design thinking.

Positivity. Designer 01 explained the importance of positivity with design thinking.

> [D01] Rather than you saying, “No. Let’s not do that, but let’s do this,” you say, “Well, yes, that’s a good idea, any maybe we could also look at this.” So you try to be very positive and generative in your language and approach to things rather than shooting down somebody because that’s no way to have people feeling positive and supportive.

Openness to Feedback. One leader explained the importance of clients being willing to receive feedback as a part of the process.

[L01] So I'd say though that the open-mindedness is important, the willingness to change, the willingness to— and this one's tough because I think people think they have it, but it's harder too is if— especially if they're the instructor, is to have their course kind of put under the microscope a little bit, and we tend not to be a very judgmental team, that if you're going to want to try to change your teaching, that means you probably need people to come and observe how you're teaching and give you feedback and make suggestions. And that means putting sort of a little bit of you out there for evaluation and change, and we try to be gentle about that. But it is hard.

No Special Attitudes Required. Client 04 who is a leader in her area mentioned that participants did not need to have any specific attitudes or ways of thinking for participating in the Design Challenge.

[C04] I wanted them to come in in their diversity of thought because, otherwise, if we're all— that's not where innovation happens…I valued having the diverse opinions on my team because it helps you consider things that you would not have considered if everyone is on the same page or doing the same work, etc.

Emotional Intelligence and Listening. One Leader described they have hired designers with strong emotional intelligence. One Designer described the importance of being able to listen and to interpret goals and needs that may not be explicitly stated.

Important Attitudes and Skills for Design Thinking Coded Data

***Creativity, Curiosity, Openness, and Exploration*.** Participants used a variety of words to describe important attitudes in the creative, exploratory aspects of design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [C07] I think that a mindset of exploration and wanting to envision a really wide scope of possibilities is very helpful to this part of the process
>
> [D05] I think the biggest attitude that we try to prepare them with is …to try to think about whatever the question is without boundaries. If there were no limitations what would you do?
>
> [D02] I think openness and collaboration. Being able to keep that open communication going at all times, I think, is incredibly important.
>
> [L03] So yeah, they have to really be curious. They have to be driven by curiosity.

Emotional Intelligence and Listening. Participants described emotional intelligence and listening as important skills in design thinking work. This section contains a compilation of the most important verbatim statements from that theme:

> [L03] But if anything, I suppose, we tend to sit with problems longer. I don't know. And then I just think we end up hiring a lot of people with strong emotional intelligence. And we haven't even really articulated that in the hiring process. But I kind of think we've-- I don't know if it's intuitive, but I'd like to sort of begin to articulate more about what goes into hiring decisions.

> [D04] Soft skills are, I think, a huge part of it, even though it's kind of weird to talk about. I think it's hard to imagine being successful at something like design thinking without a really attuned listening ear and without really being able to pick up on really small throwaway things that actually might really indicate where a particular faculty member is at and what they're able to take on, or what a concern they're not willing to state might be.

Organizational Aspects of Enacting Design Thinking

Learning about Design Thinking. Participants described a number of ways they learned about design thinking. Several Designers said they learned about design thinking from other designers and leaders on the team. The Design Team has paired up Designers who are less experienced with design thinking with Designers who have more experience as a part of the Design Challenges. The Design Team conducted monthly Juntos, professional development gatherings where members read and discussed articles. Design thinking topics have been a part of the Junto discussions. One Leader mentioned they worked with a consultant who had previously been an IDEO staff member to learn more about design thinking. Several participants mentioned taking an online course from Coursera on design thinking. Several Clients mentioned they learned about design thinking through a presentation on design thinking that members of the Design Team had given at a teaching and learning conference through the university. Several Clients also mentioned they had learned about design thinking through their professional organizations.

Funding. The work of the Design Team is covered through the university general fund; they do not charge departments or groups within the university for working with them.

Support from Organizational Leadership. Leader 03 said there has been support for design thinking from leadership at the university. However, there have also been challenges as some people in the organization may not have seen the value in design thinking.

Change Management. Several participants described change management processes in relationship to design thinking. The Design Team has worked to identify the readiness for change as a part of projects they have done.

> [L01] We typically find that the people who come find us are really highly motivated…and want to do something different but they tend to be embedded within systems that aren't necessarily as motivated or don't quite get the change that they're proposing. So that's actually been more of where we've been trying to pay attention to now is how do we do something around departmental readiness? Is the department, or the unit, or the team ready to do this change? Because they don't always know what it means to try to dive into a project and make change happen.

One member of the Educational Technology Group worked on a grant-based project to help assess and facilitate change within university departments to support stable and sustained education reform. The change work was based in six core principles of change that were developed by the Principle Investigators for the grant.

Designer 02 explained how he sees design thinking as a framework for change that allows stakeholders to have ownership in the process.

> [D02] I think that design thinking is really helping become the framework for change and a way of getting people comfortable…So it's not an individual that's bringing change or helping people see how change could be positive, it's the group that's able to do that and the stakeholders themselves that take the leadership of that change and decide what they want to move forward with and what they don't.

Participants also explained that the university has worked with a consulting firm as a part of change management work. Client 02 described integrating design processes and change management processes.

> [C02] You would, typically, have a team working on a project. As part of that you would – if you're doing things well – doing good project management. You might have a project plan with some different steps associated with it, maybe a Gantt chart and you're doing your stuff. Right? You're following one of those different design frameworks I might have been talking about before. What we used to do was— and we'll talk to people as we go through that and tell them that they need to change now. Okay? What we now recommend is either embedding in that team somebody who understands change management and is a team member doing change management and helping people move through [the change management process] as individuals. Or have an external team that is supporting that team.

Leader 01 explained how within a change process, design thinking is a way to help people to better understand the problem and a method to develop potential solutions.

> [L01] I think design thinking is a way for us to do a lot of problem clarification to make sure that when we are advocating change that we're hopefully doing it around things that are the right things as opposed to change for change sake. Or throwing a band-aid on something that is the wrong place to spending our time…So I'm hoping that's where the design thinking impact is kind of teasing out those problems and the potential solutions a bit more.

Organizational Aspects of Enacting Design Thinking Coded Data

Learning about Design Thinking. Participants described how they learned about design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [L02] So we have monthly Juntos, which are kind of a gathering of the minds seminar style where we come and talk about different topics that we're interested in. And we usually have assigned readings so we really take the seminar approach to heart. So for this week, for this month, we're reading one on complexity in design and this is-- I'll describe it for you. But this is kind of the activity theory framework and the idea is there is this-- it's a descriptive framework that tries to unpack the different things happening within when you're trying to design for something.

[D03] But, yeah, I mean, [Leader 03] kind of re-thought how we would help faculty. And so we all kind of came back to the mothership, and then started working on this Design Thinking. And [Leader 02] are you meeting with her this week? So she was instrumental in getting us going with design thinking and doing design challenges and stuff like that. But I mean, it really has been learning on the job. So we've done things like attend workshops, do Juntos, so we read about it and then we come and discuss what we've learned about it. We've taken a MOOC. A few of us did a MOOC on design thinking. Which was actually really cool because we were able to apply our own work to the coursework. That kind of stuff. And it's a really great fit for our team because all of us really love helping people. We have a really strong connection with improving teaching and learning, and I mean, we love working with people, but the design thinking really opened our eyes to working not only with faculty but with everyone who might be involved with teaching and learning including students.

[D02] Well, most of it is trying to learn from each other and attend every other design thinking event that's out there because if people are going through the process, I want to learn how they did it. What can I learn from just parts of the process like a lessons learned to meeting? Love to sit through that just to see how other people look at lessons learned, what they captured, what they don't. But I spend a lot of time in-- there's this design kit. I don't know if you've ever seen this, yeah, Acumen runs it. And they do a good job. So that was actually

where I kind of got started with some of it was to go through that course and looking at that with some other people. A couple of us took it together. It's just an online course to try to get our understanding up. And we also do monthly meetings called Juntos is what we call, Junto, J-U-N-T-O. [Leader 03] started it up way back in the day. But I really look at that as a way of professional development monthly where we'll sit for an hour and a half, and we normally have readings. And it's normally around either design pedagogy or design thinking, and its impact on our daily work. So we'll read a bunch of stuff, and then come back, and discuss over food and lunch how that particular topic is impactful for us, lot of Educause articles, stuff like that, things that we can kind of glean, sometimes from business because we have such a big connection to aerospace and business. We're always trying to bring in best practices from them too.

[L03] So that's kind of what I want to articulate in this next period but I would say it's-- we tend to have a lot of Design Challenges, we even have them scheduled every Thursday at 1:00. They get canceled a lot but we knew that we needed to carve a time out in case someone had a question or How Might We question. So it tends to be following, I think, from that first Coursera MOOC. What we learned was-- the other piece we had was we took a Saturday seminar, I forgot about this, that was offered from our business school and they took us through what they said was a full design thinking experience and it went through the divergence, convergence, divergence,

convergence and had prototyping in it. And I think we sort of thought of that as the full experience of design thinking because that's kind of what was shown to us.

[C07] And I've helped myself and [a Designer], have partnered for the last three years to help run a group called the Professional and Educational Developers group, PED. It was at a PED gathering that [Designers] presented design thinking. And so that was where sort of some of the broader community here got exposed to design thinking. That happened to coincide in time with when I was trying to give a group I consult for some advice on how to run a very difficult in-person working meeting, where they had to get a lot done and then come to some decisions, but it was very messy. I had just gone through this design thinking workshop and I was like, "Ah, ah, perfect!"

Funding. Two Leaders explained how the Design Team is funded in the organization. This section contains a compilation of the most important verbatim statements from that theme:

[L01] So our resources within [IT and the Design Team] are general funded. The salaried professionals that are in the [Learning Experience Designer] positions, our work on these projects means we just commit resources in-kind essentially from the organization. Which is another reason we want to make sure we're doing the good strategic work of an individual college or the university as a whole. So when we work on projects the partnering department doesn't have to pay us to work with us.

[L02] Historically, we haven't worked with Continuing Education before, much before, because of our different kind of funding lines. They're auxilliary funded, we're general funded. So funding issues like that have made it really hard for us to collaborate on projects.

Support from Organizational Leadership. Leader 03 described how design thinking has been supported by people in leadership positions at the university. This section contains a compilation of the most important verbatim statements from that theme:

[L03] Well, it's been so surprising because for so long I would try variations of this. I mean, I've been here since '99, and Buchanan's essay was before that. And people just didn't get it. And then all of a sudden when I wrote this up – so I guess it was four years ago – it just took off. And I think what happened was our CIO had been in meetings with other CIOs of major universities, and I think they'd all been talking about design and design thinking and creative problem-solving. And I think you might— oh, yeah this is emerging. And then we had our research vice chancellor coming in… And so she said, "I'm going to own innovation." And then she kind of built up this whole area of design thinking, and so you just started to see it pop everywhere, and it's once in a while, you're catching idea, and it just shows up a lot of places. So it's been well received in a sense that there's just this milieu, where a lot of people are doing it. I think it hasn't been well received in the sense that what I've always had as a critique of what I do and what other

people do is that we don't do enough to get the word out about it… And the thing that we're always under scrutiny for is people think we play, that we have too much fun at work, that we don't have strict accountability. Even though I can tell you what I've measured, and I can tell you what the data say, and I can you how we've made changes over time, but we always have this reputation as being the misfit group that plays around with LEGOs.

Change Management. Several participants described change management processes in relationship to design thinking. This section contains a compilation of the most important verbatim statements from that theme:

[L01] I think our organization is going through a bunch of-- our organization [IT] and actually the larger campus has engaged a lot of change work right now, in fact, I'm going through a little training cell Prosci or ADKAR is a change management kind of process and campus has bought into that. And within our IT organization, we've recently hired a couple of change manager type folks who are focused on trying to better manage change in the organization. So I think to the extent that change or change management, however, you can define that a lot of different ways. And I think it looks pretty differently depending on different parts of our organization I think we're looking at definitely organizational culture change a lot in the work that we do. I think some of the change happened in our organization is really around project management level change to make sure if we turn on this switch that then that doesn't break something down the line and so the people

down the line need to know you're going to turn on that switch. So just kind of transparency around change. And then we've had some big kind of high visibility maybe not failures but pretty close to failures with some big systems kind of across campus in the last couple of years. And so there's been-- we have some definite culture work to do there because people had a really bad experience with the system that was changed. It was supposed to get better and instead it made everything worse and much more painful. So there's a lot of work kind of going into those areas but for us, I think design thinking is a way for us to do a lot of problem clarification to make sure that when we are advocating change that we're hopefully doing it around things that are the right things as opposed to change for change sake. Or throwing a band-aid on something that is the wrong place to spending our time…So I'm hoping that's where the design thinking impact is kind of teasing out those problems and the potential solutions a bit more.

[D02] I think that design thinking is really helping become the framework for change and a way of getting people comfortable…So it's not an individual that's bringing change or helping people see how change could be positive, it's the group that's able to do that and the stakeholders themselves that take the leadership of that change and decide what they want to move forward with and what they don't.

Connections to other Design Models and Practices

Participants described design thinking in relationship to user-experience design, instructional design, and process improvement frameworks.

Design Thinking and User Experience Research and Design. Several participants described design thinking in relationship to user experience design. Leader 02 explained how she integrated design thinking and user experience research for a project to design a unified student experience with the student portal.

> [L02] So an example of ways in which I've applied design thinking on projects is really pairing it up with user experience research. So framing it as collecting data from us and end users or stakeholders really understand what the challenge is and better designing for them.

Client 03 described experience design as a broad category that includes learner experience design and user experience design and he sees design thinking as a process for conducting experience design.

Design Thinking and Instructional Design. Several participants described a relationship between design thinking and instructional design. One Designer said she primarily uses a Backward Design (Wiggins & McTighe, 2005) approach to designing courses but will infuse design thinking into that work.

> [D06] And the reason why we use a Backwards Design model is because we find that it's easy. It's something that faculty can use across the board with whatever course they're redesigning, whether it's face-to-face, online, hybrid, or flipped. It provides them with a good baseline. We infuse design thinking

into that. Because lots of times, I think folks have a hard time visualizing and sort of stepping out of the boundaries… So, we use elements of design thinking to kind of open their minds to seeking out new possibilities.

Two participants said that using aspects of design thinking with the Backward Design instructional design framework may help them to bring more student perspectives into the design process. One Designer explained how he views design thinking as a development of concepts developed in earlier instructional design models and practices.

Designer 05 described differences in how problems are approached in design thinking and Backward Design.

[D05] I do think they work well together. But it's different in that Backwards Design wants you to start with the learning outcome. What do you want to see at the end? Whereas Design Thinking really doesn't want you to jump to the end just yet. You don't go to solving the problem just yet…Where Backwards Design probably does have you thinking about what the answer is, where I think, Design Thinking doesn't really want you to think about the answer until you've gone through more of the process.

Designer 04 identified differences in the roles of Learning Experience Designers and the roles of Instructional Designers, emphasizing that Instructional Designers work may focus more on course design and working with technology and a Learning Management System than do Learning Experience Designers.

Design Thinking and Process Improvement Frameworks. Two participants described an overlap between design thinking and design and process improvement models such as LEAN, Advanced Quality Planning, or Six Sigma DMADV.

> [C02] But again they're all kind of based on the same idea which is start off by talking to people who are going to be using this product or service to understand their needs, somehow quantify that, somehow turn their language into language that makes sense to design to, somehow turn into that into design targets, turn those design targets and creatively come up with different ways of meeting those design targets, try some out, prototype,

Connections to other Design Models and Practices Coded Data

Design Thinking and User Experience Research and Design. Participants described a connection between design thinking and user experience research and design practices. This section contains a compilation of the most important verbatim statements from that theme:

> [L02] So kind of labeling [design thinking] as user experience research helps especially when you're working with project managers and they're very familiar with business analysts, so in the work that they do or application on the list, so sometimes I call it user analysis work, kind of speak their language. And then sometimes people have a negative reaction to kind of buzzwordy stuff, so we've heard from a few faculty members that design thinking is just a fad, is just buzzwords. We don't believe in that. So simplifying it and calling it design or user experience research sometimes helps.

[Interviewer] So you mentioned design thinking. How do you define it?

[D04] So for me, as I understand it, it's something that grew out of user-centered design and human-computer interaction, right? It came out of user testing, I think, user acceptance testing. I mean I think that created the situation where I think design thinking could be born. But that stuff is much-- I mean it's much more about a technology, right, and what the user experience is… But I think design thinking is about situations that extend beyond technology. And I think that they want to integrate and envision what the end product will be from the beginning and what a user experience would be. And user extends to kind of become customer experience, I guess, if you want to use a really generic term, because user implies technology but I think it's about being really strategic about your intents from the very beginning, as opposed to starting with the solution, right.

[C03] So this idea of experience design being a big umbrella and there's user experience design and learner experience design and other kinds of experience design underneath that umbrella that kind of thinking has already been very much part of how I approach this. So when I hear about the phrase design thinking, I think of it as a methodology that is more of a sort of— let's give you a boom, boom, boom, several steps that execute what constitutes good, experience design as a process.

Design Thinking and Instructional Design (Connections). Participants described a connection between design thinking and instructional design models and

practices. This section contains a compilation of the most important verbatim statements from that theme:

> [D02] There is a lot of overlay. And I think of back when I got a Master's in instructional design stuff, ADDIE, rapid prototyping. Really, rapid prototyping, I think, was an early version of what design thinking does… And so I look at what design thinking does now, it's kind of an elongated step of a sprint if you look at a big business flow of what we're trying to do with the change. It's a way of helping people think through change. It's not a scary and ending thing but a natural part of any position, any job, in a university. There's never really a stagnant stop. It's always going to be an evolution, an iteration for future, so. I think those things are just kind of early versions of what we have as design thinking. I wonder what will come next.
>
> [Interviewer] Do you see a connection between design thinking and instructional design models?
>
> [C04] Yes, yeah.
>
> [Interviewer] How so?
>
> [C04] So in our context, the focus is typically the same, right. We're trying to design-- we're going through the process and so that's one thing that's the same, it's a process. There's, as an instructional designer I went through a process of developing a course paying attention to different phases in that process, right. In our context, the goals are the same too. Ultimately our goal is to support learning. And so for instructional design how can I design X in

order to support, encourage, etc. my students' learning. In our context we do a lot of-- and I say we and I really just mean the academic technology group in their work-- they facilitate design thinking sessions with that goal as well. I know that design thinking, it can do more than that in terms of the goal may not always be for learning. In my example, it was to improve work, right. But in our context, there's also an opportunity to think about how classroom spaces can be designed differently to support learning. Or how can we design this large lecture classroom? Or there's this space grant that we have. What can we do to support learning so the goals are the same? So it's in the process, it's phase approach and in the goals in our context that I think are similar.

[Interviewer] Do you see connections between or inter-relationship between design thinking and instructional design models?

[C05] Yes. Yes, definitely.

[Interviewer] How so?

[C05] Well, I think the- I mean certainly the user-centered approach. I know I'm sounding like a broken record with that, but that's really it…Something I'd like to do more of is to get a more, a richer voice from the students on what their experience is like. So I mean I'm talking— so not just— so going beyond just the student satisfaction surveys and perhaps meeting with a focus group. And just sitting down with students face to face and taking with them about their experience. So that to me is something that I would like us to do more of, that I think design thinking encourages.

[Interviewer] So how do you-- given the Backward Design framework and what you know about design thinking, how do you see these as integrating? Or do they?

[D06] I see the Backwards Design framework as filling in gaps that the Backwards Design model-- providing support that the Backwards Design model doesn't give us…Like empathy. Things like brainstorming. The Backwards Design model, it's pretty prescriptive. And I think it's-- I think rightfully so. With the caveat that we do-- we actually pare it down quite a bit because I think it's too much for faculty coming in to actually give them the whole spectrum of it. But I think that the Backwards Design-- I mean, I think the design thinking framework allows them to add creativity into the picture. I think it allows them to acknowledge that there's a piece of empathy. There's also this piece about ideation and just design thinking is an opportunity for them to continuously figure out a way that makes their course better. So if one idea doesn't work, let's go back to the drawing table. Let's figure this out. So I think that it also reinforces this idea that courses are also iterative. It's never like once you get to the end it's the end all, be all, this is how my course is going to be. So I think in some ways, again, so design thinking fills in gaps. But I think it also reiterates certain aspects of course design. Does that make sense?

Design Thinking and Instructional Design (Differences). Designers described a difference between the roles of Learning Experience Designers and

Instructional Designers. This section contains a compilation of the most important verbatim statements from that theme:

> [Interviewer] You mentioned learning experience design and instructional design. How do you see those roles as being different?
>
> [D04] I think they end up being pretty different because I think if you answer a job posting for an instructional designer, a lot of it's going to be building within an LMS. A lot of it is going to be-- and making some recommendations to faculty too, based on your familiarity with the software. But I see it as more software oriented. And I think instructional design is a little bit like you are not necessarily-- except with the technology--you're not necessarily co-creating a class with a faculty member, whereas learning experience design starts much earlier, I think, than-- my understanding of the usual timeline with instructional design, starts much earlier, and is much more about an overhaul of the actual course, and using technology if there's a technology that makes sense, like an intervention. But I think instructional design is just-- it can encompass all those things, but I think in terms of what, what faculty typically contact instructional designers for. I think it's much closer to the actual course. It's much less about, "Help me figure out not just how to build and structure the course and assessment." It's much more focused on-- at least here, I think our Continuing Ed instructional designers, it's all about helping the faculty build out the course so that they don't have to own that technological aspect. And that's my understanding from the instructional designers I've talked to as

well, is that you're living in technology and the support is a little bit more last minute, less strategic.

[D05] I do think they work well together. But it's different in that Backwards Design wants you to start with the learning outcome. What do you want to see at the end? Whereas Design Thinking really doesn't want you to jump to the end just yet. You don't go to solving the problem just yet…Where Backwards Design probably does have you thinking about what the answer is, where I think, Design Thinking doesn't really want you to think about the answer until you've gone through more of the process.

Design Thinking and Process Improvement Frameworks. Two participants described a connection between design thinking and other design and process improvement frameworks. This section contains a compilation of the most important verbatim statements from that theme:

[C02] What I find about that is that things like problem-solving that's the scientific method formalized in some way or the other way, there is so much different approaches but they're all kind of basically the same thing. The Advance Quality Planning by nature of the different things that you might be creating or designing are going to be really, really different, so if I'm designing a car versus an electronic chip versus a process for handling my vendors by nature they're really different so Advance Quality Planning is really interesting as a framework because you can use that to start off and say, "So, yeah." And the first step we're probably going to want to figure out how

people are going to end-use it, so we probably want to start off with the end in mind, you probably ought to talk to the people who are going to use it, that makes sense. Okay, so then I've got this 14 different steps, some of which are totally not applicable and some which you might have to kind of massage my brain to make think about what that makes sense of in this particular case and some of which is totally exactly what we need to do. So it's a good framework to start with but it always needs to modified to work in the environment in which you're working in. So yeah, it's a pretty common in the manufacturing world aerospace, automotive in particular. I've used other frameworks as well, we had a design framework that we call D-squared C-squared which is define, design, commercialize, control, there is the DMADV that I've used as well, that's within the Six Sigma world if you've heard of that. Design, measure, analyze, define, this isn't something I teach, it was defined, measure, analyze, design, verify, something like that, don't quote me on that one. Well, I'm on the recorder so I'm quoted. But again they're all kind of based on the same idea which is start off by talking to people who are going to be using this product or service to understand their needs, somehow quantify that, somehow turn their language into language that makes sense to design to, somehow turn into that into design targets, turn those design targets and creatively come up with different ways of meeting those design targets, try some out, prototype, see if it works so it doesn't get back to the process again if it does work, fabulous, have you rolled it out and commercialize it.

[Interviewer] So you mentioned the LEAN process. Do you see a relationship between design thinking and LEAN?

[D02] Totally. LEAN was like my-- I got another graduate certificate in 2005 on that stuff … And LEAN was more about, "Let's it was the same idea, sticky notes, thinking through processes, getting the right stakeholders in the room, but it was more about what people do during the day in their everyday lives, every step of their protocol, the task are assigned to them, and looking for either things that people were doing the exact same task in the same department, and do they really need to both be doing that same task? We can have somebody else doing another thing, or more revisiting process and policy. So the LEAN stuff was really a generator for change of policy [at another university system Designer 02 had previously been employed at]. A lot of the stuff I ended up doing was about changing policies, union-based system. It's a lot with policy at that point. But when I look at design thinking, design thinking is really playing off that base. And LEAN was kind of started. It was a Toyota thing for-- it was basically manufacturing. They've kind of adapted for business and higher ed. And so the LEAN kind of cycled out as design thinking really came in and became more of a mindset of how to bring change to an organization. And so I kind of looked at LEAN as just being one step along the way toward design thinking, so. I don't hear a lot about LEAN anymore. Design thinking is the thing that people talk about or process change, process change being a lot of-- human-centered design, different

terms that what I heard a lot of in like 2005, 2008. Those are the times that LEAN seem to be in there, so. Actually I think that there's overplay in those two. I think that when design thinking hits more on the business side of a campus that's when it's going to-- I think that's the next step. With some of the LEAN stuff is rethinking how some of the business units do things on campus, not just the academic.

Research Question 2: How do designers, leaders, and clients perceive the value of design thinking?

This section addresses how participants perceived the value of design thinking, challenges they faced using design thinking, and types of projects for which they think design thinking is a good and not a good approach.

Perceived Value of Design Thinking

Overall, each participant described design thinking as valuable. Some participants mentioned aspects of design thinking that they do not like. One Client shared how she did not receive as many actionable ideas as she had hoped through her experience in a Design Challenge. Another Client explained that the full impact of design thinking cannot yet be measured as the project is not complete. Many participants described challenges that they face in using design thinking.

Perceived Value of Design Thinking by Clients. Each of the Clients identified aspects design thinking they like and see as valuable. Clients valued how they had the help of the design team to address their problem. Several Clients valued

how design thinking is a collaborative, creative, empathetic approach that brings multiple voices and perspectives into the design process.

> [C04] I do like…having multiple voices and perspective in the room. And what happens in the moment is people are listening and light bulbs are going off. And there's something about collaborative aspect of design thinking that I enjoy.

Others valued design thinking as a flexible framework that can be used in a variety of situations. Clients also valued the use of divergent and convergent thinking modes throughout the process.

> [C07] It's been valuable for me. Again, I think a lot of it for me is the value of thinking about these progressively opening up and closing down the spaces like that. It's a framework that's useful for me and thinking about the process of having discussions and coming to decisions in general but in particular— in relationship to trying to come up with a product or program or something that you're going to then go out and do. So, it's a useful facilitation mechanism for me.

Some Clients also mentioned that there were aspects of design thinking they did not like, were not as valuable as they had hoped, or that they were not yet sure about. One Client described design thinking as a bit of a black box and did not find the Design Challenge experience as helpful as she had hoped.

> [C06] I thought that the individual— my particular challenge I don't think ended up giving me as many actionable things, new ideas as I thought. And I

think that's mainly because my question, my focused question was interpreted differently than I was interpreting it.

One Client mentioned that a member of her team did not feel heard as a part of the Design Challenge. Another Client mentioned that the full value of design thinking remains to be seen as the project was not yet finished. Another Client found it challenging to communicate design thinking to others.

Perceived Value of Design Thinking by Designers. Each of the Designers said design thinking is valuable. Several Designers valued design thinking as a framework that could be used and adapted to meet needs in a variety of fields. Several Designers valued how design thinking is inclusive and brings the perspectives of students and stakeholders into the design process. Designers valued how design thinking can help people to reframe the problems they are trying to solve and better understand the needs of students and stakeholders. Designers also valued the iterative components of design thinking. "And we love the fact that there's really kind of no such thing as failing because you're iterating" (D03).

Designers also mentioned aspects of design thinking that they do not like. Designer 04 explained how she did not like how design thinking is associated with an innovation fad. Designer 06 said that design thinking is time intensive and that there are times when design thinking felt like it was more work than it was worth. Designer 02 said that he initially thought that the design thinking would be too rigid of a framework, but that concern has diminished as he has worked more with design thinking.

Perceived Value of Design Thinking by Leaders. Each of the Leaders said design thinking is valuable. Leader 01 described design thinking as a valuable approach to helping people in higher education to reframe problems and approach solving problems in a different way. Leader 02 described design thinking as valuable as an empathetic, student-centered approach. Leader 03 described design thinking as a valuable approach for invention to help higher education to respond to disruption. Leaders 01 and Leader 03 did not articulate things they do not like about design thinking. Leader 02 did not like how people have reacted negatively to design thinking as a buzzword.

Participants' Perceived Value of Design Thinking Coded Data

Perceived Value of Design Thinking by Clients (Positive Statements). Clients described how they perceive the value of design thinking using positive statements. This section contains a compilation of the most important verbatim statements from that theme:

> [Interviewer] RT: So do you think design thinking is valuable?
>
> [C01] Heck yeah. Yeah, I think that for me it's hard to imagine doing work without this kind of approach, but I certainly have worked with people that do not have this kind of approach and I think, design thinking, allows just broader perspectives. There's an intentionality and there's a creativity that are brought to the process that I think are— underpin progress. It's like we cannot make progress without having a wide lens to understand a complex problem first.

[Interviewer] So do you think design thinking is valuable?

[C02]: Yes, and again, depending on one's definition of that. But I think in my experience and again like I said my background metallurgical material science engineering and I've seen design done well and I've seen design to be something like, "Well, let's make something and figure it out once we've made it." And so in principle I would say it's much better to spend time ahead of time creatively thinking about solutions than it is to do something and then try and fix it and if you design it ahead of time to meet the customer requirements or client of requirements it's just so much cheaper and so much better and it doesn't make you look like an idiot…In our world, I don't think that's what it is, in particular in higher ed. We end up designing, abandoning, designing, abandoning, designing, abandoning all the time and so we come up with things that are imperfect that we don't have any loop to improve over time. And we throw these things out there because we feel the pressure get something done and then it's not what anybody needed, so in my mind the idea of larger concept of design and planning would involve thinking about--design thinking would be thinking about and planning what the design is going to be and some creative ways to meet that and then execute against that and then put a process in place to continue to improve it over time.

[C02] One of the things that came up that we haven't really considered deeply was the concept of accessibility. And since my very first website had considered such things but it had not really been kind of primary to my design

intent…So that was opening a whole facet that we never would have thought of because we had that kind of broad participation. And so looking at [the Design Team] who were participating there. That was ideal because you had a whole bunch of people who had that high-level understanding of not just teaching and teaching tools, but also a broad base of things that they're interested in or working on. So I think that kind of diversity of opinion coming in was really helpful too, because stuff would come up that we would never think of.

[C03] Oh, I think [design thinking is] extremely valuable, especially anytime you're leading with empathy and thinking into the others' experience…So I felt like their systematic approach executed on the empathizing and the looking into the client's experience, into the user's experience, into the learner's experience. I think it was very explicit. That's what we want to start with. It was very explicit about let's throw out ideas and let's do brainstorming right and well. Let's do it in a way that doesn't inhibit people, but instead just really kind of gets their creative juices flowing and let's have an energy and excitement about that. And then honing the thinking, honing the ideas, prototyping that aspect of it. So yeah, overall - that's a longwinded answer - but overall, I find it very, very effective.

[C04] Again, it provides a process for approaching problem-solving and coming up with new ideas and bringing in different voices and perspectives. And a time to pause and do that, the way that I've observed it and read about,

it’s an event in a way, and it can take place over a period of time. But it’s good to take a break from the operations and step back and answer those questions or think about how we could approach this differently, etc. And so in that, there’s value.

[C05] I think it gives you just a really flexible toolset that you can apply in a lot of situations, whether it just be a team meeting that it can be to help guide, something to help guide you through it with the basic data collection, and reframing ideas, and that sort of thing. I mean, I think there’s certainly value in that.

[C05] I like the user-centered approach. I like the data-driven approach. And I like that it tries to strip away barriers, too. So letting people freely generate ideas and without fear that someone's going to say, "Oh, that idea is just insane." It kind of opens it up to receiving those off the wall ideas.

[C06] This is one of the design thinking ideas. Divergent, convergent. Divergent, convergent. Divergent, convergent. That’s a really good concept for people to have. How I work would be, get some ideas, and then go down my own path. That’s convergent, convergent, convergent. Especially when a team is trying to work on it and people are going to have different ideas at different times, you have to allow that divergent and encourage that divergent. I might have picked that up from seeing a picture and saying, “Yeah, that’s a good way to work”.

[C07] I like that there's so much written about it. That was the thing that was so useful. She gave me some ideas. She suggested a book, the person at [the College Educational Technology Team]. I grabbed the book. And now I've got access to this whole really useful space of participatory facilitation techniques and decision-making processes. It was exactly what I was looking for I didn't know I needed for a lot of projects. It was just like, "Okay, participatory facilitation." It was just sort of like-- but no. It's like participatory facilitation with a purpose. And so it just opens this whole space of things that I can now specifically recommend to people too. So it's a resource, a valuable resource that I can use and that I can give to other people, and it's a thing. I don't know how else to say it. Instead of just best practices in facilitation, it's just such a useful framework that I can give to somebody, and there are so many useful resources to support that, that I feel like it's-- yeah. It's really transportable.

Perceived Value of Design Thinking by Clients (Ambivalent or Negative Statements). Clients described how they perceive the value of design thinking using ambivalent or negative statements. This section contains a compilation of the most important verbatim statements from that theme:

[C03] I can't think of anything off the top of my head except that-- I think that it isn't that I don't like it, it's that there's a remains-to-be-seen quality about sort of the end product. In this case, we haven't seen my end products yet. What we've seen is that I sharpened my thinking thanks to this group and that I pointed to a particular pilot that I wanted to start with on a long, long project

that will take years and years for me to execute. But it sharpened my thinking for that path. If we're talking about actual execution of a particular program or a particular product, I haven't seen the end of that and I don't have a felt sense of how effectively this leads to destination.

[C04] Yeah. It was positive for me. I think my team found it-- some members of my team didn't feel heard. But I think that that was a personality type. That's one of the things that influenced me to say that I wouldn't have it in this space. I might go elsewhere to kind of break from our baggage. And so there was one person that just felt that their voice wasn't heard in the process. And so, I might also spend a little bit of time talking about, in the future if I were to do this, how people can help themselves feel heard and vice-versa, some listening activities so that that didn't come up again. Because stronger personalities apparently for this person took over. But other than that, it was a positive experience.

[C06] Design thinking is a bit of a black box in terms of the overall what it is…Maybe it's just that it seems theory heavy, so it's a little bit less accessible, or I felt like it was less accessible, but the theory is probably one of its big strengths.

[C07] It's so hard to communicate. I feel like I don't yet know how to facilitate or make suggestions to somebody without trying to explain this whole diagram. I feel like people need to be on board with that whole thing in order to be able to participate in it. Otherwise, how do they engage productively if

they don't know what the purpose is of their engagement at that point? If I could have a-- and I'm sure there's handouts out there. If I could find a nice, short handout that just kind of talks about it in general but without me having to explain the purpose of each of these stages, and I think those six stages are fairly common across the different levels of design thinking. I see them referred to with different names, but. So I think that the complexity of the process and trying to explain why this is valuable. And if you're in any one of them, if I'm-- I was just making recommendations for someone to-- oh, we need to open up the idea space before we come up with a design for our whatever it is. That would be pretty easy. But if you're trying to get people to see it as a whole process, that's the part that's hard.

Perceived Value of Design Thinking by Designers (Positive Statements). Designers described how they perceive the value of design thinking using positive statements. This section contains a compilation of the most important verbatim statements from that theme:

[D01] I like a lot of the very positive ideas and openness of the process and inclusivity of the process. And then I love the idea of, in principle, of iterating-- prototyping and iterating, I think there's a lot to that. It's definitely hard though when you've got 20 different projects on your plate or whatever, so.

[D01] I think way too often we think we know our audience and we don't, and that goes for not only the students, but the faculty… So I think there's a lot for

really, yeah, designing for people and always keeping in mind that whole aspect of the process.

[D02] I think it's important for people to step out of the daily workflow that they have. I do these tasks everyday. This is what I do for work and be able to think a little larger picture about how that fits into the organization, is that really the best way that they can spend their time? Are we chasing an answer to a problem but it's the wrong problem? Just a chance to step back.

[D02] That I think is an important piece of the design thinking, in my mind, is really it's an empowerment tool. It's a way to have people feel more empowered and feel like they have a role in what they're doing instead of just, I got these tasks that I do every day. And so empowerment is the way I look at it.

[D03] But what design thinking has done is really brought us closer to learning more about a lot of the problems that we're trying to all have to do with helping learners get the most, the best experience out of their time here, whether that is in a classroom, outside of the classroom, academic, non-academic. And so it's been really great to involve those students in our processes and get a better understanding of where they're coming from and what their needs are.

[D03] I do really like it because it provides this really neat structure. And by that, I mean, very loosely because it's not rigid. But it provides a framework to really creatively get at the heart of a problem and innovative solutions. I

think other different processes and ways of thinking could also be good. And we might end up adopting something later or morphing this into something else that works even better for us. But, I mean, especially for the fact that we all came into this without any experience, it's been a really rewarding thing to have learned and to been involved with. And we love the fact that there's really kind of no such thing as failing because you're iterating. And it really kind of opens up the possibilities, and you know that everything that you do not only contributes to the project, it contributes to our greater knowledge of how to do projects better and how to approach our processes better. So it's been really rewarding. Very valuable.

[D04] And design thinking, I think that's something that can be adapted and is being adapted into so many different fields and it's-- I mean, it has like a flashy title but all it really is, is strategic thinking that can be applied everywhere. So those are things that I like about it, I guess. You know what I like? It feels like we're serving a real need because again people aren't that good at doing that unless prompted so it feels like a really valuable skillset to be developing and yeah. I like how adaptable it is and how it can apply to so many different various and yeah.

[D05]: Yeah. I mean, I do think it's valuable. I think it just really gave me a new way of trying to approach my work. So our two groups merged about a year and a half or two years ago now, and it just kind of-- that whole framework and philosophy just helped me think about how to approach my

job differently. So it just kind of happened. It might not be that it's so much more valuable than something else, but at the time I was in a bit of a rut and this gave me a new way to think through things.

[Interviewer] What do you like about design thinking?

[D05]: Well, I think I'm a process person in a way. And so it does kind of give you some steps and guidelines-- it makes you slow the process down and move through some steps instead of just always trying to, "Well, what are we going to do now? What's the next thing?" So trying to be a little bit more systematic and strategic in approaching problems.

[D06] I think it's valuable because of the flexibility that it provides. The way that I use it may not be the correct way but I think it's flexible enough where you can integrate it into constructs. Like, backwards design or instructional design. You can take that idea, you can take what you need – infuse it into what you're doing, use it to your advantage. I think for me, incredibly would be powerful.

Perceived Value of Design Thinking by Designers (Ambivalent or Negative Statements). Designers described how they perceive the value of design thinking using ambivalent or negative statements. This section contains a compilation of the most important verbatim statements from that theme:

[D02] That I don't like. Oh, that's a good question. For me, when I first started hearing about design thinking on campus I like the facilitation idea of it and because I've done a bunch of that LEAN facilitation stuff before and

just kind of working through processes and workflows at work in a position or a department. I was worried a little bit that design thinking was going to be too stringent and it was going to dictate-- and it was my own misunderstanding, truthfully. So the only thing I don't like about it is stuff that I missed understood when I first started thinking about design thinking. But my fear was that I was afraid that the process was so strict that it was going to lead to a resolution that wasn't really the stakeholders' first choice. So I had great concern about that upfront but the more I got involved with design thinking I started thinking about it and trying to realize the possibilities. I realized how iteration and openness and human-centered design makes such a huge difference to that outcome. So it was really the only thing I didn't like about design thinking was my own misunderstanding upfront. The more I do it, the more comfortable I get with it and the more confident I have that the decisions that'll be made are going to be in the best interest of those stakeholders.

[D04] I don't like how jargony it feels right now. I don't like how it is attached to this sort of innovation fad. And by that I mean people are caught up in a lot of words and chasing innovation… It doesn't mean what would really be innovative in this context or what's really going to be a good decision. So I don't like that it's caught up in that because it makes-- and because I think it emerged in business contexts, it makes faculty really suspicious of it sometimes, when it's really a very valuable thing that I don't think is a threat

to educational processes at all, or to whatever vision a faculty has for a particular thing. So I don't like how it's caught up in that. I'll be happy when some of the hype around it dies down because I think it will be less dismissible.

[D06] I think some parts of it, I can't be specific but I think sometimes it's-- I feel It's more work than the product that you get out of it. I think one part that works against our advantage is that it takes time. If you're going to attack a problem and you want a solution to end - it's a long process and oftentimes we chunk our meetings into one-hour periods or two hours. Oftentimes, we can't get through the entire process within two hours. So if there is a disadvantage, I think it's the timepiece.

Perceived Value of Design Thinking by Leaders (Positive Statements). Leaders described how they perceive the value of design thinking using positive statements. This section contains a compilation of the most important verbatim statements from that theme:

[L01] I do think it's valuable. Again, just because I think it brings in a different lens and a different sort of feeling to the work. And I think in higher ed and in working with faculty and administrators, we get pretty set in our ways. We go at things. People are really smart. But they're really set in their ways and their thinking tends to kind of go back to these very traditional patterns. And so I think design thinking can be a way to really try to get them out of some of the well-worn tracks of how to go at problem-solving or how

to think about what a problem is and if this is their problem. So to that extent, I think it is really helpful.

[L02] It's definitely valuable. I think it's challenging at times when you're trying to design for a diverse set of users or stakeholders. I think it's valuable in the sense of being empathetic and really supporting or promoting a user-centered, or student-centered, or even human-centered approach but it takes a lot of time. So that's something that's challenging with it… So sometimes I worry that other people may not see the value of it just because it can slow people down a little bit, slow the process down. But the value is definitely in collecting good data, so making data, informed, and evidence-based decisions, and it's about really partnering with our end-clients, usually students creating that partnership, making the students feel heard as well.

[L03] To me the value is, and I kind of get this from Buchanan's essay, is design is a series of placements that are heuristics for invention. So when you're stuck and particularly I think higher ed is stuck right now, I think they're stymied and they're like they know that change is coming— they, this big collective thing of higher ed. I think we know that disruption is coming and is here and I think we know we need to react to it but we don't know how. And design thinking, I think, is great for that because it can give you a way to view your situation, to change perspective on your situation, change again, change again, and start, through these different orthogonal views of things, get

a new view on it. And that's what invention is. And so the new view becomes the prototype, becomes the new approach.

Perceived Value of Design Thinking by Leaders (Ambivalent or Negative Statements). Leaders described how they perceive the value of design thinking using ambivalent or negative statements. This section contains a compilation of the most important verbatim statements from that theme:

> [L02] I'm not a big fan of design thinking, just because it's just so intuitive. I don't know. Maybe just, some people reacted negatively thinking it's a buzzword. It's just really a mindset. So I wish we can just call it design, good design, and then that'd be good.

Challenges

Participants described many challenges they face in using design thinking at the university.

Time. Participants described design thinking as a time-intensive process and that it can be a challenge to get people to commit the time that is necessary to go through the full process. Several participants mentioned that there is a desire on campus to move to solutions quickly.

> [L02] Maybe it's just specific to our context, but people really want to jump to a solution and "tell me what the solution is, tell me what the price is, tell me how much time is going to take," and design thinking can sometimes appear that we're taking too long or kind of bogging down the process a little bit.

Participants also said that building trust and buy-in can be a challenge as it takes a lot of time.

> [D01] That kind of thing is often stressful and you don't have enough time to have those kinds of long-term relationships with people that we work with to make this impact or to really support them throughout this process. It takes so much time for them to trust us and then really adopt some of our just general best practices with teaching and learning.

Faculty members have a significant responsibility for research, which has created challenges for getting faculty participation and time for projects related to courses and teaching. It has also been challenge for the design team move projects forward in the summer as many faculty and staff are on nine-month appointments and are not available during that time.

Design Thinking Not Seen as Serious. Several participants described a challenge that design thinking is sometimes seen as a buzzword or fad. As a fad, there has been resistance to using design thinking.

> [L01] I think maybe the biggest challenge with design thinking is similar to lots of things that I've run through is that higher education faculty don't like something that seems faddish.

Participants also described design thinking as a different way of working than many people are used to doing, which may have made people uncomfortable. Additionally, because of some of the methods and tools used in design thinking, some people may not see design thinking as a serious approach to work.

> [L03] And the thing that we're always under scrutiny for is people think we play, that we have too much fun at work, that we don't have strict accountability. Even though I can tell you what I've measured, and I can tell you what the data say, and I can you how we've made changes over time, but we always have this reputation as being the misfit group that plays around with LEGOs.

Leader 03 also described how a design thinking approach to solving problems is different from the common problem solving approach within the IT organization and that the differences in approaches can be a challenge. Leader 03 described the IT organization as being very good at solving determinate problems but may miss a number of solution opportunities because of their approach to problem solving.

> [L03] And yet, here we are in the midst of that juggernaut [IT]. When anything that's technological fails, they're going to approach it as, "Is it this or is it this?" It's a tree. And design thinking it's almost like the opposite of that. It's almost like an integrating instead of a differentiating factor. So, yeah, if you already know the answer why pull everybody together? And if you're going to divide the world into splits of two, go ahead. And you're probably going to solve the problem to some extent, but I think philosophically what happens is you end up leaving a lot on the table.

Departmental Politics. Participants said that departmental politics have been a challenge when using design thinking. Designers and leaders described challenges they experienced when the person identified as the decider in the project is not

actually the decider and decisions are being made in a different way in the department. They also explained how multiple faculty members may have a stake in a course and it can be challenging to get agreement about how to move forward in a project.

Power Dynamics. Several participants mentioned power dynamics as a challenge they face in using design thinking. Participants explained how people have not felt free to share ideas as a part of the design thinking process out of fear about what supervisors might think or out of fear that change through the process might impact their job.

> [D02] Some people might be afraid that what they say is going to get the guile of their supervisor and then they're going to get in trouble. And so breaking people away from that feeling of this is what I do and I don't want anyone to touch what I do because it might mean my job.

Faculty and Staff Dynamics. Several participants also described a challenge in that faculty members don't always listen to staff members or may have been dismissive of staff members. Designer 04 described that even though many staff members have advanced degrees, faculty have assumed that staff are not in a position of expertise or knowledge. Another participant negatively described how staff had not been included in some decision making processes at the university.

Prototyping Courses. Designer 05 said that prototyping can be a challenge when designing courses.

[D05] I think that's why I never maybe get all the way through because prototyping is really hard when it's not like a physical product. If we're developing widgets or something you can draw it. You can, yeah, use some kind of tools or, yeah, LEGOs or whatever to try to get a better picture of what this thing would look like. But when you're talking about course design it's a little bit harder to do some kind of prototype. So maybe thinking about prototypes as just pilot projects is probably what we end up doing more of. Some kind of small iteration, or first pass at it. It's not that I don't like it but sometimes I think that's what is more difficult.

Challenges Participants Faced in using Design Thinking Coded Data

Time. Participants described a challenge of time constraints in using design thinking. This section contains a compilation of the most important verbatim statements from that theme:

[D01] So we really try to understand and take some time at the start of our projects to get the lay of the land, which is really hard to do in higher ed because everybody wants to do things quickly, and they all think they know the solution, everything, but we really try to take time at the start of the projects to really figure out what the problem is if that problem is really the one that the people brought to us, who all was involved, who were all actually designing a solution for, those sorts of things.

[D01] I was working with this faculty member for a year and just now he over the summer he was finally like, "Oh that's why you wanted me to write

learning goals and learning objectives." He finally had an ah-ha moment about why that was important a year after we had started working together. That kind of thing is often stressful and you don't have enough time to have those kinds of long-term relationships with people that we work with to make this impact or to really support them throughout this process. It takes so much time for them to trust us and then really adopt some of our just general best practices with teaching and learning. But if they haven't been working on that or thinking about that it takes them a while.

[D01]That kind of thing is often stressful and you don’t have enough time to have those kinds of long-term relationships with people that we work with to make this impact or to really support them throughout this process. It takes so much time for them to trust us and then really adopt some of our just general best practices with teaching and learning.

[D02] The struggle I think in a lot of the university around here is everybody has more than they can take on or do. And so to take on something new means something else has to drop. And so that being able to reprioritize their work is something that I think is a challenge that we always run into here, especially if it's around academics because 40% of work for faculty here is specifically on research. And so when we start talking about, "We're going to change pedagogy," that's actually taking away from some of the research. And the research is how they're going to really get tenured. And so it has to be that

buy-in and excitement to try something new and invest their time in it has been something that's big.

[D06] I think some parts of it, I can't be specific but I think sometimes it's-- I feel It's more work than the product that you get out of it. I think one part that works against our advantage is that it takes time. If you're going to attack a problem and you want a solution to end - it's a long process and oftentimes we chunk our meetings into one-hour periods or two hours. Oftentimes, we can't get through the entire process within two hours. So if there is a disadvantage, I think it's the timepiece.

[L02] Maybe it’s just specific to our context, but people really want to jump to a solution and “tell me what the solution is, tell me what the price is, tell me how much time is going to take,” and design thinking can sometimes appear that we’re taking too long or kind of bogging down the process a little bit.

[L02] No, I think the main ones are that it feels like we're taking too long sometimes. One challenge that's coming up for me recently is how do you balance collecting good data from students but not really-- I'll give you an example. I'll give you an example of it and see if I can then articulate it well. Again, with this Unified Student Experience Project, one of the things that I really wanted to do is-- so we've identified three potential interface designs for the new student portal. And my perspective is, let's publish these online. Let's put them in front students. Let's collect as much data as we want, as we need to, to help us make a good decision. Which of the three designs we want to

implement? So the challenge I face is how do you balance kind of getting good data and good feedback from your students with still maintaining control over the process a little bit. So other people, specifically in upper management level, concerned about putting something that's a work in progress or not complete in front of students and concerns about, well, what if people misunderstand and think we've already identified these designs, or what if uncover that they're really too expensive and they're not feasible. So how do you balance doing good design in getting good feedback with some of the political challenges and concerns and what our stakeholders are going to think in all of that. So that's kind of what challenge that I still trying to work through right now.

[L01] It takes building trust and trust takes time, and so again, as we've kind of gone from projects being longer and bigger and we've thought maybe we should shrink them down because we can do more small iterative projects and maybe that makes more sense, in a lot of ways I think it does, but one of the big challenges we've identified in smaller projects is it just takes time to build trust. And if you shrink the process down to three or six months which still seems like a long time, but if you're only meeting a couple times a month you just don't get the trust-building in early enough.

[L01] One other challenge that is just a very interesting, what seems like a simple challenge, but summers. Summers have been a huge challenge for us because most faculty are on nine-month appointments and a lot of staff are on

nine-month appointments. And so we often look at summers as great times to do this work. And then when we get to summer, we realize the faculty said they would be around or could have some time, we don't get anything done in the summer or a lot less than we thought. So summers are one of the tricky challenges we're trying to figure out. And then when people come back and they're here for the semesters, that's also a busy time for them to do everything else. So when to do the work is really challenging.

Design Thinking not Seen as Serious. Participants described a challenge of design thinking being seen as a fad, a buzzword, or not a serious approach to work. This section contains a compilation of the most important verbatim statements from that theme:

[L02] And then sometimes people have a negative reaction to kind of buzzwordy stuff, so we've heard from a few faculty members that design thinking is just a fad, is just buzzwords. We don't believe in that. So simplifying it and calling it design or user experience research sometimes helps.

[C05] Just from maybe getting people to fully-- I mean, it wasn't-- I would say most people were pretty well engaged. But I felt like some people were just kind of kind of sloughed it off as some just new-fangled thing that is just the latest and greatest business process that had come along and probably didn't see the real value. And therefore, didn't commit to the activities. I think that

was one thing. I don't know how you might overcome that besides maybe showing some examples of how it's been effective-- Would be one way?

[D04] And I think there's some ways in which design thinking gets a bad rep because it feels like it's really bound with ed tech in some ways. And you need to demonstrate that you're not just trying to toss in the next flashy technology or the thing that people think is going to be the next new thing. You have to back it up with data and show that you've actually done your research. There's a reason you're recommending this and it's not because some vendor approached us with a cool, new tool.

[D04] I don't like how jargony it feels right now. I don't like how it is attached to this sort of innovation fad. And by that I mean people are caught up in a lot of words and chasing innovation, but they're not really thinking deeply about-- like in that context it means sexy, right? It doesn't mean what would really be innovative in this context or what's really going to be a good decision. So I don't like that it's caught up in that because it makes-- and because I think it emerged in business contexts, it makes faculty really suspicious of it sometimes, when it's really a very valuable thing that I don't think is a threat to educational processes at all, or to whatever vision a faculty has for a particular thing. So I don't like how it's caught up in that. I'll be happy when some of the hype around it dies down because I think it will be less dismissible.

[C02] So some of the things I've used for that purpose, whether they're traditionally thought of as design thinking or not, seem silly to people…Here we are a bunch of very, very important professors, and you're taking us, and having us break up into tables, and talk to each other and then come up with this number, and you're having us make a lot of noise and move around and I'm really uncomfortable with this whole situation. Although I've got to tell you, professors have no problem with it. It's the accountants that freak out. Just the goofiness or the-- particularly in higher ed there's a great emphasis on higher thought, and higher thought is often seen to be very stultifying and boring and one person working alone. Creative thought is really different from that. And in this environment, it's sometimes uncomfortable for people to be put into situations where they're doing stuff on a sticky note. We ran a facilitated discussion with the Chancellor's Executive Committee, which is the deans and chairman or chairpeople and that type of thing. And we went into it a little hesitant because these are high-octane folks in higher ed. The idea I came up with is a science project. It's common you've got a science project. You make your poster. It's fairly common in academia that you make posters when you go to conferences or something like that, so let's give everybody a poster to make, and so make a poster of your idea. And we were a bit hesitant thinking that they were going to think it's really wacky, and they totally dug it. [L03] Well, the worst thing I heard in critique of design thinking was one of our senior vice-chancellors said that our research dean, or vice-chancellor, had

people go on a day-long retreat to do design thinking and what they did was they planned a party. And that pissed that guy off so bad. He's like, "You wasted a day of my time to make me plan a party." And what the person was trying to do was use a non-threatening focus to learn the methods, but what he got out of design thinking was it was a bunch of fufu goofy stuff.

[Interviewer] Are there other challenges that you've come up against in trying to use design thinking?

[L01] Yeah. I think a whole bunch. Probably more challenges than anything else, but one is design thinking is just out of most people's typical way of thinking about problems and processes, especially in higher education. If you're asking people to do more kind of big brainstorming, not think about solutions immediately and kind of be open to all sorts of possibilities, that tends to be not how they're usually doing their thinking in higher ed which tends to be much narrower and limited. So I think that's hard, just the groups that we work with, faculty, just getting them to come into an open space and do something that's totally outside of what they'd normally do, like giving them stickies and saying, "Write down ideas," they'll look at us like, "What do you mean? This isn't how I do my work." So I think just that whole sort of-- it's less the mindset but it's sort of, yeah, that just letting go of some of the strictures, I guess, of what feels like seriousness or intellectualism or those kinds of things and this sometimes feels loosey goosey and unstructured and creative and that can be a little scary.

> [L01] I think maybe the biggest challenge with design thinking is similar to lots of things that I've run through is that higher education faculty don't like something that seems faddish. Faddishness seems to be something folks just have a really strong reaction to. So I think as design thinking pops up and people read about it and see it and they're like, "Oh, the latest fad is design thinking and design thinking in higher education. I think people sort of, before having even had an experience with it, kind of put the breaks on it because they don't want to be seen as being faddish or on the latest trend. So I think if we can get around that and do that by just doing solid work, we try to really build in a lot of evaluation and assessments so that people actually see that the value does show up and that we can try to measure the impact or the value of what we're doing, that seems to help a lot.

Organizational Politics and Power Dynamics. Participants described organizational politics and power dynamics as a challenge in using design thinking. This section contains a compilation of the most important verbatim statements from that theme:

> [L02] Again, with this Unified Student Experience Project, one of the things that I really wanted to do is-- so we've identified three potential interface designs for the new student portal. And my perspective is, let's publish these online. Let's put them in front students. Let's collect as much data as we want, as we need to, to help us make a good decision. Which of the three designs we want to implement? So the challenge I face is how do you balance kind of

getting good data and good feedback from your students with still maintaining control over the process a little bit. So other people, specifically in upper management level, concerned about putting something that's a work in progress or not complete in front of students and concerns about, well, what if people misunderstand and think we've already identified these designs, or what if uncover that they're really too expensive and they're not feasible. So how do you balance doing good design in getting good feedback with some of the political challenges and concerns and what our stakeholders are going to think in all of that. So that's kind of what challenge that I still trying to work through right now.

[D02] And an example being that, sometimes-- it's interesting when you get higher administration and more worker bees - I kind of think of myself as a cog in a machine - together in one room, sometimes the worker bees don't always want to give advice to the higher-ups, worrying about jobs stuff.

[D02] That's something I think that's been one of my lessons learned in the last year is making sure we have the right stakeholders around for the project that we're doing at that time. That I think is a big piece of it. That influences personalities and a bunch of other things… And so how do you change the culture of a department to make change and bring positive change? Because one thing that we're finding a lot of the time is it's that department interpersonal politics influence the success or failure or timings of projects that we're trying to do with design thinking.

[D02] Some people might be afraid that what they say is going to get the guile of their supervisor and then they're going to get in trouble. And so breaking people away from that feeling of this is what I do and I don't want anyone to touch what I do because it might mean my job. To make them think a little bit larger, that this is a safe place that we can talk through possibilities. We're just talking about possibilities right now. That I think is a challenge that it takes a little while for people to feel comfortable. And some groups are great, they're really comfortable talking. Other groups you'll start posing questions to a group in a design challenge, let's say, and they just all look right at their supervisor waiting for their supervisor to talk first. And so getting people to feel comfortable is normally a bigger challenge upfront if you can get them all in the room at the same time.

[D06] The folks that come to us, specifically, have a more mature sense of intrinsic motivation to want to do better for their teaching or for their students' learning. So a lot in common with the idea that they want to change something about their course. So again, we're not really battling that sort of, "I'm not going to do this" attitude. But the one thing, again, that we do struggle with is the idea of opening your mind. And I think oftentimes it's uncomfortable because faculty, typically, have a sense of their own faculty decorum. When I go to meetings, it might be very combative. And so I'm going to stick to the script in our workshops, and they're like, "No--" come in with an open mind. Open your mind to possibilities and let's see what we can learn here.

[L01] I think probably the big challenge we've identified in the last year or so which probably was always there but just seems more apparent now, is that these are really people-challenges more than anything else, so there's always structures and things and policies and processes but really it comes down to the people. So we might identify a great person to work with and they're the decider, and then they say, "Yeah, I'm the decider," then we realize part way through they're not really the decider. The decisions in their department actually happen in much different ways, and so they're embedded in lots of kind of ways that make it hard for them to actually be able to enact change even though we want them to be able to. So departmental politics is huge individual faculty member politics are really big. If they're in a teaching team, they may make some decisions to go this way but their colleagues don't want to go that way. And so how do we help in that. So I think the people stuff is the most challenging. So I think we're going to continue to work on developing our skills around facilitation and change at like a small group department level instead of just thinking like individual project level.

Faculty and Staff Dynamics. Participants described faculty and staff dynamics as a challenge. This section contains a compilation of the most important verbatim statements from that theme:

[D04] But that's also coming from my position as a staff member at a higher education institute where people assume staff don't-- I mean, to be a staff member here you have to have a pretty advanced degree, typically, like in the

higher roles. And faculty tend not to assume that. They tend not to assume you're coming from a position of expertise or knowledge. So there's that dynamic, too.

[D06] The other thing, too, is that I recognize that faculty don't always listen to staff, but they'll listen to each other.

Design Thinking Fit for Projects

Design thinking is a helpful approach for addressing a wide variety of problems at the university including complex, *wicked problems*, in situations where there is not a black and white answer to a given problem. Participants used design thinking as an approach to designing a variety of things including courses, a unified student experience with the student portal, a museum exhibit, a process for taking attendance, and technology services.

Design thinking is not a good approach for problems that are determinate and have known solutions. Design thinking may also not be a good approach when designers will not have a lot of choices because of time, technology, or financial constraints. Design thinking may not be a good fit for high-risk projects when people may not be comfortable with the possibility of the solution not working. Design thinking is not necessary for operational work and responsibilities. Client 04 said that while design thinking can be helpful for project work in her area, it is not necessary in conducting the operational tasks her team is primarily responsible for doing.

Projects for which Design Thinking is a Good Fit. Participants described types of projects for which design thinking is a good fit. This section contains a compilation of the most important verbatim statements from that theme:

> [D01] I think it's a good approach for problems that's-- yeah, or multi-faceted, right? You can't quickly sit there and think, "Oh, this is actually the solution," or, "This is really the one contributing factor. We just need to deal with this person, and then the problem will be solved." It's more indeterminant and tricky problem that have a lot of different kinds of people involved with a lot of different motivations or needs. Those are the kinds of problems I think that it works for. It's also nice too to think of problems that-- yeah, problems that you can't solve the same way over and over again. So maybe you've dealt with this thing before, and it seems like you've solved that challenge but now we're dealing with a whole new group of stakeholders.
>
> [L03] Yeah, when you're stymied. When there's a wicked problem. When the problem is so difficult that there's just not going to be one right answer and you're probably never going to solve it. And those are often the kinds of meaty problems we're dealing with in higher ed. That's what design thinking's perfect for because it sort of honors the fact that you're not going to have a complete solution, it looks at everybody is a source of inspiration and innovation and movement forward. It gives you a roadmap for how to deal with that new way forward.

[Interviewer] Are there particular types of problems or projects that you think design thinking is a good approach for?

[D03] I actually think a lot of them. I can't think of one that it would be bad for assuming that you're walking in with something that doesn't have a black and white solution. So any problem that's gray area, which is a lot, I think running it through this process couldn't hurt for sure. And I think it can actually lead you to understanding the problem better and finding out what possibilities there are.

[C03] And I think in general, when we're talking about the world of experience design, user experience design, learner experience design, client experience design, the kind of experience design you have when you go to a museum, the kind of experience you have now with the emergence of augmented reality and virtual reality and so on, I think it's a great-- I think design thinking is terrific for the whole grand umbrella of experience design. I think that's what I can speak to. That's what intuitively feels like a compelling use of it. And it's like if you're going to build a car, the driver and passenger experience is of paramount importance. So it's a great tool for anything where you need to be-- any kind of product or service or process or whatever, where thinking into somebody's experience is important, I think it's a good tool for that.

[L01] We decided that design thinking was a good model for us to think about trying to implement, a way to think about and frame our work, particularly as

we moved from doing more transactional work to these larger things project-based work where it was really around what we call wicked problems, so sort of indeterminate problems without a clear answer. Design thinking seemed to be a nice mode for thinking about those kinds of problems.

Projects for which Design Thinking is not a Good Fit. Participants described types of projects for which design thinking is a not good fit. This section contains a compilation of the most important verbatim statements from that theme:

[D01] Well, it takes up a good amount of time and energy. So I mean I think if something is easily solved with other means, then those are not problems for design thinking. I think problems that involve very few kinds of people, or whatever, or people with different backgrounds, or different experiences, or small groups of people, depending on the experience, I guess. Yeah. And also, our work needs to be kind of different. We can't tackle-- I'm trying to think of how to-- innovative problems, problems that you need a new kind of solution for, that's another kind of a good challenge to be solved by design thinking, so, not something that's been solved a thousand times already.

[C04] So we're the group that keeps the train running. And so there's not a lot of opportunity for applying [design thinking] as much as I would like…So we're not creating things, we're maintaining them. And so we are ensuring that the technologies are working, that people can log-in, that people know what's working or not working in the system. And so it's less of a creative function in ways that I think design thinking would help and support….I have a project

now and we're designing this service-- So that's when I think it would be useful, when we're creating something new. But for us, we're doing kind of this standard process that's been in place for a long time, and it's working.

[C04] If there's high risk and people aren't-- so if there's high risk and also maybe if people aren't comfortable with the gray-- because this may or may not work…I think that that would be two problematic areas. Because, in some ways, it helps out a culture where it's okay to fail. Because it may not work, whatever the Design Thinking activity comes up with, and people have to feel safe in that.

[Interviewer] Are there particular types of problems or projects that you think design thinking is not a good fit for?

[L03]: Determinant problems. Simple how to fix things. Which [IT] is so good at right. I mean, binary thinking and sort of dividing everything into two camps, design thinking is not good for that. And yet, here we are in the midst of that juggernaut. When anything that's technological fails, they're going to approach it as, "Is it this or is it this?" It's a tree. And design thinking it's almost like the opposite of that. It's almost like an integrating instead of a differentiating factor. So, yeah, if you already know the answer why pull everybody together? And if you're going to divide the world into splits of two, go ahead. And you're probably going to solve the problem to some extent, but I think philosophically what happens is you end up leaving a lot on the table.

Summary

Designers, Leaders, and Clients at Western University enacted design thinking in a variety of ways including through Design Challenge events, using design thinking as an approach to projects, and using design thinking as a flexible framework of activities. Participants described a number of aspects and practices involved in design thinking as well as roles, attitudes, and skills they view as important in doing design thinking work. Participants also described spaces, tools, and organizational aspects that are important for supporting design thinking work.

Overall, Designers, Leaders, and Clients perceived design thinking as valuable. Participants identified many things they valued in design thinking, including aspects of design thinking that they like and dislike, challenges they faced in suing design thinking, and types of work for which they think design thinking is a good approach.

Chapter 5: Discussion, Implications, and Recommendations

Overview of the Study

This study is a qualitative case study exploring how design thinking has been enacted and valued as an approach to solving problems at Western University, a large public university in the Western United States. Western University was chosen for this case study as it has created a Design Team that specifically used a design thinking approach to solving problems.

The researcher interviewed 15 people using a semi-structured interview approach during a 5 day visit to the Western University Campus in September, 2017. One participant was interviewed a week later using web-based video conferencing software. Each interview was about an hour long. The researcher interviewed Designers and Leaders who worked in the Educational Technology Group that is a part of the IT organization at the university. The Educational Technology Group included the Design Team and the College Educational Technology Team. The researcher also interviewed Clients who worked with the Design Team to use design thinking. The researcher visited spaces used to support design thinking and took photos using the camera on a mobile phone. The researcher collected documents from participants and the university website that described the design thinking work of the

Design Team. The interviews were recorded using digital audio recorders and transcribed using a transcription service. The researcher analyzed the interview transcriptions, documents, photos, and notes. The researcher generated a list of themes and created codes drawn from the data and coded the data using the software MaxQDA. The data related to each of the research questions were presented in summary form and verbose-coded form in Chapter 4.

Review

Design thinking provides a framework of practices and tools that may help higher education institutions to change, adapt, and innovate so they might better address complex challenges they face (Bell, 2008; Morris & Warman, 2015; Zenke, 2014). The challenges facing higher education institutions are often complex, sometimes are ill-defined, and may even be considered *wicked problems* (Zenke, 2014). Design thinking has been described as a productive approach to these types of problems (Buchanan, 1992; Cross, 2011; Rowe, 1987). Many authors have written about the potential design thinking has to help people in higher education to solve complex problems they face (Bell, 2008; Gilbert et al., 2017; Morris & Warman, 2015, 2015; Weerts et al., 2015; Zenke, 2014).

There are many resources, articles, and toolkits that support design thinking. While this may have contributed to the notion that design thinking is a fad, Design thinking's popularity and abundance of resources may also helped to make human centered design concepts and practices accessible to people who have not had the benefit of formal design education.

Higher education institutions contain many designed artifacts and systems. Campus plans, buildings, programs, curricula, courses, print materials, websites, services, and a variety of other artifacts and systems are designed. People in higher education are designing whenever they seek to change current conditions into preferred conditions by planning and conceiving of new artifacts, services, and systems (Buchanan, 2001; Simon, 1996). Some of the design work conducted in higher education systems is related to professionalized design traditions while other design work is not related to a specific design tradition. University leaders may engage architects to design campus buildings or graphic designers to create print materials. However, there may not be a professionalized human-centered design tradition around the creation of other university systems and services. Design thinking is promising for higher education because it is a broad design framework that can be applied to a variety of problems in a variety of contexts (Buchanan, 1992, 2004). Design thinking may provide a human-centered design framework for addressing problems in higher education systems where there is not already an existing human-centered design tradition.

There is developing interest in how design thinking might help higher education to address complex problems and people in higher education have used design thinking to address problems (Bell, 2008; Berrett, 2015; Morris & Warman, 2015, 2015; Weerts et al., 2015; Zenke, 2014). However, little is known about how design thinking is enacted in higher education settings and if it is valuable. This study

provides insight into how people at Western University enacted and perceived the value of design thinking. The research questions for this study were:

1. How do designers, leaders, and clients at Western University enact design thinking?
2. How do designers, leaders, and clients at Western University perceive the value of design thinking?

The following section provides findings from the research that answer the research questions.

Research Question 1 Findings

Participants enacted design thinking in three primary ways: Design Challenges – enacting design thinking as an event; enacting design thinking as an approach to projects; enacting design thinking as a flexible framework of activities. Participants defined design thinking, described characteristics of design thinking, and described practices involved in design thinking in ways that are consistent with the literature. Participants used design thinking models to visualize and guide their design thinking work. Participants also described roles, spaces and tools, leadership support, professional development, and assessment, documentation and communication as important factors of enacting and supporting design thinking.

Design Thinking Models. Designers and Leaders at Western University developed their own design thinking process models and used them to guide and frame their design thinking work. Participants primarily discussed the design thinking

diagram that visualized convergent and divergent thinking modes enacted across six stages (Figure 10).

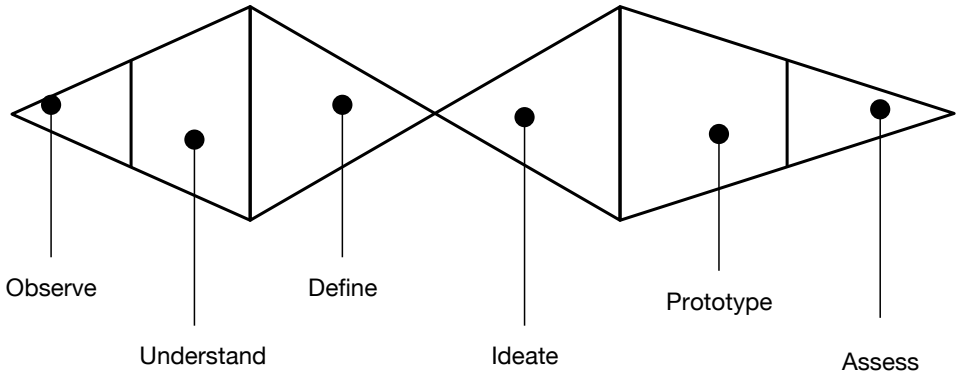

Figure 10. The Design Team's design thinking diagram. This diagram provides a visualization of the Design Team's design thinking process.

The visualization of divergent and convergent thinking modes in Design Team's diamond shaped process diagram (Figure 10) is consistent with other visualizations of divergent and convergent thinking processes included in other design thinking models and toolkits (e.g. Brown, 2009; Liedtka & Ogilvie, 2011; Riverdale Country School & IDEO, 2012; Stanford University, 2010).

The Design Team's six-stage process models are very similar to the four- and five-stage models found in the literature (Figure 11). One notable aspect of the Western University models is that they have built problem framing and reframing activities into the stages of their model. While problem framing activities are sometimes mentioned in design thinking models (Riverdale Country School & IDEO,

2012; Stanford University, 2010), both framing and reframing are not always itemized or visualized in the models.

Participants at Western University described using their design thinking models to guide their design thinking work. Many participants described the diamond visualization articulating convergent and divergent thinking (Figure 10) as helpful. Using a design thinking model to visualize design thinking concepts and to guide design thinking work may be an important factor in enacting design thinking at other higher education institutions.

Author	Perspective	Design Thinking Stages								
		Discover and Define				Ideate, Prototype, Test				Implement
Brown (2008)	CEO and president of the design firm IDEO.	Inspiration				Ideation				Implementation
IDEO.org (2015)	A toolkit developed by IDEO.org to support human-centered-design work.	Inspiration				Ideation				Implementation
Fraser (2009)	Director of the Business Design Initiative at the Rotman School of Management.	Empathy & Deep User Understanding				Concept Visualization				Strategic Business Design
Porcini (2009)	Was Head of Design, Consumer & Office Business Worldwide at 3M.	Design in R&D				Design of Products				Design in Business
Clark & Smith (2009)	Leaders at IBM writing about IBM's experience design model in the context of design thinking for organizational use.	Understand	Observe			Conceptualize	Validate			Implement
Kelley & Littman (2001)	Kelley was general manager of IDEO. This is his representation of their process.	Understand	Observe			Visualize	Evaluate & Refine			Implement
Liedtke and Ogilvie (2011)	Liedtke is an academic in management, Ogilvie is a consultant in innovation strategy.	What is?				What if?	What wows?			What works?
Riverdale School and IDEO (2013)	A toolkit developed by a school and IDEO to support design thinking in education.	Discover	Interpret			Ideate	Experiment	Evolution		
Stanford University (2010)	A toolkit to support using design thinking developed by the Stanford d.school.	Empathize	Define			Ideate	Prototype	Test		
Western University Diamond Diagram Model	The design thinking process diagram used in Design Thinking Challenge presentations.	Observe	Understand	Define		Ideate	Prototype	Assess		
Western University Website Model	The design thinking process stages on the Design Team's website.	Framing	Discovery	Reframing		Ideate	Prototype	Test		

Adapted from Howard (2015).

Figure 11. Comparing Western University's Design Thinking Models with Other Models and Toolkits. This diagram provides a visualization comparing the stages of the Western University design thinking models and other models and toolkits from the literature.

Design Challenges – Design Thinking as an Event. The Design Team enacted design thinking by hosting Design Challenges, ninety-minute to four-hour events that brought groups through a design thinking process. Design Challenges provided a number of benefits to the university. Client teams received support in addressing their problems in a creative way by using a design thinking approach. Design Challenges helped the Design Team to develop design thinking facilitation skills among members of the Design Team. Design Challenges also helped to build awareness and familiarity of design thinking approaches to solving problems with client groups and other groups across the university. The limited time commitment of a Design Challenge may have been important in allowing client teams to try out design thinking without committing to a longer project process.

The structure of the Design Challenges is similar to introductory design thinking experiences from the Stanford d.school such as the *Virtual Crash Course in Design Thinking* (Stanford University, n.d.-a) and *The Wallet Project* (Stanford University, n.d.-b). These experiences help participants learn more design thinking by taking them through an entire design thinking process in ninety minutes. These introductory design thinking processes present design challenges to redesign a wallet or redesign a gift giving process; challenges that many people might participate in solving.

The Design Team's approach was somewhat different; instead of using a provided problem such as redesigning a wallet, the Design Team worked with clients to address a problem the clients identified. The Design Team's practice of using

problems identified by the client teams in Design Challenges may have helped the client teams connect design thinking to their own work and see value in design thinking as a problem solving approach.

Design Thinking as an Approach to Projects. The Design Team used design thinking as an approach to projects such as redesigning large courses. Designers conducted design thinking based projects within the established project management environment of the university IT organization. Designers described conducting project management tasks in addition to design tasks as a part of their work on design thinking based projects. The design thinking literature generally does not address project management as an aspect of design thinking work. However, many of the examples of design thinking work in the literature were large projects conducted in large organizations where it might be assumed that some project management practices were used.

Many participants said that design thinking was used as an approach to working on projects, but few described using design thinking in operational based work. Client 04 said that her group primarily worked on operational tasks and so there was not much opportunity to use design thinking, though she articulated that design thinking was helpful for project based work in her group when it occurred.

The distinction of project based work and operational based work is not a focus area in the design thinking literature, but may be significant for the use of design thinking in higher education. Universities may have some units primarily focused on operational work and others more focused on project based work. Higher

education institutions also may not have project management practices and systems broadly used across the organization. Having an established project management practice in place within an organization may be an important factor for success in using design thinking as an approach to projects.

Design Thinking as a Flexible Framework of Activities. Several participants described design thinking as a flexible framework that can be applied to many types of problems. They described design thinking as a toolbox or a buffet table where they selected and used components or activities of design thinking without going through an entire design thinking process. Designers described conducting activities such as brainstorming, creating personas, or creating journey maps as a part of work they did during faculty seminars.

This behavior is somewhat similar to the concept of design thinking as a mindset rather than a process. It is different from many of the toolkits that present design thinking as somewhat linear process. The activity-based framing of design thinking as a collection of activities is similar to some human-centered design resources and toolkits that emphasize activities rather than an overarching process (Lipmanowicz & McCandless, 2013; LUMA Institute, 2012).

Many participants also made connections between design thinking and other design and problem solving frameworks in instructional design, process improvement, user experience design research, change management, and project management. Participants described integrating aspects of design thinking with various other frameworks and models in their design and problem solving work. This

behavior is similar to research findings that suggest that expert designers are aware of—but may not strictly follow—design process models (Ertmer et al., 2008; Rowland, 1992).

There is a significant amount of similarity among design thinking process models in the literature (Figure 11). Client 02 suggested there is also a significant amount of similarity among problem solving approaches formalized in a variety of design models and process improvement frameworks.

> [C02] What I find about that is that things like problem-solving that's the scientific method formalized in some way or the other way, there is so much different approaches but they're all kind of basically the same thing… they're all kind of based on the same idea which is start off by talking to people who are going to be using this product or service to understand their needs, somehow quantify that, somehow turn their language into language that makes sense to design to, somehow turn into that into design targets, turn those design targets and creatively come up with different ways of meeting those design targets, try some out, prototype, see if it works so it doesn't get back to the process again if it does work, fabulous, have you rolled it out and commercialize it.

Participants at Western University used design thinking activities opportunistically, selecting activities as needed and sometimes blending them with other design frameworks such as the Backward Design instructional design framework. They also described connections and identified similarities between

design thinking and other problem solving frameworks. There may be a variety of design and problem solving frameworks already being enacted at a given university. Practitioners enacting design thinking at other higher education institutions may also find connections and opportunities for integration of design thinking and other problem solving frameworks.

Roles. Roles were an important aspect of enacting design thinking at Western University. The Learning Experience Designer position was a role that led and supported design thinking work. Leaders developed specific criteria for the type of people they sought to hire as Learning Experience Designers. Participants identified many roles that people assumed as a part of Design Challenges and design thinking based projects. There has been some exploration of roles in the literature, but there is not agreement on a set of roles used in design thinking. There were similarities and differences between the roles identified at Western University and the perspectives and roles identified by Body, Terrey, and Tergas (2010), Sanders and Stappers (2008) and Howard (2015).

Table 4

Comparing Roles in Design Thinking

Western U. Design Challenge Roles	Western U. Design Thinking Project Roles	Body, Terrey, Tergas (2010) Perspectives	Sanders and Stappers (2008) Roles	Howard (2015) Roles
Co-Lead	Lead & Second	Designer	Designer	Facilitator of the Design Process
Client	Client	Holder of the Intent	Researcher	Design Lead
Decider	Decider	Specialist	User	Educator in the Design Process
Time-Keeper	Student	User		Composer of the Design Experience
Note-Taker	Stakeholder			Client
Participant	Sponsor			
	Endorser			

The Lead and Co-Lead roles at Western University were responsible for leading and facilitating Design Challenges and design thinking based projects. The responsibilities of these roles are similar to the role descriptions of the Design Facilitator perspective (Body, Terrey, & Tergas, 2010), the Designer role (Sanders & Stappers, 2008), the Researcher role (Sanders & Stappers, 2008), and Howard's (2015) roles of Facilitator of the Design Process, Design Lead, Educator in the Design Process, and Composer of the Design Experiences.

The Client and Decider roles at Western University were responsible for initiating and receiving design work and making decisions for how to move forward in design thinking work. These roles have has some similarities the role descriptions of the Holder of the Intent perspective (Body, Terrey, & Tergas, 2010) and Howard's (2015) discussion of client involvement in design thinking. There is not an equivalent of the Sponsor and Endorser roles in the frameworks developed by Body, Terry, and Tergas (2010), Sanders and Stappers (2008) or Howard (2015).

The Student role at Western University aligns with the User role and perspective (Body, Terrey, & Tergas, 2010; Sanders & Stappers, 2008). The Participant and Stakeholder roles may have some alignment with either the User role or the Specialist perspective, but it is not completely clear how these roles align across the (Body, Terrey, & Tergas, 2010; Sanders & Stappers, 2008). For example, a faculty member working as a part of a course design could be considered a user of the designed course system, or as a Specialist bringing their subject matter expertise to the project, or as the Holder of the Intent.

Creating and identifying roles to support design thinking may be an important factor for enacting design thinking at other higher education institutions. This may include developing roles, such as the Learning Experience Designer position, that support design thinking work. This may also include identifying roles that people enact during Design Challenges and design thinking based projects.

Spaces and Tools. Spaces and tools were an important aspect of supporting design thinking at Western University. Designers and Leaders used the Exploratory as

a space to support design thinking. Participants identified characteristics of spaces that they desired when selecting spaces for conducing design thinking work. Participants also described a variety of tools they used to support design thinking work such as sticky notes, foam core boards, and materials for building prototypes. The spaces and tools created and used by people at Western University are consistent with the recommendations for spaces and tools provided in design thinking toolkits (Doorley & Witthoft, 2012; Liedtka & Ogilvie, 2011; Riverdale Country School & IDEO, 2012; Stanford University, 2010). Providing spaces and tools to support design thinking work may be important aspects of enacting design thinking at other higher education institutions.

Leadership Support. Participants said that it was important to have support from leadership for design thinking. Participants also described challenges they experienced when people in leadership questioned the value of design thinking. Having support from university leadership may be an important factor in enacting design thinking in higher education institutions.

Professional Development. The university provided opportunities for people to learn about design thinking through an online design thinking course and through regular Juntos. Designers were also paired as co-leads during Design Challenges and in design thinking based projects. This helped designers develop their knowledge and skills in leading design thinking at the university. Designers and Leaders also presented at a teaching and learning conference at the university, which helped other staff members to learn more about design thinking. Providing professional

development opportunities that help people to learn more about design thinking may be an important factor in enacting design thinking in higher education institutions.

Assessment, Documentation, and Communication. The Educational Technology Group included assessment activities to determine the value and impact of their design thinking work. The Design Team created documentation and communication practices to share information about their design thinking work. These practices may have helped to generate understanding and support for design thinking within the university. Conducting assessment and communicating outcomes may be an important factor for developing support for design thinking work at other higher education institutions.

Research Question 2 Findings

Designers, Leaders, and Clients at Western University described design thinking as a valuable approach to addressing complex, *wicked problems* they faced. However, design thinking was not a panacea for participants at Western University. Participants said that design thinking was a valuable approach for addressing some problems but it was not described as helpful or appropriate in all cases. Participants described design thinking as a valuable approach for project based work, but design thinking was not a good fit for operational work. Participants described design thinking as a helpful approach to solving indeterminate and *wicked problems*. They did not describe design thinking as a valuable approach for solving determinate problems. Participants also described aspects of design thinking that participants they did not like. While the people interviewed for this study generally found design

thinking valuable, the critique of design thinking as a fad or a buzzword suggests that design thinking may not be universally valued at Western University.

Participants described a number of challenges they faced in using design thinking. Challenges included time, design thinking was not seen as serious, departmental politics, power dynamics, faculty and staff dynamics, and in prototyping courses. The literature does not significantly address challenges to using design thinking. The interview protocol used in this research contained questions about challenges people faced in using design thinking to help address this gap in the literature.

These findings provide evidence supporting proposals that design thinking may be a valuable approach to solving complex problems in higher education (Bell, 2010; Warman & Morris, 2014; Zenke, 2014). Practitioners at other universities may also find design thinking to be valuable approach to solving complex problems at their institutions. However, there may be situations or types of problems where design thinking may not be an appropriate or helpful approach. Practitioners at other universities may also encounter challenges in using design thinking at their institutions.

Design Thinking, Change Management, and Adaptive Design

Designers, Leaders, and Clients described a relationship between and design thinking and change management. This was an unanticipated finding. There was not question regarding change management in the interview protocol; it was a topic participants brought up during the interviews. The design thinking literature does not

generally address change management as a part of design thinking processes and practices. Articles, books, and toolkits often address the creative and innovative potential of design thinking but they do not address potential challenges that may be encountered in implementing designed changes. The lack of attention to change management has been an unaddressed weak spot in the design thinking literature. The design literature has tended to be optimistic about how great ideas will naturally be adopted within organizations. However, this may not be the case in practice. Ideas may be resisted and not implemented during the change process (Bernstein & Linsky, 2016; Heifetz, 1994; Heifetz & Linsky, 2002). Developing creative, innovative ideas though a design thinking process is well and good but the ideas will not have the desired impact if the ideas are not implemented because of organizational challenges with change.

One notable exception to the inattention to change management in design thinking is Bernstein and Linsky's (2016) work connecting design thinking and adaptive leadership into a framework they call adaptive design. Adaptive design blends the creative, human-centered aspects of design thinking with the change leadership aspects of adaptive leadership, a framework for addressing complex change (Bernstein & Linsky, 2016; Heifetz, 1994; Heifetz, Grashow, & Linsky, 2009; Heifetz et al., 2009).

Bernstein and Linsky (2016) described design thinking an empathetic, creative, human-centered design framework that can be used in a variety of settings. Their design thinking model is a four-stage process including empathy, definition,

ideation, and prototyping. In the empathy stage, people gather insights on the needs of users. In the definition stage, people reframe the challenge based on what was learned during the empathy phase. This may involve creating How Might We questions. In the ideation stage, people develop many ideas that might be possible solutions. In the prototyping phase, people create prototypes of the solution concept.

Adaptive leadership is a framework for addressing complex, adaptive change (Bernstein & Linsky, 2016; Heifetz, 1994; Heifetz, Grashow, & Linsky, 2009; Heifetz et al., 2009).

> Adaptive leadership…emphasizes two core distinctions—the difference between exercising authority and exercising leadership, and the difference between technical problems and adaptive challenges. People in positions of power exercise *authority*. Authority figures provide direction, protection, and order…Exercising authority is important work, but it has nothing to do with exercising *leadership*…[leadership is] about telling people what the *need* to hear—especially when what the need to hear differs from what they *want* to hear. (Bernstein & Linsky, 2016, p. 7, emphasis in original)

Adaptive leadership focuses on helping people to address adaptive challenges rather than technical problems. "Technical problems are susceptible to clear definition, and they have clearly identifiable solutions" (Bernstein & Linsky, 2016, p. 8). People in positions of authority have the expertise and are given the power to solve technical problems. Adaptive challenges are problems where the problem and

the possible solutions are not well defined (Heifetz, 1994; Heifetz & Linsky, 2002; Heifetz, Grashow, & Linsky, 2009).

> Adaptive challenges…are hard to define precisely. Solving them involves changing hearts and minds and solutions of that kind often threaten people's self-identity…Adaptive leadership is uncomfortable because it involves helping people through loss. After all, we don't resist changes that we think will be exciting or good for us—starting a new job, moving to a new city, getting married, having children, winning a lottery. But we do fear and resist the need to leave behind something that we cherish. Part of the work of adaptive leadership, therefore, is identifying the losses that come with any change. (Bernstein & Linsky, 2016, p. 8)

In adaptive leadership, leaders help people to do the difficult work of making adaptive changes (Bernstein & Linsky, 2016; Heifetz et al., 2009).

Bernstein and Linsky (2016) described the adaptive leadership process with three stages: observation, interpretation, and intervention. In the observation stage, people observe the systemic patterns happening around them. "People step back from their immediate work in order to see what is happening around them" (Bernstein & Linsky, 2016, pp. 8–9). In the interpretation stage, people interpret their observations, but this work can be difficult.

> People will gravitate toward interpretations that are narrowly technical and that favor consensus. The will resist interpretations that are systemic in scope

> or that focus on conflict and loss. Yet systemic disruption, conflict and loss are inevitable aspects of real change work. (Bernstein & Linsky, 2016, p. 9)

In the intervention stage, "practitioners undertake customized experiments that focus on the human element of the change process" (Bernstein & Linsky, 2016, p. 9).

Bernstein and Linsky (2016) identified complementary strengths and weaknesses between design thinking and adaptive leadership. Design thinking has strengths as an empathetic, creative, human-centered approach that helps people to take risks. However, design thinking does not provide the frameworks and tools to address resistance to change based on perceived threats. Adaptive leadership provides people with the leadership tools frameworks to be both optimistic and realistic as they do the difficult work of helping people address adaptive changes. However, adaptive leadership does not provide much support for the creative, iterative work of developing possible interventions.

In order to take advantage of the complementary strengths present in design thinking and adaptive leadership, Bernstein and Linsky (2016) combined the two processes into a single framework they called adaptive design. Adaptive design blends the two processes into four stages: empathetic observation, interpretation, ideation, prototype interventions. In the empathetic observation stage, people conduct empathy work to discover the needs of users but they also use political mapping to understand the "values, alliances, and perceived threats that pertain to each stakeholder in an given system" (Bernstein & Linsky, 2016, p. 11). In the interpretation stage, people draw on adaptive leadership to "distinguish technical

problems from adaptive challenges, and they work to discern the value conflicts and the apprehensions about loss that affect various stakeholders" (Bernstein & Linsky, 2016, p. 11). People also draw on practices from design thinking to frame, reframe, and define challenges. In the ideation stage, people draw on the creative tools from design thinking to generate a variety of potential solution options. In the prototype interventions stage, people create prototypes and conduct "experiments that not only test potential new products and processes, but also reveal the ability of an organization or system to accommodate change" (Bernstein & Linsky, 2016, p. 11).

There are similarities in the concepts of adaptive challenges, addressed though adaptive leadership, and the ill-defined and *wicked problems*, identified through the design thinking literature. Both identify the problems and potential solutions spaces as ill-defined. These complex types of problems are defined in opposition to problems that are well defined and have known solutions that can be implemented. There are also differences. The literature in adaptive leadership has focused on the human, organizational, and interpersonal aspects of solving adaptive challenges (Heifetz, 1994; Heifetz & Linsky, 2002; Heifetz, Grashow, & Linsky, 2009). The design thinking literature has focused on the behavior of designers as they work to understand and develop solution concepts for solving ill-defined problems and *wicked problems* (Cross, 2007; Lawson, 2006; Rowe, 1987; Schön, 1983). More research is needed to understand the relationship of adaptive challenges, ill-defined problems, and *wicked problems*.

Participants at Western University discussed a relationship between design thinking and change management. Participants described challenges they encountered in design thinking because of departmental politics, power dynamics, trust, university support, varying levels of participation, and challenges in cultures of problem solving within university departments. Participants described using a change management process developed by the consulting firm Prosci (Prosci, n.d.). They did not discuss change management using terms from adaptive leadership or adaptive design. Nevertheless, adaptive design does provide a lens for examining the integration of design thinking and change management as described by participants at Western University. This section examines the findings of this study through the lens of the four stages of adaptive design.

The adaptive design stage of empathetic observation focuses on understanding user needs and observing the institutional political environment. Participants at Western University engaged in empathetic discovery work as a part of their design thinking processes. While political mapping was not an explicit component of their design model, designers and leaders did describe organizational political aspects that were factors in their design work. For example, Leader 02 described how she used design thinking as a way to break down organizational silos when working on a project where relationships were political because of shared ownership between departments of the student portal that was being redesigned. Leader 01 and Client 06 described how the Educational Technology Group has worked with other departments to assess their readiness for change prior to taking on a major initiative. While

participants did not use the adaptive design terms for political mapping, they described an awareness of political issues in the organization and assessing the change readiness of departments as a part of their design thinking work.

In the interpretation stage, people differentiate between technical and adaptive challenges and identify conflicts that may arise through the change process. This stage also involves framing and reframing challenges to identify creative solution opportunities. Participants at Western University described including framing and reframing as a part of their design thinking process. Participants also described orienting their design thinking work to addressing *wicked problems* they faced at the university. Participants did not use the terms technical problems or adaptive challenges that are used in adaptive design. However, participants did differentiate between determinate problems, those with a known solutions, and indeterminate and *wicked problems*, problems that are ill-defined, do not have clearly identifiable solutions, and may meet the criteria of *wicked problems*. Leader 03 described a tendency of people within the IT organization to approach problems as determinate problems with technical solutions and that the Educational Technology Group's use of design thinking to approach problems as indeterminate problems was countercultural in the IT organization. Designers also indicated that they were aware that the design process might entail concerns of loss for participants and stakeholders. Designer 01 described how one faculty member was not satisfied with a course redesign because she did not see herself in the final product. Designer 02 described that some staff members had been concerned that design thinking processes might

negatively impact their jobs. Several designers and clients described a tension between faculty and staff on campus. Participants did not use the language of adaptive design but did describe aspects of interpretation and reframing activities that are contained in the second stage of adaptive design.

In the ideation stage, people use creative activities based in design thinking practice to develop many possible solution ideas. Participants at Western University described a variety of brainstorming and ideation practices they employed to develop creative solutions to problems. They also created and used spaces that would help people to feel comfortable and to help them be creative through the design thinking process. However, several designers and clients described instances where power dynamics and organizational politics may have impacted ideation work. Designer 02 and Client 05 described instances where people looked to their supervisors before saying things in brainstorming sessions, possibly worried about what their supervisors might think. Client 04 described how she tried to limit her participation in brainstorming sessions so as not to stifle members of her team. Bernstein and Linsky's (2016) model does not address potential challenges with organizational or power dynamics in the ideation stage.

In the fourth stage, prototype interventions, people conduct experiments, create prototypes and reveal the capacity in the system to accommodate change. Participants at Western University developed and tested prototypes as a part of their design thinking work. Leader 03 described the importance of prototypes in helping people to come to a shared understanding of solution concepts. Participants also

described instances where they faced challenges. Leader 01 and Designer 02 described challenges they faced when the person designated as the decider on was not actually the decider. In these cases there were other decision making processes that needed to be engaged as a part of the process. Participants also described challenges they experienced in making sure people allocated enough time to the design thinking process, concerns that people expressed regarding faddishness of design thinking, faculty and staff politics, departmental politics, people jumping to solutions, and people's expressed concerns and fears through the change process.

Client 02 described experiences in higher education where people would resist change initiatives.

> [C02] So in higher ed…my experience of it is it was whole bunch of change this and you would never hear from it again. So people would either just wait out change, or they wouldn't change, or something would change and they just would not adopt it, or whatever.

The resistance to change described by Client 02 aligns with the concept of work avoidance described in adaptive leadership (Heifetz, 1994; Heifetz & Linsky, 2002; Heifetz et al., 2009). When faced with adaptive changes, some people will engage in work avoidance to avoid making the difficult and necessary adaptive changes (Heifetz, 1994; Heifetz & Linsky, 2002; Heifetz et al., 2009).

Participants did not use the term interventions to describe their work with prototypes. However, change management emerged as an issue as participants described their design thinking work with prototype development and the adoption of solutions.

There were aspects of the design thinking and change management work at Western University that are not addressed in Bernstein and Linsky's (2016) adaptive design framework. Participants described roles as an important aspect of their design thinking work. The roles of co-lead, client, decider, sponsor, and endorser may have a connection to change management processes. Participants also described project management as an important aspect of their design thinking work. Bernstein and Linsky's (2016) did not address roles or project management as aspects of adaptive design.

Participants at Western University described using the Prosci ADKAR model (Prosci, n.d.), a five-stage change model to help individuals enact change. Bernstein and Linsky's (2016) adaptive design model does not address stages for guiding change for individuals.

Bernstein and Linsky's (2016) adaptive design model provides a framework for describing the design thinking and change management work that occurred at Western University. While participants did not use the specific language of adaptive leadership or adaptive design, they described an integration of design thinking and change management that generally aligns with Bernstein and Linsky's (2016) adaptive design framework.

Adaptive design may be a promising framework for people in higher education who desire to use design thinking to help support change initiatives at their institutions. Adaptive design brings together the chocolate of design thinking with the peanut butter of adaptive leadership in ways that may be productive for people in

higher education. Design thinking provides frameworks and tools to design solutions to ill-defined problems and *wicked problems* in a creative, empathetic, human-centered ways. However, design thinking resources rarely address the change management implications of solutions developed in design thinking processes. Adaptive leadership provides frameworks and tools for helping people address adaptive challenges but it does not provide much support for creatively developing solution concepts. Adaptive design combines the creative, human-centered approach of design thinking and the change leadership approach of adaptive leadership in ways that may help higher education leaders to they seek to develop and implement creative solutions to complex problems they face.

Recommendations for Practitioners

There are a number of aspects of how Western University enacted design thinking that may interest practitioners wishing to use design thinking as an approach to solve problems in their own higher education contexts.

Consider Using Design Thinking for Course Design and Student Experience Design. Practitioners interested in design thinking should consider using design thinking as an approach to designing courses and student experiences.

Use a Design Thinking Model. Practitioners should consider using a design thinking model to help people visualize, communicate, and structure design thinking work. Practitioners should consider using a model as a flexible process that can be changed and adapted to project needs rather than using the model as a rigid, linear process. There is a significant amount of similarity between design thinking models

in the literature. Practitioners should consider choosing one of the models that suits their own institution. They might also consider adapting existing models to create a model for their own institutions, as people at Western University have done.

Consider Leading Design Challenge Events. Practitioners at other universities should consider developing Design Challenge events as a way to address problems and to help develop interest and skills in design thinking. Practitioners should also consider using problems identified by client teams within their university for Design Challenges rather than using pre-determined problems such as redesigning a wallet.

Consider using Design Thinking as an Approach to Projects. Practitioners should consider using design thinking as an approach to projects that address complex challenges. Practitioners wishing to use design thinking as an approach to projects should also consider the project management capabilities of their own institution and provide project management expertise and support for design thinking based projects.

Consider using Design Thinking as a Flexible Framework of Activities. Practitioners should consider using design thinking as a flexible framework of activities that are used without going through an entire design thinking process. Practitioners should consider integrating these activities with other design models or process improvement frameworks that may already be in use at their institutions.

Identify Clear Roles. Practitioners wishing to support design thinking should consider clearly identifying and supporting roles as a part of design thinking work. Practitioners should consider and articulate the attitudes and skills they will look for

when hiring people to support design thinking. Practitioners should consider creating roles that focus on leading and facilitating design thinking work for the university, such as the Learning Experience Designer roles at Western University. Practitioners should also consider supporting pairs of designers on design thinking based project and Design Challenges to facilitate learning and to provide designers with a dialog partner. Practitioners should also consider identifying clear roles as a part of Design Challenges or design thinking based project work.

Provide Time and Resources. Design thinking can be a time-intensive process. Practitioners wishing to use design thinking as an approach to projects should consider the amount of time it may take to complete a design thinking based project and allocate necessary time and resources to the project.

Find or Create Spaces to Support Design Thinking. Practitioners wishing to use design thinking should consider intentionally choosing or allocating space for design thinking that will be welcoming to people and supportive of the creative and collaborative activities of design thinking.

Provide Leadership Support. Practitioners wishing to use design thinking should seek support from university leadership. Practitioners in positions of leadership should consider providing explicit support for design thinking.

Provide Professional Development Support. Practitioners wishing to use design thinking should consider supporting designers and potential clients by providing opportunities to learn about design thinking.

Proactively Address Challenges. Participants described a number of challenges they faced in using design thinking. These challenges may occur in using design thinking in other university contexts. Practitioners should consider how to proactively address these challenges at their own universities.

Manage Change. Change management is rarely addressed in the design thinking as an aspect of implementing designs or changes that result from a design thinking process. Practitioners should consider how the results of a design thinking process may introduce changes that would benefit from support through an intentional change management process. Bernstein and Linsky's (2016) framework of adaptive design may provide guidance on how to integrate design thinking and change management.

Assess and Communicate Outcomes. Practitioners should consider how they will assess and communicate the outcomes of design thinking work.

Recommendations for Researchers

Participants at Western University used design thinking to address a number of different types of problems. Participants in this study indicated that design thinking was a valuable approach to addressing problems at Western University. Other universities have used design thinking as an approach to solving problems and there is interest in how design thinking may be a helpful approach for university leaders to address problems (Bell, 2010; Berrett, 2015; Morris & Warman, 2015; Weerts et al., 2015; Zenke, 2014). While there is interest and people are using design thinking in higher education, there is very little research on the use of design thinking to solve

problems in higher education; more research is needed. Based on the findings of this study, there are a number of aspects of design thinking as an approach to solving problems in higher education that would benefit from more research.

Enacting Design Thinking. Participants enacted design thinking through Design Challenges, using design thinking as an approach to projects, and using design thinking as a flexible framework of activities. More research is needed to understand if design thinking is enacted in similar or different ways at other higher education institutions.

Design Thinking and Other Models. More research is needed to understand how design thinking models are similar to and different from other design models, change management models, project management processes, and process improvement frameworks. More research is also needed to understand if and how people at other universities are integrating design thinking with other design models and frameworks.

Roles in Design Thinking. While there were some similarities among the design thinking roles identified in this research with roles identified in the literature, there were also differences. More research into roles used in design thinking within higher education would help to improve understanding and professional practice.

Perceived Value of Design Thinking. More research is needed into how people perceive the value of design thinking for addressing problems in higher education. More research is also needed to understand when design thinking is a helpful and appropriate approach to solving problems and when it is not.

Challenges in using Design Thinking. The literature does not significantly address challenges that people face in using design thinking, more research would help to improve understanding of the challenges people face in using design thinking and how they address those challenges.

Adaptive Design. Bernstein and Linsky's (2016) adaptive design framework combines design thinking and adaptive leadership in ways that may be helpful for leaders in higher education. More research is needed to understand if adaptive design is a beneficial framework designing and implementing change initiatives in higher education.

Research Methods. Research and knowledge production using methodologies other than a qualitative case study, such as observational studies, action research, or design cases could help create a more robust understanding of design thinking in higher education.

Concluding Comments

In this research I have worked to understand how Designers, Leaders, and Clients at Western University enacted and perceived the value of design thinking. Participants described enacting design thinking in a variety of ways including conducting design thinking based events through the Design Challenges, using design thinking as an approach to projects, and using design thinking as a flexible framework of activities. Participants enacted design thinking in ways that are consistent with the design thinking literature and I have identified a number of ways where their practice is different from identified practices in the literature. Participants also related design

thinking to other models and practices in design, process improvement, change management, and project management.

Participants identified design thinking as a valuable approach to solving complex problems at the university, however they also identified challenges they faced in using design thinking. Their perceived value of design thinking confirms some of the literature that suggests that design thinking may be a helpful approach to solving problems in higher education.

While there has been interest in design thinking as an approach to help people in higher education to address complex challenges that they face, there has been little research conducted to understand how people enact and perceive the value of design thinking in higher education. This study provides insight into how one university has enacted design thinking and it shows that participants valued design thinking as approach to addressing the complex problems they faced. The findings of this study have already helped me in supporting design thinking as approach to solving problems at my university. I hope the findings and recommendations of this research, through exploring the design thinking work that the people at Western University have done, will be helpful to other higher education leaders and researchers in understanding how design thinking may help address complex challenges we face in higher education.

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Appendix A – Interview Protocol

Interview Notes Sheet Date _____ Participant _____

*Reminders to Self * Be objective * Be neutral*

Introduction

1. Thank you…
2. Purposes: I am interested in learning how design thinking is enacted and valued as an approach to solving problems at your university.
3. Your participation is voluntary. Would you sign this **consent form**?
4. As it specifies on the consent form, I will use this data only for this research study and your name and school will never be attached to results.
5. I am going to record this interview for better analysis. **Start recorders here.**
6. Benefits:
    - To you: Hopefully this will spark your thinking about design and design thinking in your work and at your university.
    - To the broader education community: Hopefully this will help higher education to learn more about design thinking.

Background Questions

What is your role at the university?
How long have you been in this role?
Please describe the work you do at the university.
Are you familiar with design thinking?
How are you involved with design or design thinking projects at your university?
Do you personally participate in the design projects?
    If no, are you involved in supporting or sponsoring design work? If so, how?

How do you define design thinking?

Please describe how you define design thinking.

How do you enact [design thinking / your design process]?

Do you use a design thinking approach in your work?
Do you use your [design thinking / design] process for your individual work, as a part of teamwork, or both?

Individual

What types of work do you use your design approach on?
    How do you determine what projects you will work on?

Team

What types of work do you use your [design thinking / design] approach on with at team?

- How do you determine what projects you will work on?
- How do you organize the teams?
- Who do you have on the teams?
- Do team members operate in different roles? If so, what are roles do people play on the team?
- Is it important for members of the team to have specific attitudes or ways of thinking? If so, what are they?
  - Is it important if the person is comfortable with ambiguity?
  - Is it important that the person is optimistic?
  - Is it important that the person is creative?
  - Is it important that the person use strategic thinking?
  - Is it important that the person uses divergent and convergent thinking?
  - Is it important that the person use abductive logic patterns?
  - Is it important that the person have an empathetic approach?
  - Is it important that the person is collaborative?

Design Thinking Process

Please describe what you do in your [design thinking / design] process.

- What is important to you in your [design thinking / design] process?
- If you use a [design thinking / design] approach in both individual work and teamwork, are the processes the same? If not, how are they different?
- Do you gather information from users and stakeholders as a part of your process? If so, what types of information do you gather in your process? How do you gather it?
- Do you use brainstorming or other ideation practices as a part of your process? If so, please tell me more.
- Do you use sketching as a part of your process? If so, please tell me more.
- Do you use other types of visualization in your process? If so, please tell me more.
- Do you use prototyping as a part of your process? If so, please tell me more.
- Do you usually create many concepts or just one for a project? If so, please tell me more.
- Do you test concepts with users and stakeholders? If so, please tell me more.
- Do you ever reframe a design task that was given to you? If so, please tell me more.

Do you always use the same process or do you change it? If so, why?

Do you use a specific [design thinking / design] model? If so, which one?

Do you use the model as is or do you modify it?

Space & Tools

Where do you do your [design thinking / design] work?

- Do you have a dedicated space that you use for your [design thinking / design] work?
- If a specific space, please describe what you like about this space. What do you not like about this space?
- What are important features of the spaces where you do your [design thinking / design] work?

Are there specific tools you use in your [design thinking / design] work?

[For Department / Org. Leaders - people who support / sponsor design teams]

Are you involved in leading or supporting teams that do design work?

- If so, why do you support a [design thinking / design] approach to work at the university?

[For Clients - people who receive the work in the design projects.]
Why did you work with this team for your project?

Did you work with this team because of their [design thinking / design] approach?

Have you worked on a [design thinking / design] project before?

Was working with this team a good experience? Why or why not?

How do you support your [design thinking / your design process]?
What resources such as books, materials, events, etc. do you find helpful in supporting your design work?
What [tools, resources, funding, staffing training] do you need to support your [design thinking / design] process?
Are you getting the support you need now? If not, what do you need?

How do you perceive the value of [design thinking / your design process]?
Do you think [design thinking / your design process] is valuable? Why or why not?
What do you like about [design thinking / your design process]?
What do you not like about [design thinking / your design process]?
What challenges do you face in using [design thinking / your design process]?
What has been successful what has been successful for you in your [design thinking / design] work?
What has not been successful for you in your [design thinking / design] work?
Are there particular types of problems or projects that you think a [design thinking / design] approach is good for? If so, please describe the types of problems?
Are there particular types of problems or projects that you think [design thinking / design] is not a good fit? If so, please describe the types of problems.

Is there anything you would like to share that I didn't ask about?

If I have questions for clarification after the interview, would it be ok if I email you? Any email responses would be confidential. You of course are not obligated to respond.
Again, thank you.

Appendix B – Code Structure

DT Definition

- Approach to Projects
- Approach to Wicked Problems
- DT as Mindset
- DT as Process
- Flexible Framework (buffet?)
- DT as catalyst
- Innovation (response to disruption)
- Strategic Work

Characteristics of DT

- Human-Centered
- Understanding Context
- Empathetic
- DT and AI
- Student involvement in design (co-design?)
- Diversity (of voices)
- Inclusivity
- Focus on Student Experience
- Focus on Client & Stakeholder Needs

Data-driven

Interdisciplinary

Collaborative

Participatory

Creativity

Expansive thinking - out of the ruts

Buzzword

DT Practices

DT in LXD Projects

DT Experiences (Challenges)

DT use by people not on Design Team

DT Models & Toolkits

DT Process

Initial Client Meetings

Stealth Mode

Discovery

Ideation

Iteration

Divergent / Convergent <>

Problem framing / reframing (fresh mind)

How Might We Questions

Research Methods

- Interviews / Canvasing
- Surveys
- Observations
- Poster / Whiteboard with questions
- Focus groups
- Look for analogous situations / peer research

Interacting with Data & Decision Making

- Create visualizations
- Journey Mapping
- Dot Voting
- Engage Artifact
- Tuning Protocol
- Fist of 5
- Design Critique
- Personas
- Data / Design Gallery

Brainstorming

Prototyping

User-Testing

Project Hand-off / Consult

- Design Heuristic
- Follow up Consult

- Document Projects
- Assessment (of project outcomes)
  - Construct Mapping
  - Pre-mortem and Post-mortem
- Space & Tools

Roles

- LXD Role
- Participant Role
- Role: Lead / Co-Lead
- Role: Note-taker (& Timekeeper)
- Role: Faculty / Teaching Team / Client
- Role: Decider
- Role: Sponsor
- Role: Endorser

Attitudes

- Attitude: Adaptability / Flexibility
- Attitude: Not too much ownership of ideas
- Attitude: Open to failure
- Attitude: Comfortable with Tension
- Attitude: yes-and (positive)
- Attitude: Openness & Collaboration
- Attitude: Mindset of Exploration

- Attitude: Creative Thinking
- Attitude: Willingness to change
- Attitude: Willingness to engage in process
- Attitude: Open to receiving feedback

Skills

- Skills: Project Management
- Skills: Organization
- Skills: Ability to research
- Skills: Ability to synthesize
- Skills: Bring big ideas (creativity)
- Skills: Ability to listen
- Skills: Strong Emotional Intelligence
- Skills: Ability to translate (people don't say what they mean)
- Skills: Collaborating with Coworkers

Value of DT

- Like about DT
- Dislike about DT
- Successes
- Client motivation (why work with Design Team?)
- How Clients Learned of Design Team
- Work DT is good for
- Work DT is not good for

Challenges

- Challenge: Time
- Challenge: Jumping to Solutions
- Challenge: building trust - buy in
- Challenge: DT not seen as serious (fad)
- Challenge: Don't want to show a work in progress
- Challenge: Departmental politics / culture
- Challenge: Power Dynamics
- Challenge: Faculty v. Staff
- Challenge: Unclear Decider
- Challenge: Making sure people feel heard
- Challenge: Perception of IT Staff
- Challenge: Different way of working for some people
- Challenge: Fear of Change
- Challenge: Differing DT training / understanding
- Challenge: Prototyping Courses

Organizational Dimensions

- Support / Learn about DT
- Dept. Structure
- Funding

Relation to Other Models

- User Experience Design (Overarching Approach?) 7

Change management

Universal Design & Accessibility

Rhetoric & Design

Project Management

AQP

Instructional Design

LEAN

International Development

Liberating Structures

Participatory Evaluation