

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Design Thinking Across Different Design Disciplines: A Qualitative
Approach

Zeynep Ondin

Dissertation submitted to the faculty of the Virginia Polytechnic Institute
and State University in partial fulfillment of the requirements for the degree
of

Doctor of Philosophy
In
Curriculum and Instruction

John K. Burton, Chair
Barbara B. Lockee
Ken R. Potter
Katherine S. Cennamo

12/08/2016

Blacksburg, Virginia

Keywords: design process, design thinking, design practices, design research

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Zeynep Ondin

ABSTRACT

Even though disciplines that are not traditionally affiliated with design have started to show interest in design thinking such as business, education, healthcare, engineering, and IT (Clark & Smith, 2008; Cross, 2007, 2011; Dorst, 2011; Finn Connell, 2013; Lawson, 2004, 2006; Owen, 2007; Razzouk & Shute, 2012) design thinking studies has tended to focus on limited design disciplines such as architecture, engineering design, and industrial design and there are not enough studies to prove that designers in different design fields perform design processes as design thinking literature proposed (Kimbell, 2011). This qualitative study explores the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and the design activities proposed by the design thinking literature. Design strategies of experts from different design disciplines were studied and compared, in relation to the activities proposed by the design thinking literature. This basic qualitative study was designed to use semi-structured interviews as the qualitative method of inquiry. This study employed purposeful sampling, specifically criterion sampling and snowball sampling methods. The researcher interviewed nine designers from instructional design, fashion design, and game design fields. A semi-structured interview protocol was developed and participants were asked demographic questions, opinion and values questions, and ideal position questions. Demographic questions provided background information such as education and number of years of design experience for the participants. Opinion and value questions were asked to learn what participants think

Design Thinking Across Different Design Disciplines: A Qualitative Approach

about the research questions. Ideal position questions let participants describe what good design would be. The researcher analyzed the interview data and the results were reported in a way to demonstrate the differences and similarities within and across disciplines.

Zeynep Ondin

GENERAL AUDIENCE ABSTRACT

This study explores the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and the design activities proposed by the design thinking literature. In broad terms, design thinking can be defined as cognitive activities that designers are engaged in while involved in the design process (Cross, 2007, 2011; Liu, 1996; Owen, 2007) as well as the knowledge designers have (Kimbel 2011). Design thinking studies has tended to focus on limited design disciplines such as architecture, engineering design, and industrial design and there are not enough studies to prove that designers in different design fields perform design processes as design thinking literature proposed (Kimbell, 2011). The experience of professional designers in other design fields can provide a different and useful perspective to help us understand whether the essential characteristics of design thinking are consistent across different design fields. Design strategies of working professionals from different design disciplines were studied and compared, in relation to the activities proposed by the design thinking literature. The results were reported in a way to demonstrate the differences and similarities within and across discipline

Dedication

This dissertation is dedicated to my parents, Fadime and Yunus Ondin, who have dedicated their lives to my sister's and my education and made a lot of sacrifices throughout our education journey.

Acknowledgement

I would like to thank Dr. Burton, my committee chair, for his continuous support, guidance, and encouragement over the past five years. I would also like to thank my committee members Dr. Lockee, Dr. Potter, and Dr. Cennamo for their support during the doctoral process.

I would like to thank my participants for taking part in this study and providing me great insights.

I would like to thank my twin sister and better half, Zerrin Ondin, for her continuous support and guidance from the first day of my doctoral journey until its very last day. Thank you for listening me patiently and proving me constructive feedback whenever I needed. Without you, this journey would not have been this easy, joyful, and meaningful.

I would like to thank my older sister, Arzu Bahar, for sending photos of my niece, Lea Bahar, and my nephew, Ediz Bahar, every day over the last five years. Their photos gave me strength and motivation to finish my dissertation.

I would like to thank Larry A. Cox II for listening to me talk about my dissertation and providing logistic help during my data collection process and brewing strong coffees to keep me awake during our weekend dissertation writing sessions.

Finally, I would like to thank David Duckett for spending countless hours to proofread my dissertation and sending his joyful drawings on the most painful days of writing my dissertation.

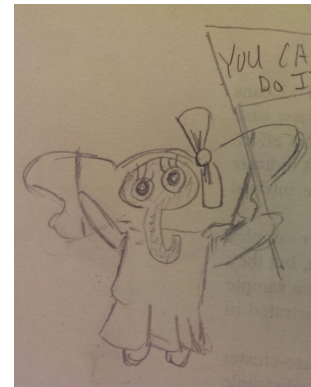


Table Of Contents

Chapter 1: Introduction 1
 The Research Problem..... 1
 The Purpose 4
 Research Question 4
 Significance of the Study for the Instructional Design Community 4
 Organization of the Study 5

Chapter 2: Literature Review 6
 What is Design? 6
 Design Paradigms 7
 Design versus Other Disciplines..... 8
 Design Thinking 11
 History and Definition 11
 Current Focus 15
 Characteristic Features of Design Process as defined by Design Thinking ..17
 Ill-structured Problem Solving 17
 Problem and Solution Co-evolution..... 21
 Iteration 22
 Sketching 22
 Reflective Thinking 23
 Creative Thinking 24
 Abductive Reasoning..... 27
 Characteristics of Designers..... 27
 Design Thinking Process Models 28
 Stanford d.school Design Thinking Process Model 29
 IDEO Design Thinking Process Model 29
 NoTosh Design Thinking Process Model 30
 Criticism..... 31

Chapter 3: Methodology..... 32

Research Design 32
 Qualitative Inquiry..... 32
 Sampling and Participants 34
 Gaining Access 37
 Data Collection 38
 Qualitative Interviews 39
 Online Synchronous Interview 40
 Interview Questions 41
 Probing..... 43
 Interview Guide / Protocol..... 43
 Interviewer Responsibilities..... 43
 Recording an Interview Data – Interview Notes 44

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Interview Steps.....	44
Data Analysis.....	45
Trustworthiness or Credibility, Consistency, and Transferability.....	47
Credibility or Trustworthiness.....	47
Consistency.....	48
Transferability.....	48
The Researcher’s Reflexivity.....	48
Chapter 4: Findings.....	53
Designers’ Profile.....	53
Software usage.....	57
Design Process.....	58
Teamwork Versus Individual Design.....	58
First Step: Identifying a Design Idea or Problem.....	60
Second Step: Analysis.....	63
Third Step: Proposing Solution(s).....	67
Fourth Step: Prototype – Test – Iterate.....	70
The Last Step.....	77
Design Journals.....	78
Design Process Across Different Design Projects.....	79
Challenges faced During Designing.....	80
How do the Designers define a Good Design?.....	83
What is the Designer’s Definition of Design?.....	85
What Does Being a Designer Mean to the Designers?.....	86
What Does Design Thinking Mean to the Designers?.....	89
Chapter 5: Discussion.....	91
Discussion of the Findings.....	91
Design Process.....	91
Challenges Faced During Design Process.....	95
Good Design.....	95
Design.....	96
Being a Designer.....	96
Design Thinking.....	96
Intended Contribution of the Research Study to the Field of Instructional	
Design.....	97
Limitations of the Study.....	97
Recommendations for Future Research.....	97
References.....	98
Appendix A: IRB Approval.....	108
Appendix B: Interview Protocol.....	110
Appendix C: Consent Form.....	112

Appendix D: Recruitment Letter	115
Appendix E: Thank You and Snowballing Email	116
Appendix F: The Summary of the Findings.....	117

List of Tables

Table 3.1: Demographic information of participants.....37

Table 4.1: Demographic information of participants.....53

Chapter 1: Introduction

The Research Problem

How can we define which skills we need to possess to become a productive member of our society? Are those skills that we gain in school? Studies have found that what we learn in school is hardly helpful to prepare us for the complex problems of the real world (Jonassen, 1997, 2000, 2004). The type of problems that schools present to students typically have well-defined goals, a clear definition of all the elements affecting the solution, and predictable, prescribed, and correct solutions (Jonassen, 1997). A number of researchers have reported that solving such problems requires following linear steps of understanding what is given and what is asked, creating a mental representation of givens and goals, developing a solution strategy which generally involves application of predictive and prescriptive rules and principles, and validating accuracy of the solution (Bransford & Stein, 1993; Gick, 1986; Jonassen, 1997; Newel & Simon, 1972; Polya, 1948). On the other hand, problems in the real world often consist of unclear goals, implicit limitations, more than one solution or no solution, and multiple criteria to evaluate the solution (Jonassen, 1997). Previous studies have reported that the solution of complex, real-life problems requires higher-order skills such as:

- *analysis*: identifying what factors could be critical for the solution,
- *synthesis*: emerging new factors that have potential to affect the solution,
- *what-if analysis*: evaluating the potential impact of the solution,
- *argumentation*: validating possible other solutions based on what-if analysis,

Design Thinking Across Different Design Disciplines: A Qualitative Approach

- *reflection*: understanding the actions to solve the problem and the results of those actions (Choi & Lee, 2009; Cuban, 2001; Frensch & Funke, 1995; Jonassen, 1997; Sinott, 1989; Voss 1988)

Researchers have advocated design thinking as a means to close the skillset gap developed from solving the types of problems posed in schools as compared with the more complex problems presented in real life (Finn Connell, 2013). Researchers use the term design thinking to indicate cognitive activities that designers are engaged in during the design process (Cross, 2007, 2011; Owen, 2007). Researchers have claimed that the processes used by expert designers to solve design problems, which are commonly ill-structured problems, through innovative solutions could, if modeled, be used to effectively teach novice designers or non-designers to solve complex real-life problems (Cross, 2007, 2011; Finn Connell, 2013; Jonassen, 2000; Lawson, 2004, 2006; Rowe, 1987).

Owen (2007) listed key characteristics of design thinking as conditioned inventiveness, human-centered focus, environment-centered concern, ability to visualize, tempered optimism, bias for adaptivity, predisposition toward multi-functionality, systemic vision, view of generalist, ability to use language as a tool, affinity for teamwork, facility for avoiding the necessity of choice, self-governing practicality, and ability to work systematically with qualitative information. In design thinking, designers are mediators that create experiences for target audiences to engage with and are actively innovating rather than working solely to fulfill client-specified needs (Buchanan, 1992). Moreover, design thinking accepts Donald Schön's explanation of design process as a reflective process, in which designers are engaging in continuous dialogues with the

Design Thinking Across Different Design Disciplines: A Qualitative Approach

problem and making interpretations based on personal values and experiences to advance toward the solution (Schön, 1983).

In recent years, disciplines that are not traditionally affiliated with design have started to show interest in design thinking such as business, education, healthcare, engineering, and IT (Clark & Smith, 2008; Cross, 2007, 2011; Dorst, 2011; Finn Connell, 2013; Lawson, 2004, 2006; Owen, 2007; Razzouk & Shute, 2012). Researchers attributed other disciplines' interest to the fact that professionals in such disciplines deal with problems that are complex and ill-structured — problems in which solutions demand innovative applications and in which design thinking could provide a model to deal with these complex open ended problems (Clark & Smith, 2008; Cross, 2007, 2011; Dorst, 2011; Finn Connell, 2013; Lawson, 2004, 2006; Owen, 2007; Razzouk & Shute, 2012).

Although there are several claims about design thinking as an effective way to teach people how to solve complex problems the same way as designers, it is necessary to consider whether the essential characteristics of design thinking are consistent across different design disciplines. Research on design thinking has tended to focus on limited design disciplines such as architectural design, industrial design, and engineering design, and there are not enough studies to prove that designers in different design fields perform design processes as design thinking literature proposed. The experience of professional designers in other design fields can provide a different and useful perspective to help us understand whether the essential characteristics of design thinking are consistent across different design fields.

The Purpose

The purpose of this qualitative study is to explore the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and the design activities proposed by the design thinking literature. Design strategies of working professionals from different design disciplines were studied and compared, in relation to the activities proposed by the design thinking literature. Designers were selected from the following design disciplines: instructional design, fashion design, and game design. The results were reported in a way to demonstrate the differences and similarities within and across disciplines. This study employed one-to-one semi-structured interviews as the qualitative method of inquiry.

Research Question

In order to explore the design process of professionals from different design disciplines and to understand the similarities and differences between their process and design activities proposed by the design thinking literature, this research study is guided by the following central research question:

“How do designers in the fields of instructional design, fashion design, and game design go through the design process?”

Significance of the Study for the Instructional Design Community

Based on Bureau of Labor Statistics (2014), in the United States there were 224,110 training and development specialists in 2013, and based on AECT Curricula Data of Degree Programs in Educational Technology (2014), there are 141 programs offering an instructional design degree in the United States. This study is important to the instructional design and technology community for several reasons: 1) it is helpful to

Design Thinking Across Different Design Disciplines: A Qualitative Approach

understand if the field's design practices are similar to or different from the proposed design thinking process; 2) it is useful to know if instructional designers' design processes show similarities with or differences from design processes of designers in other fields; 3) the study provided reasons to explain these differences and similarities; 4) the study provided valuable knowledge to reconsider conceptualization of design in the field and professional identity of instructional designers.

Organization of the Study

Chapter 1 introduces the research problem and presents the purpose statement and the central research question of the study.

Chapter 2 presents a review of literature related to the research problem focused in this study.

Chapter 3 focuses on the methodology and includes information about the research design, participants, data collection, and analysis procedures.

Chapter 4 presents the findings.

Chapter 5 summarizes the findings and presents the limitations of the study and recommendation for future research.

Chapter 2: Literature Review

What is Design?

A considerable number of researchers have tried to define what design is; is it art, science, discipline, process or product (Cross, 2011; Nelson & Stolterman, 2012; Rittel, 1987; Rowland, 1993; Simon, 1996). Even though we encounter the term “design” almost everywhere such as on web sites, in books and magazines, in exhibition names, and fashion shows (Marcus, 2002; Marks & Porter, 2009), the common view is that defining the term “design” in a unanimously agreeable way is challenging because there are various design disciplines, and professionals from these disciplines perform design activities on a daily basis (Nelson & Stolterman, 2012). In addition, these professionals tend to define design in way that the definition reflects only their process (Aspelund, 2010). Nelson and Stolterman (2012) listed some of the design disciplines such as architectural design, engineering design, graphical design, fashion design, software design, educational system design, and healthcare design. Some scholars claim that even professionals that are not in a design discipline also perform design on an informal level, with examples being lawyers, doctors, and teachers since these jobs include promoting an improvement (Bonsiepe, 2007; Heskett, 2005; Simon, 1996) which makes the concept of design even harder to define.

Even though a generally accepted definition of design is lacking, at this point I would like to provide a definition of design in broad terms; design is an intentional change of a current situation to a desired one (Nelson & Stolterman, 2012; Simon, 1996). It is an exploratory (Cross, 2011) and an iterative process (Ambrose & Harris, 2010), which is shaped by when and where the process takes place (Rittel, 1987). Even though

Design Thinking Across Different Design Disciplines: A Qualitative Approach

designing an artifact is described separately from developing an artifact (Bonsiepe, 2007; Cross, 2011), the context of the use of a designed artifact and designers' process in designing are inseparable elements (Rowland, 1993).

To have a full understanding of how we define design currently, it is important to look at how the definition of design has changed over the years. Cross (2007) stated that even though cognitive processes underlying design process have gained importance for understanding design process recently, the history of the design field has witnessed paradigms that define design differently. The following is a brief summary of design paradigms.

Design Paradigms

In the 20th-century, the first design paradigm, modern movement of design, began in the 1920s and found itself regaining popularity again in the design method movements in the 1960s (Beyazit 2004; Cross, 2007). This period is often referred to as the design-science decade (Cross, 2007). In this decade, people used the values of science such as objectivity and rationality to define design in a systematic way (Beyazit 2004; Rith & Dubberly, 2006). Researchers stated that efforts to find systematic solutions to imperative problems of World War II resulted in tendency to treat design as a science (Beyazit 2004; Cross, 2007). Design was defined as rational problem solving which includes the following steps: divide problems into small solvable sub problems, define the sub problems that interact with each other, and solve each sub problem separately (Beyazit 2004). Although this first paradigm gained popularity in engineering and industrial design in the 1970s, it got criticism even from its early pioneers, such as Christopher Alexander and Christopher Joes, because it attempted to explain everything with a logical

Design Thinking Across Different Design Disciplines: A Qualitative Approach

framework that was limited in its usefulness to explain complex design problems of real world (Cross, 2007).

The second design paradigm emerged with the idea of defining design problems as wicked problems that have no correct solutions or stopping rules. The solution of wicked problems often leads to higher-level problems where the solution is highly dependent on the solvers' skills and experience (Beyazit 2004; Buchanan, 1992; Rittel & Webber, 1973). Researchers adopted the constructivist view of design (Cross, 2007) in which design is defined as a reflective process in which designers engage in continuous dialogues with the problem and make interpretations based on their personal values and experiences to reach the solution (Schön, 1983). Cross (2007) highlighted another important characteristic of this period: user involvement in the design process.

The first paradigm tends to define design as a rational problem-solving process whereas the second paradigm defines design as a reflective, ill-structured problem-solving process. Having summarized how the definition of design process has changed over the years, it is now necessary to mention how similar or different the design discipline is from other disciplines. In the following pages, I will present studies that focus on illuminating these similarities and differences.

Design versus Other Disciplines

A number of scholars have attempted to compare design with other forms of inquiry to highlight differences and similarities (Bonsiepe, 2007; Cross 2007, 2011; Nelson & Stolterman, 2012; Owen, 2007; Rowland, 1993). Before proceeding to examine differences and similarities, it is important to keep in mind that making this comparison is not easy as design is not a single discipline. There are many design disciplines and even

Design Thinking Across Different Design Disciplines: A Qualitative Approach

though we can talk about commonalities in their practices, each discipline could have its unique practices. Therefore, the following comparisons were made based on domain independent design practices.

A great deal of previous research into how design is different or similar to other disciplines has focused on comparing design with science (Bonsiepe, 2007; Cross 2007, 2011; Nelson & Stolterman, 2012; Owen, 2007). Nelson and Stolterman (2012) compared design and science in terms of their focus and claimed that even though design does not have a well-analyzed history compared to other disciplines, it has a wider focus as its aim is to create new experiences for people.

Owen (2007) found dramatic differences between design and science in terms of their goals, values, and measures. According to Owen (2007), the goal of science is to understand, and it values correctness, thoroughness, and testability to reach its aim. Theories of science should be testable, correct, and certain (Owen, 2007). On the other hand, the goal of design is to create forms, and it values appropriateness, effectiveness, and cultural fit (Owen, 2007). Design products should work, be sustainable, reflect the aesthetic sense of the culture they were created for, and be appropriate as determined by human factors (Owen, 2007).

Another scholar, Cross (2011), studying science and design, observed notable differences between science and design in terms of their focus, methods, and values. According to Cross (2011), science focuses on the natural world, and it values objectivity, rationality, neutrality, and it employs controlled experiments and analysis. In contrast, design focuses on the artificial world, and it values appropriateness, practicality, and creativity, and it employs modeling and synthesis (Cross, 2011). In addition, Cross

Design Thinking Across Different Design Disciplines: A Qualitative Approach

(2011) emphasized that while results of scientific studies should be repeatable, results of design studies must not.

The distinction between science and design that emerged from these studies is that science is concerned about universal truth whereas design is concerned about being appropriate. Appropriateness is highly contextual and dependent on human and environmental factors, while universal truth is uninfluenced by context and is testable.

With regards to similarities between science and design, Bonsiepe (2007) found that designers and scientists are both engaged in experimental approaches.

Before proceeding to examine the differences and similarities between design and another field of inquiry, it is necessary to mention three concepts that Cross (2011) discussed to clarify the relationship between design and science. The first concept is *scientific design*. Cross (2011) defined scientific design as:

“modern, industrialised design – as distinct from pre-industrial, craft-oriented design – based on scientific knowledge but still utilizing a mix of both intuitive and non- intuitive design methods” (p. 97).

The second concept is *design science*. Cross (2011) defined design science as:

“ an explicitly organized, rational and wholly systematic approach to design; not just the utilisation of scientific knowledge of artefacts, but design in some sense a scientific activity itself” (p. 98).

The third and the last concept is *science of design*. Cross (2011) described science of design as:

“body of work which attempts to improve our understanding of design through ‘scientific’ (i.e., systematic, reliable) methods of investigation” (p. 99).

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Having discussed the relationship between design and science, I will now move on to compare design with other forms of inquiry, namely humanities and art. Cross (2011) compared design and humanities and found major differences. Areas where significant differences were found include their focus, method, and values (Cross, 2011). According to Cross (2011), the humanities focuses on human experience, and it values subjectivity, imagination, commitment, and it employs evaluation and criticism. On the other hand, design focuses on the artificial world, and it values appropriateness, practicality, creativity, and it employs modeling and synthesis (Cross, 2011).

Owen (2007) compared design and art in terms of their goals, values, and measures. According to Owen (2007), the driven need of art is expression, and it values insightfulness, novelty, and stimulation to reach this aim. Artwork should be thought provoking, fresh, and exciting (Owen, 2007).

As a review, this section began by describing what design is and went on to review the paradigm shift in which the definition of design has changed, and finally it outlined how design differs from other forms of inquiry. The following sections of this literature focus on design thinking as follows: describing design thinking by exploring how the term emerged, reviewing its characteristics, exploring models that developed to explain the design thinking process, and discussing criticism on design thinking.

Design Thinking

History and Definition

In recent years, there has been an increasing interest in design thinking not only in design disciplines but also in disciplines such as business, education, engineering, medicine, and IT (Clark & Smith, 2008; Cross, 2007, 2011; Dorst, 2011; Finn Connell,

Design Thinking Across Different Design Disciplines: A Qualitative Approach

2013; Lawson, 2004, 2006; Owen, 2007; Razzouk & Shute, 2012). Before I provide a definition for design thinking and explain the reason behind the current interest, it is necessary to understand how the term emerged.

The previous section explored how the definition of design has changed over the years. To better understand when and how the design thinking concept emerged, it is useful to analyze the history in a detailed way as the history of design thinking is complex (Kimbell, 2011). Researchers started to investigate the processes behind how expert designers solve complex design problems during the second design paradigm, and this research focus converged into design thinking research (Kimbell, 2011).

For this research, it is valuable to note the work of two researchers, Christopher Alexander and Herbert Simon, towards defining design. Alexander (1971) defined the fundamental goal of design as creating form, which is defined as a physical arrangement and concrete objects. Kimbell (2011) stated that this definition is the core of design fields such as architecture, fashion design, and industrial design. On the other hand, Simon (1969) defined the goal of design as improving a situation to a desired one, and his definition focused more on the set of steps that designers take to solve a problem that will lead to desired state. Kimbell (2011) indicated that this definition is central to not only professional design fields but also all other fields.

Kimbell (2011) emphasized that even though these two definitions of design (i.e., design as a physical object and design as an abstract thinking) are still being used by researchers who are focusing on design thinking, neither Alexander nor Simon used the term design thinking. The term design thinking was used first by Peter Rowe in 1987 as a title of his book (Dorst, 2011; Kimbell, 2011) in which he analyzed the design process to

Design Thinking Across Different Design Disciplines: A Qualitative Approach

offer the definition and principles underlying this process. In his book, Rowe (1987) claims that designers work in an episodic fashion in which they use assumptions as well as facts.

Since Rowe's book was published, the term design thinking has been used by many researchers who wanted to explain the complex nature of the design process (Dorst, 2011; Kimbell, 2011), and several different design thinking models have been developed with a different interpretation of design process (Dorst, 2011). Cross and Lawson are two researchers who tried to explain the design process by observing and conducting interviews with successful designers in the fields of architecture, industrial design, and engineering design (Cross, 2007). Cross (2007, 2011) suggested the term "designerly ways of knowing" to refer to the knowledge that is unique to designers. He claimed that to understand what design is, researchers need to investigate people who engage in design activity, processes that people are involved in designing, and products that people produce at the end of the design process (Cross, 2007, 2011). Studying these three would provide information about design ability, design strategies and tactics, and design attributes (Cross, 2007).

Having mentioned how the term emerged, it is necessary to provide a definition of design thinking. In broad terms, design thinking can be defined as cognitive activities that designers are engaged in while involved in the design process (Cross, 2007, 2011; Liu, 1996; Owen, 2007) as well as the knowledge designers have (Kimbel 2011). Design thinking has become a popular concept due to the claim that skills required to solve real life complex and dynamic problems are inherent in expert designers' behavior; precisely because of expert designers' discovery of innovative solutions to design problems, which

Design Thinking Across Different Design Disciplines: A Qualitative Approach

are one type of ill-structured problem, and if we could model expert designers behavior in finding innovative solutions to design problems, we could teach novice designers or non-designers how to handle complexity of real life problems (Cross 2007, 2011; Finn Connell, 2013; Jonassen, 2000; Lawson, 2004, 2006; Rowe, 1987).

Johansson-Sköldberg, Woodilla, and Çetinkaya (2013) defined two discourses of design thinking as designerly thinking and design thinking. Designerly thinking refers to: the academic construction of the professional designer's practice (practical skills and competence) and theoretical reflections around how to interpret and characterize this non-verbal competence of the designers. Designerly thinking links theory and practice from a design perspective, and is accordingly rooted in the academic field of design (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013, p.123).

Design thinking refers to:

the design practice and competence are used beyond the design context (including art and architecture), for and with people without a scholarly background in design, particularly in management. 'Design thinking' then becomes a simplified version of 'designerly thinking' or a way of describing a designer's methods that is integrated into an academic or practical management discourse (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013, p.123).

After reviewing the literature on design thinking, Kimbell (2011) identified three different approaches to define design thinking: design thinking as a cognitive style, design thinking as a general theory of design, and design thinking as an organizational resource. Studies that define design thinking as a cognitive style focus on expert

Design Thinking Across Different Design Disciplines: A Qualitative Approach

individual designers, and they define the aim of designing as problem solving, the design problems as being ill-structured problems where problem and solution evolve together, and the sites of design activity as design disciplines that are traditionally affiliated with design (Kimbell, 2011). Studies that define design thinking as a general theory of design focus on design discipline, and they define the aim of designing as cultivating wicked problems, the design problems as wicked problems, and the sites of design activity as symbols, things, actions, and environments, which are also known as four orders of design (Kimbell, 2011). Studies that define design thinking as an organizational resource focus on organizations that are in need of innovation, and they define the purpose of design as innovation, the design problems as organizational problems, and the sites of design activity as any context such as education, healthcare, and social change (Kimbell, 2011).

Having explained how the design thinking concept emerged and having explained different approaches to define design thinking, I will move on to explore the reason behind the popularity of the term in fields other than design.

Current Focus

In recent years, disciplines that are not traditionally affiliated with design have started to show interest in design thinking such as business, education, healthcare, engineering, and IT (Clark & Smith, 2008; Cross, 2007, 2011; Dorst, 2011; Finn Connell, 2013; Lawson, 2004, 2006; Owen, 2007; Razzouk & Shute, 2012). Researchers stated that the reason behind this interest is that the nature of the problems that professionals deal with in these disciplines tend to be complex and ill-structured, and the solution to these problems requires innovative ways which could benefit from design thinking since

Design Thinking Across Different Design Disciplines: A Qualitative Approach

it suggests a model to deal with these complex open ended problems (Clark & Smith, 2008; Cross, 2007, 2011; Dorst, 2011; Finn Connell, 2013; Lawson, 2004, 2006; Owen, 2007; Razzouk & Shute, 2012).

Education is one of the disciplines that started to show interest in design thinking (Finn Connell, 2013; Razzouk & Shute, 2012). Studies identified a gap between problems students deal with in school, and problems they deal with in real life (Jonassen, 1997, 2000, 2004) and design thinking could help educators to teach skills such as critical and creative thinking, teamwork, and problem solving (Finn Connell, 2013; Razzouk & Shute, 2012). Researchers also claimed that those skills are consistent with suggestions of theories of learning such as constructivism and situated cognition (Razzouk & Shute, 2012).

Researchers in instructional design have also started to show an increased interest in design thinking (Tracey & Boling, 2013; Tracey, Hutchinson, & Grzebyk, 2014). These researchers claimed that the field should reframe its design practices in a way that would liberate its practitioners being passive followers of prescribed design steps in the instructional design models and give emphasis to designers' skills to find intuitive solutions to complex instructional design problems (Rowland, 1993; Tracey & Boling, 2013; Tracey, Hutchinson, & Grzebyk, 2014). Accordingly, instructional design education should reflect this new approach, and design thinking could be used as a pedagogical strategy (Tracey, Hutchinson, & Grzebyk, 2014). Researchers explained the reason behind these claims using a number of studies that found recently graduated instructional designers are not well prepared for the actual instructional design practice (Julian, Kinzie, & Larsen, 2000; Larson, 2005; Verstegen, Barnard, & Pilot, 2008;

Villachica, Marker, & Taylor, 2010). Engineering education faces a similar problem that explains the field's current interest in design thinking. Razzouk and Shute (2012) stated that current engineering graduates are not ready for the real engineering practice in industry as the engineering education curricula depends on linear models that do not reflect the complex nature of engineering practice (Razzouk & Shute, 2012).

Having presented the definition and history of design thinking and its current popularity, the next section will explore how design process and designers are defined in design thinking.

Characteristic Features of Design Process as defined by Design Thinking

As mentioned in the previous section of this literature, it is hard to come up with a definition of design that everyone agrees on; therefore, the following characteristics are domain independent features of the design process.

Ill-structured Problem Solving

Some scholars have defined design as an ill-structured problem solving activity (Buchanan, 1992; Cross, 2011; Jonassen, 2000) and others have claimed that problem solving is one aspect of designing, but not the only one (Visser, 2006). Before proceeding to explore these claims, it is necessary to define ill-structured problem solving.

A considerable amount of literature has been published on problem solving and consequently there are many definitions of the term 'problem'. For simplicity, a problem exists if there is a distance between the given state and the goal state, and there are obstacles that prevent reaching the goal state (Cuban, 2001; Duncker, 1972; Frensch & Funke, 1995, Hayes, 1981; Mayer, 1983; Newell & Simon, 1972). Moreover, a problem

Design Thinking Across Different Design Disciplines: A Qualitative Approach

exists only if one accepts that it exists and that solving it is worthwhile (Henderson & Pingry 1953; Jonassen 2000, 2004).

A number of scholars have argued that there are different types of problems and any effort that would define all problems the same way would be problematic (Jonassen, 2000). For example, the problem of “What percent of 100 is 60?” and “How to solve the world’s refugee crisis?” should not be classified the same (Jonassen, 2000). There are different problem categorizations in the literature, and the following section briefly mentions three of them.

Reitman (1965) categorized problems based on how well the given and goal states are specified. His categories include the following: a clearly defined given state and goal state, a clearly defined given state and an ill defined goal state, an ill defined given state and a clearly defined goal state, an ill defined given and goal state (Reitman, 1965).

Another researcher Greeno (1978) categorized problems based on the information and instructions provided to the problem solver. His categorization included generative problems, transformative problems, and adjustment problems (Greeno, 1978). One of the most cited categorizations was developed by Jonassen (2000). He claimed that problems differ in terms of their structure, complexity level, dynamicity of parameters, and domains (Jonassen, 2000). His categorization included logical problems, algorithmic problems, story problems, rule-using problems, decision making problems, troubleshooting problems, diagnosis-solution problems, strategic performance problems, case analysis problems, design problems, and dilemmas (Jonassen, 2000).

According to Jonassen (2000) design is an ill-structured problem. He listed the characteristics of ill-structured problems having no known or predictable answer and

Design Thinking Across Different Design Disciplines: A Qualitative Approach

therefore not only one-way to find the solution (Jonassen, 2000). Finding the solution path is a personal process in which personal experience with the problem type, background knowledge, expertise, epistemological beliefs, motivation, and cognitive style such as cognitive flexibility, cognitive complexity, and field independence play an important role (Jonassen, 2000). Problem solvers need to make decisions about the solution and defend the solution they devise (Jonassen, 2000). Because there are multiple ways to solve ill-structured problems, there are multiple criteria to evaluate the solution (Jonassen, 2000).

Jonassen's (2000) definition of design problems as ill-structured problems shows similarities with Rittel's definition of design as wicked-problems (as cited in Buchanan, 1992). Rittel defined characteristics of wicked problems as having no absolute formulation or stopping rules (as cited in Buchanan, 1992). Moreover, he added that the solution of wicked problems yields a higher level of wicked problems, and measures to evaluate the solution involve good and bad rather than correct and incorrect (as cited in Buchanan, 1992).

Cross (2011) and Lawson (2006) supported the view of design as ill-structured problem solving even though they did not use the term 'ill-structured'. Cross (2011) indicated that problem and solution develop together in design process and designers do not follow predefined ways to solve the problem; instead, designers take a personal approach to solve the problem in such a way that the problem itself may change in nature. Another important design researcher, Lawson (2006), also emphasized that in design problems the path from problem to solution is not always clear and significantly dependent on the designer's experience.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Before proceeding to review other characteristics, it is useful to briefly mention differences between expert and novice problem solvers. In broad terms, expertise can be defined as domain specific problem solving skills and knowledge that lead to outstanding problem solving performance (Krems, 1995). Researchers started to realize the effect of background knowledge on problem solving performance in the 1970s (Novick & Bassok, 2005). Researchers stated that being exposed to same type of problems yields to certain amount of expertise, which then increases performance of problem solving (Frensch & Funke, 1995; Funke, 1995;). Jonassen (2000) listed problem solvers' experience with the problem type as one of the strongest factors influencing problem-solving performance. He added that expertise in one type of problem domain is not easily transferrable to another problem domain as cognitive skills required for different type of problems show differences (Jonassen, 2000).

Cognitive flexibility, the problem solver's ability to switch between problem solving means and new situations (Krems, 1995), plays important role in problem solving process (Jonassen, 2000). In his cognitive flexibility theory, Spiro (as cited in Krems, 1995) explained that expert problem solvers has multilayered knowledge representation which helps them shifting between different contexts. Also Egan and Greeno (as cited in Krems, 1995) observed that experts' long-term knowledge is more accessible for different purposes. Krems (1995) indicated that expertise has positive effect on cognitive flexibility.

In addition to cognitive flexibility, researchers stated that problem representation is also important for problem solving performance as it leads problem space construction (Jonassen, 2000; Novick & Bassok, 2005). Problem solvers construct a problem model to

summarize their understanding of the problem's fundamental features, which is called as problem representation (Novick & Bassok, 2005). Researchers stated that there are two types of problem representation: internal and external (Novick & Bassok, 2005). Internal representation refers to image problem solvers generate in their memory whereas external representation refers to image problem solvers draw on a paper (Novick & Bassok, 2005). Problem representations could be verbal, propositional, declarative or pictorial and diagrammatic (Novick & Bassok, 2005).

Novick and Bassok (2005) claimed that expertise affects the problem representation that problem solvers construct or select. Similarly, Jonassen (2000) stated that expert and novice problem solvers differ in terms of constructing problem space using information in problem representation. Expert problem solvers usually employ artificial symbol systems that are specific to the domain for representing problems whereas novice problem solvers have difficulty with those symbol systems (Jonassen, 2000).

Problem and Solution Co-evolution

Researchers agreed that designers do not follow the traditional problem solving strategy which is trying to fully understand the problem first and then attempt to reach the solution (Cross, 2004; Dorst & Cross, 2001; Goel & Pirolli, 1992; Kruger & Cross, 2006). Designers start to develop a solution to the problem from the outset without waiting to fully understand everything given about the problem, and they keep moving back and forth between the problem and the solution (Dorst & Cross, 2001). Designers continuously move between the problem space and the solution space in a parallel fashion, therefore problem and solution co-evolve (Kruger & Cross; 2006).

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Kruger and Cross (2006) identified two types of strategies unique to designers: problem driven and solution driven strategies. In problem driven strategies, designers first articulate a partial structure of the problem space and then transfer that partial structure into a solution space, while in solution driven strategies, designers first articulate a partial structure in the solution space and then move that structure to the problem space to understand the problem (Kruger & Cross; 2006). Which strategy the designer will use is highly dependent on his/her previous experience with the problem type (Cross, 2004).

Iteration

Researchers agreed that designers go through the design process in an iterative fashion rather than a linear one (Akin, 1979; Nelson, 2003; Visser, 2006). Designers first create an idea and then test the idea and finally revise it based on the result of testing (Adams, 2002). Designers go through a continuous cycle of idea formulation, idea testing, and idea revision (Akin, 1979). Within each cycle, designers' understanding of the problem changes (Goel & Pirolli, 1992). Researchers claimed that iteration is highly related with design success (Adams, 2002; Dorst & Cross, 2001).

Sketching

Problem solvers' representation of the problem plays an important role in generating a solution (Jonassen, 2000; Novick & Bassok, 2005). There are two types of problem representations that problem solvers generate: internal representation and external representation (Jonassen, 2000; Novick & Bassok, 2005). While internal representation refers to an image in working memory, external representation refers to any drawing on paper (Novick & Bassok, 2005). According to Jonassen (2000), problem

representation leads to a solution as it helps the problem solver encode what are the givens. It also helps the problem solver retrieve related information from long term memory and helps to further explore the problem and evaluate each generated alternative solution (Jonassen, 2000).

In design practices, problem representation takes the form of sketching or modeling. Lawson (2004, 2006) and Cross (2011) emphasized the importance of sketching in design practices and education, and they stated that it constitutes a cognitive aid and supports designers' dialogue with the problem.

Reflective Thinking

In his seminal book, Schön (1983) defined design process as a reflective process in which designers are engaging continuous dialogues with complex design problems and making interpretations based on personal values and experiences to reach the solution. Designers are engaged in reflective practice while they are moving back and forth between the problem and solutions they produce (Schön, 1983).

Schön (1983) detailed his notion of reflective practice by introducing two concepts: reflection-in-action and reflection-on-action. Reflection-in-action refers to designers' ongoing mindfulness regarding their actions about design decisions occurring during the design process (Schön, 1983). On the other hand, reflection-on-action refers to designers' thoughtful revision of their design process in general (Schön, 1983). Both reflection-in-action and reflection-on-action are highly personal processes (Schön, 1983). It is useful to mention another concept related with reflective practice: reflection-for-action. Reflection-for-action refers to designers' active employment of their previous design experiences before acting on a new problem (McAlpine & Weston, 2000).

Design Thinking Across Different Design Disciplines: A Qualitative Approach

There is an agreement among researchers that success of a design process highly depends on personal reflection (Cross, 2011; Lawson, 2006; McAlpine & Weston, 2000; Schön, 1983; Tracey & Boling, 2013).

Creative Thinking

Another significant characteristic of the design process is creative thinking. Before proceeding to examine the relationship between design and creativity, it is useful to briefly define creativity and review the ongoing debate about how it is defined and assessed. Plucker and Makel (2010) stated that research studies on creativity often have conflicting results which makes it difficult to have an accepted definition of creativity. The same authors also claimed that the term creativity has many synonyms such as imagination, innovation, inspiration, novelty, originality, talent, and serendipity, and this situation makes creativity even more ambiguous (Plucker & Makel, 2010). Because assessment of anything should be based on its precise definition, assessment of creativity encounters issues due to its ambiguity. Plucker and Makel (2010) provided a comprehensive definition of creativity to make the concept more operationalized:

The interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined by social context. (p. 49)

Sternbers and Kaufman (2010) pointed out that novelty and quality are main aspects of creativity definitions, and while novelty implies uniqueness, quality implies usefulness and appropriateness. Decision of what is appropriate is a highly relative process which makes assessment of creativity more difficult (Sternbers & Kaufman, 2010).

Design Thinking Across Different Design Disciplines: A Qualitative Approach

In analysis of creativity theories the same problems arise. There are many theories trying to explain creativity, and most of them are alike (Kozbelt, Beghetto, & Runco, 2010). For the purpose of categorizing creativity theories, Kozbelt et al. (2010) used six aspects of creativity: process, product, person, place, persuasion, and potential (Kozbelt et al., 2010). These six aspects are also known as the six P's of creativity, and they constitute distinctive properties of theories related with creativity (Kozbelt et al., 2010). Kozbelt et al. (2010) summarized the six P's of creativity as follows:

- *Creative process* studies deal with a person's mental process when she or he is involved in creative activity.
- *Creative product* studies focus on what a person produces such as work of art, inventions, and publications.
- *Creative person* studies aim to explore personality traits that have an effect on creativity.
- *Creative place* studies seek relation between people and workplaces.
- *Creative persuasion* studies argue that persuasiveness is a characteristic that creative people should possess as they have influence on the way other people think.
- *Creative potential* studies aim to search yet-unfulfilled possibilities of creativity.

Kozbelt et al. (2010) reviewed and organized 10 major categories of theories. Among Kozbelt et al.'s (2010) 10 categories, theories based on problem solving and expertise and theories based on problem finding can be helpful to explain design creativity.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Theories that emphasize problem solving and expertise focus on creative person, creative process, and creative product (Kozbelt et al., 2010). According to Kozbelt et al. (2010) a primary assertion of these theories is:

creative solution to ill-defined problems result from a rational process, which relies on general cognitive process and domain expertise (p.28).

As the description shows, there is an emphasis on domain-specific expertise and cognitive processes such as generating problem representation. Kozbelt et al.'s (2010) explained that a great deal of these theories focus on ill-structured problem solving because of its nature, which is more relevant to creativity. Opposite to well-structured problems where there is only one correct solution that can be reached by following a predefined approach, ill-structured problems have more than one working solution (Kozbelt et al., 2010). Experts can find more creative solutions to ill-structured problems because they are good at remembering domain related patterns, and so are more likely to generate a problem representation that will lead to an appropriate solution (Kozbelt et al., 2010). One of the notable findings of these theories is the 10-year rule which found that creative people spent at least 10 years in their field to produce their masterpiece (Kozbelt et al., 2010).

Problem finding theories focus on creative person, creative process, and creative potential (Kozbelt et al., 2010). According to Kozbelt et al. (2010) a primary assertion of these theories is “creative people proactively engage in a subjective and exploratory process of identifying problems to be solved” (p.28). These theories arose as a result of a criticism to problem solving theories in the sense that problem solving theories do not provide explanation to “how creators come to realize that a problem exists in the first

place, and how they are motivated to proactively bring their subjective experience to understand the problem” (Kozbelt et al., 2010, p.34).

Painting is among the creative processes that are given as an example to disprove claims of problem solving theories as problem solving strategies cannot be applied to painting (Kozbelt et al., 2010). This view emphasizes exploratory behaviors as an indicator of success in creativity (Kozbelt et al., 2010). One of the criticisms about these theories is that there is no clear explanation of the nature of problem finding.

Abductive Reasoning

Researchers claimed that designers perform a different type of reasoning—namely abductive reasoning during solving design problems (Cross, 2011; Dorst, 2011). Abductive reasoning can be defined as innovative ways to make connections between ostensibly associated concepts to suggest a solution to a design problem (Finn Connell, 2013). Cross (2011) compared inductive reasoning, deductive reasoning, and abductive reasoning in terms of their aim and claimed that in deductive reasoning individuals try to confirm something has to be, whereas in inductive reasoning individuals try to prove something is functioning, and in abductive reasoning individuals try to propose something might be. Cross (2011) also stated that productive reasoning and appositional reasoning can be used to refer abductive reasoning.

Characteristics of Designers

In design thinking, designers are given a central role as mediators that create experiences for target audiences to engage with and are actively innovating rather than working solely to fulfill client-specified needs (Buchanan, 1992). As mentioned earlier, Owen (2007) defined a set of characteristics for design thinking, which are related with

Design Thinking Across Different Design Disciplines: A Qualitative Approach

the designer rather than the design process. Owen (2007) listed key characteristics of design thinking as conditioned inventiveness, human-centered focus, environment-centered concern, ability to visualize, tempered optimism, bias for adaptivity, predisposition toward multi-functionality, systemic vision, view of generalist, ability to use language as a tool, affinity for teamwork, facility for avoiding the necessity of choice, self-governing practicality, and ability to work systematically with qualitative information.

Similarly, in his different research studies that aim to explore how designers think, Lawson (2004, 2006) identified characteristics of designers as follows: designers are self-confident and open to new experiences, their awareness is high, their sensitivity to the changes in their environments is also high, they are optimistic and willing to take risks, they are not afraid to fail, and they deal effectively with ambiguity and different lines of thought.

Having explained domain independent characteristics of the design process, it is necessary to review design thinking process models which were developed to explain and teach design thinking process.

Design Thinking Process Models

In this review, three design thinking process models will be reviewed. The first model was developed by Stanford d.school to teach design thinking to their students and provide the students with methods to use, and the second model was developed by IDEO, a global design company, to help their clients understand human centered design processes and provide tools for their clients to solve complex problems, and the third model was developed by NoTosh, a global consultancy firm, to help their clients deal

with organizational problems. With these models in mind, the next step is to discuss common operational practice in the models.

Stanford d.school Design Thinking Process Model

The Stanford d.school's design thinking process model is represented as an iterative model with five phases: empathize, define, ideate, prototype, and test (Stanford University Institute of Design, 2016). In the empathize phase, designers need to understand the need of the users they are designing for. Suggested methods to use in this phase include observation, interviews, and any type of interaction to fully understand the target audience's need and experiences. In the define phase, designers need to construct a user point of view by analyzing and synthesizing the data they collect in the empathize phase. In the ideate phase, designers need to propose as many solutions as possible through brainstorming, and they need to share their possible solutions in the form of sketches and receive feedback from users. In the prototype phase, designers develop low fidelity, easily modifiable prototypes based on the user feedback gathered from the ideate phase and present these prototypes for users as an evaluation of the actual experience with the product. In the test phase, designers need to take the high fidelity product to the users and observe users testing the product. After each test, the product is refined based on observations. Designers need to refine their products and let users test the products until they reach a suitable solution.

IDEO Design Thinking Process Model

The second model is IDEO's design thinking process model. IDEO's design thinking model involves three spaces: inspire, ideate, and implement (IDEO, 2016). The names of these spaces emphasize that design process is not linear (IDEO, 2016). In the

Design Thinking Across Different Design Disciplines: A Qualitative Approach

inspire phase, designers need to find a problem worth solving. In the ideate phase, designers generate many possible solutions and decide which ones they will keep and develop a prototype that is shared with the target audience. After sharing the prototype, feedback is received and the designers continue the cycle of refining the solution/ getting feedback until the solution is suitable. In the implement phase, designers present the solution to the market.

NoTosh Design Thinking Process Model

The third model is NoTosh's design thinking process model. NoTosh's design thinking model involves five phases: immersion, synthesis, ideation, prototyping, and feedback (Notosh, 2016). In the immersion phase, designers gather data to understand the current situation and the problem. In the synthesis phase, designers make sense of data they collected in the immersion phase to be able to identify the problem and challenges. In the ideation phase, designers develop a wide range of solutions. In the prototyping phase, designers select one solution and develop a prototype. In the feedback phase, designers present the solution to the target audience and gather their feedback.

After reviewing different design thinking process models in the literature, Finn Connell (2013) listed the operational practices of design process as user centricity, empathy, collaboration, shared vision, participation and inclusiveness, asking hard questions, persuading others, and creating and testing prototypes.

It is useful to briefly discuss user centricity, empathy, participation and inclusiveness before proceeding to the next section. Finn Connell (2013) described user centricity as being aware of users' standpoint and needs. He added making observations usually helps designers to understand their users better (Finn Connell, 2013). Similar to

Design Thinking Across Different Design Disciplines: A Qualitative Approach

user centricity, empathy can be defined as the ability to taking multiple perspectives into account (Finn Connell, 2013). Designers should have strong understanding of the way their users think and assign meanings to the world. Participation and inclusiveness, on the other hand, can be defined as including users to the design process (Finn Connell, 2013). Understating users' need and perspective is not enough, users should be part of the design solution which they will be affected by (Finn Connell, 2013).

Criticism

As design thinking has gained popularity, it also has started to receive criticism. Recent arguments against design thinking have been summarized by Kimbell (2011): even though there are three different approaches to explain design thinking, a clear definition is still lacking, there is no comprehensive explanation of principles underlying design thinking, there is no clear explanation of how design knowledge is different from other types of knowledge, design thinking research focuses on a limited number of design disciplines (architecture, engineering design, and industrial design), therefore not enough studies have been conducted to prove that all designers perform design process as design thinking proposed, and it is not clear how to teach design thinking. Kimbell (2011) also questioned central roles of designers and users in the design process as defined by design thinking; in Kimbell's (2011) opinion this forms a contradiction.

Chapter 3: Methodology

The purpose of this qualitative study is to explore the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and the design activities proposed by the design thinking literature. In broad terms design thinking refers to cognitive activities that designers are engaged in while involved in the design process (Cross, 2007, 2011; Liu, 1996; Owen, 2007) as well as the knowledge they have (Kimbel 2011). Design strategies of working professionals from different design disciplines were studied and compared, in relation to the activities proposed by the design thinking literature. Designers were selected from the following design disciplines: instructional design, fashion design, and game design. The results were reported in a way to demonstrate the differences and similarities within and across disciplines. This study employed one-to-one semi-structured interviews as the qualitative method of inquiry.

This section summarizes the procedures that were utilized in this study to address the central research question, which is:

“How do designers in the fields of instructional design, fashion design, and game design go through the design process?”

Research Design

Qualitative Inquiry

Qualitative research originates from anthropology and sociology (Bogdan & Taylor, 1975; Creswell, 2009; Rossman & Rallis, 2003). Researchers in the field of education started to use qualitative inquiry in the late 1970s (Merriam, 2009).

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Researchers defined the main aim of qualitative research as learning about social phenomena through gaining insights about what meanings individuals or groups assign to social phenomena based on their experiences (Creswell, 2009; Merriam, 2009; Rossman & Rallis, 2003). The end product of qualitative research is often descriptive data (Bogdan & Biklen, 2003; Bogdan & Taylor, 1975; Merriam, 2009).

The main characteristics of qualitative research can be listed as follows: (1) researchers play a central role in qualitative research by gathering data themselves, interpreting the data with the purpose of making sense of it by continuously asking questions that may change the direction of the research; (2) researchers' backgrounds have influence on how they will interpret the data; (3) data collection occurs in natural settings which means researchers enter participants' natural environments and interact with participants; (4) researchers can change the research strategies as they deem fit during inquiry; (5) researchers utilize different forms of data collection; (6) researchers are involved in an inductive data analysis process, in which they bring only guiding questions to the field instead of hypotheses to test—in other words, researchers focus on what meanings participants assign to a problem or issue, rather than meaning that other researchers hold (Bogdan & Biklen, 2003; Creswell, 1998, 2009; Merriam, 2009; Rossman & Rallis, 2003).

This basic qualitative study was designed to use semi-structured interviews as the qualitative method of inquiry. According to Merriam (2009), basic qualitative research does not fall under any qualitative research tradition, such as phenomenological study, grounded theory, or case study. Basic qualitative research involves data collection through observation, interviews, or document analysis with the purpose of understanding

Design Thinking Across Different Design Disciplines: A Qualitative Approach

how individuals or groups make meaning out of their experiences (Merriam, 2009).

Researchers in the field of education employ this form of qualitative research most often (Merriam, 2009).

Apart from being basic qualitative research, this study can also be categorized as what Bayazit (2004), Bonsiepe (2007), and Cross (2007) defined as design research.

Design research is interested in the ways designers think and work, and the information this type of research yields is helpful to contribute to the common knowledge about what design is and how it is performed (Bayazit, 2004; Bonsiepe, 2007; Cross, 2007).

There are several reasons behind the selection of basic qualitative research for this study. First, the topic of interest is comparatively new. There is little research about it, and it needs to be explored. Second, there is no theory or model existent to explain this topic, and one or both need to be developed. Third, the topic was never examined with the targeted population, and a detailed view of designers within the fields of fashion design, instructional design, and game design could be useful. Finally, the researcher is going to continue studying on design research after completing her dissertation.

Sampling and Participants

This study employed purposeful sampling, specifically criterion sampling and snowball sampling methods.

Purposeful sampling is the most common sampling technique in qualitative studies. It is used by researchers to select a sample that can provide comprehensive information (Merriam, 2009). Patton (2002) described purposeful sampling as an essential sampling method in qualitative research due to its ability to provide

Design Thinking Across Different Design Disciplines: A Qualitative Approach

information-rich cases that will provide deeper understanding of the topic under investigation.

Criterion sampling ensures data quality by letting researchers set criteria that all participants must meet (Creswell, 2009; Patton 2002). These predetermined criteria will help researchers choose participants for their study (Merriam, 2009).

In *snowball sampling*, researchers start data collection with a few crucial participants who meet the selection criteria, and then researchers ask these participants if they know other people who can also provide rich information (Merriam, 2009). As participants refer the researcher to new valuable person, the sample size increases (Patton, 2002).

Because the purpose of this qualitative study is to explore the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and the design activities proposed by the design thinking literature, the participants for the study were purposively selected from practicing designers from design disciplines that design thinking studies have not focused on so far. A total of nine designers were selected from the following design disciplines: instructional design, fashion design, and game design. The purpose behind working with designers from different design fields is to have diversity and to discover variation if any exists.

The one criterion to select the participants was at least five years of experience in design. This criterion helped to ensure that all participants have enough experience in design to be able to provide valuable, rich information.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

After the research protocol was approved by the Institutional Review Board (IRB) (see Appendix A), the researcher contacted faculty members in her institution first and then faculty members in design programs in America by using their public contact information on their institution's websites and asked them to forward her participant recruitment email to designers who fit the criteria. The researcher also sent a participant recruitment email to the following design organizations and associations: Instructional Designers Association (IDA), American Society for Training & Development (ASTD), International Society for Performance Improvement (ISPI), The Council of Fashion Designers of America (CFDA), International Association of Clothing Designers and Executives (ACDE), Fashion Industry Association (FIA), Association of Sewing and Design Professionals (ASDP), International Game Developers Association (igda), North American Simulation and Gaming Association (NASAGA), and Entertainment Merchants Associations (ema). After interviewing with the designers who volunteered to participate in the study, the researcher sent a thank you email and asked them to forward the recruitment email to other designers. The researcher continued asking participants for referrals to the next knowledgeable person until she found nine participants. The researcher interviewed only participants who were willing to share their thoughts and experiences.

In this study, the researcher interviewed nine designers from instructional design, fashion design, and game design. Table 3.1 summarizes demographic information of participants.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Table 3.1: Demographic information of participants

Pseudonym	Gender	Age	Profession	Education	Experience	Location
Ida	Female	40-49	Instructional Designer / Higher Education	BA in Art, MA in Educational Technology	13+ years	US – East North Central
Iris	Female	40-49	Instructional Designer	BA in History Education, MA in Instructional Design	14+ years	US- South Atlantic
Ileyda	Female	40-49	Instructional Designer	BA in Education, MA in Instructional Design and Technology	20+years	US- South Atlantic
Gerry	Male	20-29	Game Designer / University Instructor	BS in Computer Science	5+ years	US – East North Central
Gerard	Male	60-69	Game Designer	BA in History	23+ years	US – West South Central
Glen	Male	20-29	Game Designer	BA in Creative Writing / MA in Game Design	5+ years	US – Pacific
Felix	Male	60-69	Fashion Designer / University Professor	BA in Asian Religious Philosophy with a minor in Art / MA in International Affairs and International Business	35+ years	US - Northeast
Fiona	Female	50-59	Fashion Designer / University Professor	BA in Clothing and Textiles, PhD in Apparel Design	32+ years	US- Pacific
Frida	Female	40-49	Fashion Designer/ University Professor	BA in Theatre, MA in Fashion Design	10+ years	US- Mid-Atlantic

Gaining Access

The researcher filed a request for approval to the IRB at her institution. She provided the following supporting documents to the board:

(1) Recruitment e-mail (see Appendix D), which was used to inform potential participants about the study. The recruitment email was sent to design faculty members

Design Thinking Across Different Design Disciplines: A Qualitative Approach

and design organizations and associations. It included the purpose of the study, data collection method used in the study, data recording procedures, benefits and risks of the study, and the researcher's contact information.

(2) Thank you and snowballing e-mail (see Appendix E), which was used to thank the participant for her/his time and ask her/him to forward the recruitment email to other designers.

(3) Online participant consent form (see Appendix C), which was used to get confirmation from the participants that they are volunteered to participate in the research. The online participant consent form included the title, the purpose and the nature of the study, detailed explanation procedures used to collect data such as the duration and the location of the interview, responsibilities of participants, potential risks and benefits of the study, information about how their identity will be protected, information about their right to withdraw anytime from the study, and a permission statement to be signed.

(4) The data collection instruments (see Appendix B) which the researcher used to collect data. Data collection instruments included an interview protocol with interview questions.

Data Collection

In this study, the researcher conducted one-to-one, semi-structured interviews, as the research question can be answered best using this type of interview. In a semi-structured interview, the researcher covers the same questions with each participant, using a predesigned interview protocol. However, the researcher has the flexibility to probe and ask further questions (Merriam, 2009; Patton, 2002). Researchers agree that semi-structured interviewing provides rich data as it gives freedom to the interviewer to

Design Thinking Across Different Design Disciplines: A Qualitative Approach

ask follow up questions, and it gives freedom to respondents to share their thoughts and experiences in their own way (Bogdan & Biklen, 2003; Merriam, 2009; Patton, 2002). Moreover, asking open-ended questions forces the interviewer to listen more and focus on the response (Merriam, 2009).

Qualitative Interviews

Interviewing is one of the most popular techniques employed to collect data in qualitative research (Bogdan & Biklen, 2003; Creswell, 1998; Merriam, 2009; Patton, 2002). In an interview, a qualitative researcher engages in conversation with a participant or participants, purposefully trying to obtain information related with topic of investigation (Bogdan & Biklen, 2003; Merriam, 2009). Researchers pointed out that an interview provides doors to the participants' world, giving information to researchers about how participants construct reality, interpret the world, and think about the topic at hand (Bogdan & Biklen, 2003; Bogdan & Taylor, 1975; Creswell, 2009; Rosmann & Rallis, 2003). The perspective of people who experienced the topic of investigation provides meaningful and useful information (Patton, 2002) and making them talk about their perspectives through asking open-ended questions provides rich descriptive data (Creswell, 2009; Rosmann & Rallis, 2003).

Interviewing is particularly useful in situations where the topic of investigation is not directly observable, such as feelings, thoughts, and interpretations (Creswell, 2009; Merriam, 2009; Patton, 2002). Moreover, an interview is helpful to get information about each participant's history, which again, is difficult to discover without talking with the participants (Creswell, 2009; Merriam, 2009; Patton, 2002). An interview also gives researchers control by selecting and ordering the questions they will ask (Creswell,

2009). This control prevents researchers from being passive listeners and enables them to produce meaning together with participants (Rosmann & Rallis, 2003).

In this study, interviews were used to explore the design process of professionals from three different design disciplines. In order to understand the similarities and differences between their process and the design activities proposed by design thinking. Interviewing each designer provided detailed information, while interviewing designers from different fields provided a broad range of perspectives (Meriam, 2009).

Online Synchronous Interview

Because the potential participants were located in different sites, the researcher conducted online synchronous interviews to reduce time and cost of travel to different sites. Online synchronous interviewing is becoming a popular data collection technique as it offers numerous advantages to researchers, which includes providing easy access to a wide range of participants who live in different geographic locations. It helps to save time and money as there is no need to travel, and it provides a safe and a familiar environment for the participants, since they can stay in their offices or homes. It also helps the researcher to record spontaneous responses of the participants (Mann & Stewart, 2000; O'Connor, Mage, Shaw, & Wellens, 2012). Despite these advantages however, online interviewing has some disadvantages. Researchers should be aware that potential technical problems might occur during the interview or participants' computer skills might not be sufficient to use the conference software that the researcher has chosen (Mann & Stewart, 2000; O'Connor et al., 2012).

Design Thinking Across Different Design Disciplines: A Qualitative Approach

In this study, two online conferencing software were used: Skype and Zoom. Both programs are very popular and easy-to-use pieces of software that the participants were familiar with.

Interview Questions

Interview questions play a crucial role as they are the main tools that researchers use to get information from participants (Merriam, 2009). A good question can be described as one that produces rich descriptive data about the topic at hand (Merriam, 2009).

In this study, the researcher asked demographic questions, opinion and values questions, and ideal position questions. Demographic questions provided background information such as education and number of years of design experience for the participants. Opinion and value questions were asked to learn what participants think about the research questions. Ideal position questions let participants describe what good design would be.

The researcher formulated each question in a way easy for the respondent to understand, since asking clear questions is the key to attaining rich descriptive data in interviews (Bogdan & Biklen, 2003; Merriam, 2009; Patton, 2002). The researcher avoided asking multiple questions that were comprised of more than one question, leading questions that disclose a bias or an assumption, and yes or no questions that do not lead to rich descriptive data (Bogdan & Biklen, 2003; Merriam, 2009; Patton, 2002).

The main questions asked to the 9 participants were:

Background Questions

- What is your age?
- What is your education level?

Design Thinking Across Different Design Disciplines: A Qualitative Approach

- Can you tell me what is your profession?
- Can you tell me what you design?
- How long have you been involved with design?
- Can you tell me how you are involved in design?
 - Do you have formal design training?
- Do you use software while designing?
 - If so, which software?

Design Process and Challenges Questions

- Can you describe your design process in as much detail as possible?
 - Walk me through the way you solve a design problem.
 - Where does your design process begin?
 - Where does your design process end?
- Is your design process similar across different design problems/ projects or specific to the individual design problems/projects?
 - How so?
- What are some of the major challenges you face with designing?
 - Could you tell me an example of a memorable challenge you have encountered?
 - How do you overcome these challenges?

Ideal Position Question

- How do you define a good design?
 - How do you know you got it?
 - How do you know it is finished?
 - How do you know you have designed something that is good?

Opinion and Values Questions

- What is your definition of design?
- What does being a designer mean to you?
- What does design thinking mean to you?

Probing

The researcher probed the respondent in situations where she could not clearly understand what the respondent said, or when she wanted the respondent be more specific. Researchers described probing as asking follow up questions with the aim of clarification and elaboration (Bogdan & Biklen, 2003; Bogdan & Taylor, 1975; Merriam, 2009; Patton, 2002).

The researcher used elaboration probes, such as “Would you elaborate on that?” and “Could you say some more about that?” and clarification probes such as “I am not sure I understand what you mean by that” and “I want to make sure I understand what you are saying. I think it would help me if you could say some more about that”.

Interview Guide / Protocol

The interview protocol (see Appendix B) was designed to guide the researcher during the interview and provided her space for jotting notes. The interview protocol included the interview questions and the steps for conducting an interview, as suggested by researchers (Merriam, 2009; Patton, 2002).

Interviewer Responsibilities

Patton (2002) emphasized the interviewer’s skill as the main factor that determines the quality of data acquired during the interview. The interviewer should give her full attention and listen to the respondent without being judgmental and disrespectful (Bogdan & Biklen, 2003; Merriam, 2009). The researcher piloted one interview before conducting real interviews as suggested by Merriam (2009).

Recording an Interview Data – Interview Notes

Recording an interview is highly recommended especially when the researcher only uses interviewing to collect data (Bogdan & Biklen, 2003; Patton, 2002). Recording interviews provides fair and full capture of what the respondents said (Patton, 2002). The researcher recorded the interview and took notes during it to make sure she collected every detail necessary for analysis. Even though recording tools can have a negative effect on some participants, researchers agreed that most participants forget the existence of the recording device when they start talking (Bogdan & Taylor, 1975; Merriam, 2009).

Interview Steps

The researcher followed steps recommended by Bogdan and Biklen (2003), Bogdan and Taylor (1975), Merriam (2009) and Patton (2002) in conducting interviews. The researcher sent the online consent form and interview questions to the participants five days prior to the interview and asked them to sign the consent electronically before the interview. Then the interviewer informed the participants about the purpose of the research and the confidentiality of their information, and she got permission from the participant before she started recording. She asked background questions, opinion and value questions, and ideal situation questions. The researcher probed the respondent when she needed clarification and changed the order of the questions if needed. After all questions were covered, she finalized the interview by asking if the respondent had anything to add. The researcher reviewed the interview immediately afterward to find out if there was a need to contact the respondent for clarification. She took notes on the interview details and reflected on the interview to enhance the quality of data that she could get from the future interviews.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

The data was collected during fall of 2016. It included 9 recorded interviews and interview notes. Interviews lasted approximately 1 hour, as it is recommended to finalize the interview before respondents lose motivation or get tired (Bogdan & Taylor, 1975).

Data Analysis

In qualitative data analysis, researchers deal with large amounts of data with the aim of making meaning to answer the research question(s) (Merriam, 2009; Patton, 2002). There is an agreement between researchers that data collection and data analysis should occur simultaneously in qualitative studies because of the emergent nature of qualitative research (Creswell, 1998, 2009; Merriam, 2009; Patton, 2002). From the time the qualitative researcher starts collecting data, he or she should also start the meaning making process without waiting until data collection is complete (Merriam, 2009). Once the researcher starts data analysis, he or she will be engaged in continuous cycles of reading, note taking, coding, and categorizing (Creswell, 1998, 2009; Merriam, 2009).

In this study, interview data and interview notes constituted the main sources of data. The researcher created verbatim transcriptions of interviews using Microsoft Word and sent the transcriptions back to the participants and asked them to review their transcript and inform her about corrections they wanted to make on the transcripts. Three participants provided minor corrections.

The researcher started data analysis after conducting and transcribing the first interview. The researcher read the transcript and started the *open coding* process. Merriam (2009) defined open coding as taking notes and comments in the margins of the document to capture bits of data relevant to the research questions. The researcher explained word(s) that the respondent used during the interview, word(s) that the

Design Thinking Across Different Design Disciplines: A Qualitative Approach

researcher used to describe pieces of data, or a notion from the literature that can encapsulate the open code (Merriam, 2009). After reading the transcript, the researcher read the transcript again with the purpose of grouping the related codes. Merriam (2009) called this process as *analytical coding*. The researcher created a list of these new codes. The researcher followed the same steps for the second interview. After the researcher completed coding the second interview, she compared and merged the two lists of codes into one master list. This list evolved as the researcher conducted other interviews, and it helped her find emerging patterns and *categories*. Merriam (2009) defined categories as “conceptual elements that ‘cover’ or span many individual examples” (p.181). The qualitative analysis starts as an inductive process, which becomes deductive towards the end (Merriam, 2009). Researchers initially try to make sense out of small bits of data and develop categories. Then, they check if these categories also occur in the subsequent data (Merriam, 2009). In qualitative analysis, researchers develop many categories initially and, as they continue, they keep only the ones that occur in more than one interview (Merriam, 2009). Writing interpretations involves generating ideas and connecting them to the literature to answer the research questions (Bogdan & Biklen, 2003).

The researcher also created a memo to keep track of her thoughts and reflections during the data analysis. The memo helped to make the data analysis process as transparent as possible (Patton, 2002).

The researcher stored all data collected for this study on her laptop, and no one had access to her account. She also regularly backed up data.

Trustworthiness or Credibility, Consistency, and Transferability

In qualitative research, researchers use different terminology to refer to reliability, internal validity, and external validity. Credibility or trustworthiness refers to internal validity, consistency refers to reliability, and transferability refers to external validity (Merriam, 2009).

Credibility or Trustworthiness

Trustworthiness or credibility of the research can be defined as the accuracy of the findings (Creswell, 2009; Merriam, 2009). To ensure the credibility of the study, qualitative researchers could employ several strategies. The researcher employed the following strategies to increase credibility of this study.

Triangulation: the researcher interviewed people who can potentially have different perspectives, such as designers from different disciplines, for the purpose of having multiple sources of data as suggested by Merriam (2009).

Member checking: the researcher let participants read her initial analysis and got their feedback on the accuracy of her findings as suggested by Creswell (2009) and Merriam (2009). Patton (2002) defined member checking as an analytical triangulation.

Sufficient engagement in data collection: The researcher continued to collect and analyze data until saturation was reached.

Reflexivity: the researcher clarified potential biases and assumptions she could have about the research topic as suggested by Creswell (2009) and Merriam (2009).

Peer debriefing: the researcher had a research scientist who analyzed and assessed the research by asking questions as suggested by Creswell (2009).

Consistency

Merriam (2009) defined the consistency of qualitative study as how well the findings match the collected data. Triangulation, peer debriefing, and the researcher's reflexivity are among the strategies that also ensure consistency (Merriam, 2009). In addition, the researcher created an *audit trail*, which consisted of the researcher's memos that she kept throughout the analysis process. The audit trail reflected the researcher's decision-making process during data analysis as suggested by Merriam (2009).

Transferability

Transferability means degree of applicability of findings of the study to other situations (Merriam, 2009). Writing thick descriptions and having maximum variations in the research is among the suggested strategies to increase transferability of the study.

Thick description: the researcher provided detailed descriptions of participants along with findings and proof for findings in the form of excerpts from interviews.

Maximum variation: the researcher conducted interviews with participants who were working in different design disciplines as well as in different companies and institutes.

The Researcher's Reflexivity

Researchers are defined as key instruments since they are the ones who collect data, continuously ask questions, and make assumptions about the topic under investigation for the purpose of meaning making in qualitative studies (Creswell, 2009; Merriam, 2009; Rossman & Rallis, 2003). The knowledge researchers create in qualitative research is interpretive, and researchers' backgrounds, beliefs, and values have an undeniable effect on how they will interpret what they see and hear (Creswell, 2009;

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Rossman & Rallis, 2003). Rossman and Rallis (2003) described the researcher's biography as "the lens through which he or she sees the world" (p.10). This situation requires qualitative researchers to have self-awareness regarding their perspectives and assumptions and to state all personal information related with the topic of investigation that may create a bias in the process of interpretation (Creswell, 2009; Rossman & Rallis, 2003). This being the case, I will relate my background and experiences around design and design thinking.

I have a B.S. degree from Computer Education and Educational Technology program at Bogazici University, where I started to learn about instructional design. I took courses related to learning theories, cognitive development, computer-based instruction, instructional design, and computer science. Instruction in Bogazici University was highly structured and rigid. In learning theory courses, I was learning constructivism by behavioristic methods. Most of the courses were lectures that used exams and quizzes as a method for assessment. I only took three courses in which I was required to design and develop real instructional materials and evaluate them through formative and summative evaluation methods. In those design projects, there was more emphasis on solving an instructional problem by following established principles or guidelines, utilizing technological tools, and justifying final solution by making references to the learning theories. On the other hand, coming up with creative or intuitive solutions was given little emphasis. Only after I finished developing the instructional material did I have a chance to see if my design was successful or not in the formative evaluation step.

With the aim of learning more about design, having more hands-on experience and relate what I would learn to my own discipline, I started a master's degree in

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Interactive Media Design program at Yildiz Technical University. I took courses related with typography, video techniques, information visualization, and art history. Faculty members of this program were using situated learning theories, probably without knowing anything about those theories. In almost every course I took, cognitive apprenticeship was highly applied; I needed to develop a project for every course; there were brief lectures; I had access to the how faculty members think through getting feedback every week; I had access to other experts' way of thinking through attending workshops of different experienced designers; I needed to lead my learning experience by asking questions and trying to find answers; I was required to learn the terminology that experts were using and defend my project using that terminology; and faculty members liked to hear my interpretation of the problem in any material I developed for my projects. After spending four years in a highly behaviorist learning environment, I felt slightly lost. Until then, I was always given guidance or a place to start with. I had no previous experience of dealing with ambiguity. Moreover, the problems I was dealing with were different—they were not communication problems, they were instructional problems. During those years, I experienced how design could be taught and assessed, and how designers defined a design process: an explanatory and a creative process.

While I was doing my master's, I started to work as a research and teaching assistant at the program from which I have my B.S. degree. I had the opportunity to combine and teach what I knew about instructional design with what I was learning in my master's courses. I was teaching shooting and editing instructional video, creating storyboards for instructional materials, and designing and developing web-based

Design Thinking Across Different Design Disciplines: A Qualitative Approach

instructional materials. I was also involved in different instructional design research projects.

I did not want to start my Ph.D. before I gained ample real-life experience in the field, so I started my second master's in Computer Aided Art and Design at Mimar Sinan Fine Arts University. I took courses related with digital storytelling, 3D modeling, web design, and animation techniques. The learning environment was even less structured: fewer lectures and more projects. Different from my previous learning environments, each student had a different background such as computer science, architectural design, animation design, video and photography, and education. Even though faculty members did not plan it, my classmates and I created a learning community; we were constantly discussing our class projects and receiving help from each other. During those years, I learned a lot from my friends and understood how people from different disciplines could frame and solve the same problem in a different way.

Following the completion of my second master's, I started my Ph.D. at Virginia Tech in the Instructional Design and Technology program. After having experienced hands-on design projects and teaching about design, I felt a need to learn more about theories of instructional design, and I also wanted to conduct research. I encountered and came to understand many learning theories, instructional design models and processes, and research methods in the instructional design field. After my second year in the program, I started take courses from Human Centered Design program. I learned about design studies and interdisciplinary research. I had chance to talk with other graduate students from different disciplines and again witnessed how different everyone's problem solving process was. Also, I earned a Human Centered Design graduate certificate.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

After being a student, teacher, and practitioner in different design fields, I realized the notion of design was fundamentally different across different design fields. I can list some of the aspects as to how the design process is defined, how design is taught, how design products are assessed, how creativity and intuition are addressed, and how the role of theory and design models are described. I believe these differences can be helpful to improve our understanding of how the design process is carried out in different disciplines and which aspect of each design discipline was most valuable. The list of differences and similarities across different design disciplines could be also useful to contribute to the general understanding of what design is. I will carefully watch my own process and remain unbiased in collecting and analyzing data and will not let my experience lead me to judgments I will hear from the participants.

Chapter 4: Findings

The purpose of this qualitative study is to explore the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and the design activities proposed by the design thinking literature. To this end, interviews were conducted with nine designers practicing in instructional design, fashion design, and game design fields. This chapter presents the findings from these interviews. It involves description of participants and an analysis of the findings as they relate to the following central research question.

“How do designers in the fields of instructional design, fashion design, and game design go through the design process?”

Designers’ Profile

In this study, the researcher interviewed nine designers from instructional design, fashion design, and game design. Table 4.1 summarizes demographic information of participants.

Table 4.1: Demographic information of participants

Pseudonym	Gender	Age	Profession	Education	Experience	Location
Ida	Female	40-49	Instructional Designer / Higher Education	BA in Art, MA in Educational Technology	13+ years	US – East North Central
Iris	Female	40-49	Instructional Designer	BA in History Education, MA in Instructional Design	14+ years	US- South Atlantic
Ileyda	Female	40-49	Instructional Designer	BA in Education, MA in Instructional Design and Technology	20+years	US- South Atlantic
Gerry	Male	20-29	Game Designer / University Instructor	BS in Computer Science	5+ years	US – East North Central
Gerard	Male	60-69	Game Designer	BA in History	23+ years	US – West South Central

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Pseudonym	Gender	Age	Profession	Education	Experience	Location
Glen	Male	20-29	Game Designer	BA in Creative Writing / MA in Game Design	5+ years	US – Pacific
Felix	Male	60-69	Fashion Designer / University Professor	BA in Asian Religious Philosophy with a minor in Art / MA in International Affairs and International Business	35+ years	US - Northeast
Fiona	Female	50-59	Fashion Designer / University Professor	BA in Clothing and Textiles, PhD in Apparel Design	32+ years	US- Pacific
Frida	Female	40-49	Fashion Designer/ University Professor	BA in Theatre, MA in Fashion Design	10+ years	US- Mid-Atlantic

Ida has been involved with instructional design for more than 13 years. She has a master’s degree in Educational Technology and her bachelor’s degree is in Art. She had been teaching at a museum before she started to work as an assisting instructional designer at a university. Before she had that job, she had not known anything about instructional design. She stated that she applied for that job because one of her friends had recommended her to apply and also because her job at that time was not paying well. After she started to work as an assisting instructional designer, she decided to get a master’s in Educational Technology with the aim of learning more about the theoretical perspective of instructional design. Even though she completed the degree, she stated that she learned more about instruction design on the job. In her current role, Ida is providing consultation services to faculty in terms of instructional design and online teaching.

Iris has been involved with instructional design for more than 14 years. She has a BA in History Education and MA in Instructional Design. She had been working as a high school teacher before she got a job in industry as an instructional designer. She

Design Thinking Across Different Design Disciplines: A Qualitative Approach

started her MA with the purpose of gaining a more methodical way to go back and continue her work as a high school teacher. She explained that an opportunity presented itself, and she took a different route by starting work in industry. In her current job, she is designing both classroom and online instruction on a variety of subjects in management.

Ileyda has been doing instructional design for more than 20 years. She holds a BA in Education and an MA in Instructional Design and Technology. She had been working as a trainer before she started work as an instructional designer in industry. In her previous position, she was designing both classroom and online instruction on a variety of subjects for government offices.

Gerry has been designing games more than five years. He has a BS in Computer Science. He is mostly designing noncommercial games and teaching courses related with game design at a university. He had been always interested in games, but he became seriously involved in game design during his college years, when he began to think about theory and gained a more political stance over time that affected how he approaches game design.

Gerard has been involved with game design for more than 23 years. He has a BA degree in History. He played his first session of Dungeons and Dragons in 1977 and went to a store to buy the Player's Handbook and the Dungeon Master's Guide and read those two books in the next week and thought he could build a better world than the commercial one's he had experienced. He has been designing games since then. He has designed card games, adventure games, roleplaying games, simulations, and educational games. He has designed commercial games for game companies for a long time and, in his current job, he is designing educational games.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Glen has been designing games more than five years. He has a BA in Creative Writing and MA in Game Design. He is mostly designing noncommercial games. He has been interested in telling stories since he was a kid, and he started to design analog games with his classmates to tell his stories when he was in school. Currently, he is participating in the 100 games in 5 years challenge, and he has completed 80 games so far.

Felix has been involved with fashion design more than 35 years. He has an MA degree in International Affairs and International Business and a BA in Asian Religious Philosophy with a minor in Art. He was always interested in design even when he was a kid, during which time he was building flying model aircraft of various sizes and architectural models of buildings. He was planning to be an architect, but he changed his idea after studying at an architectural collage for one year and finding out that there were no jobs in architecture that paid enough. Before he had his own business, he worked as a design department manager for a point of purchase display manufacturing design and manufacturing company. Currently, he has his own clothing business for designing apparel and apparel-related items for private clients. He is also teaching tailoring courses at a university.

Fiona has been involved with fashion design more than 32 years. She has a BA in Clothing and Textiles and a Ph.D. in Apparel Design. She took a class in apparel design in her undergrad where she was able to make her own pattern and design; after which point, she decided that this was what she wanted to pursue. She is currently teaching at a university and designing functional design products for her scholarly projects as well as for industry.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Frida has been involved with fashion design more than 10 years. She has a BA in Theatre and an MA in Fashion Design. She has been interested in designing since she was very young. When she was young, she loved making her own clothing. After she studied theater and realized that theater wasn't going to be a reasonable career path, she decided to go to a graduate school and improved her skills there. Currently, she is teaching fashion design at a university and designing clothes for companies and for her scholarly projects.

Software usage

The participants were asked about software they use while designing. Aside from one instructional designer and two fashion designers, all of the designers indicated that they needed to use software while they are designing.

Two of the instructional designers stated that they use only Microsoft Word or PowerPoint for storyboards, and they pointed out that they are not the ones who develop the instruction if it is online. The designer not using software, Ida, expressed that her consultation work to faculty members does not depend on any specific kind of technology. But she added that her work requires her to communicate with faculty and multimedia designers through email frequently. She expressed that “in terms of my own day-to-day work, I am mostly in what I call email jail”.

Three of the game designers explained that they use game development software, such as the Unity game engine, Game Maker Studio, or an IDE (Integrated Developer Environment) to develop a game. Only Gerry and Gerard expressed that they are also using Microsoft Excel and a text editor such as Microsoft Word or Google Docs while designing core ideas of a game. Glen, on the other hand, stated that he is using only pen

and pencil for this phase. Additionally, only Gerard indicated that he is using Microsoft PowerPoint for storyboard and Visio for flowcharts.

Among fashion designers, only Frida stated that she often uses Photoshop and Illustrator for her scholarly projects, and these two pieces of software plus Microsoft Word and Excel to help organizing steps for her commercial projects. The other two fashion designers expressed that they do not use any software during designing. And both of them indicated that they prefer creating a prototype and see their design idea in three dimensions instead of sketching it using a software and seeing it in two dimensions. Fiona explained this as being a “hands-on designer”, and she stated “I can probably make it faster than I can illustrate it or draw in either software”.

Design Process

Teamwork Versus Individual Design

The participants were asked to describe their design process. While answering the question, two instructional designers, one game designer, and three fashion designers mentioned that they are designing both in a team and independently. Two game designers and only one instructional designer stated that they do not design independently; instead, they are always involved in teamwork whenever they design.

Three of the instructional designers explained that they usually design instructions for other people. Iris and Ileyda stated that they design instruction for clients, and for those projects, they need to work in a team that involves stakeholders, subject matter experts, graphic designers, developers, and project managers. Similarly, Ida stated that she is providing consultation services to faculty in terms of instructional design and online teaching, and to do that she needs to work with faculty members and multimedia

Design Thinking Across Different Design Disciplines: A Qualitative Approach

designers. Only Iris and Ileyda expressed that they rarely design instruction independently for personal use, such as a hobby or something they want to teach.

Only one of the game designers expressed that he designs games both with other people and by himself, whereas, the other two game designers indicated that they always design in collaboration with others and do not undertake solo projects. Gerry stated that he collaborates with other game designers for bigger projects that tend to be commercial, and he designs alone for his non-commercial small projects. Glen stated that he is almost always collaborating with other people (mostly musicians) while he is designing a game. He explained the reason behind the collaboration is that even though he can code and design visuals for the game, he needs someone to do music and sound effects. Similarly, Gerard explained that as he is currently designing educational games for a client, he is working within a group consisting of instructional designers, subject matter experts, graphic artists, programmers, a producer, and a project manager.

All the fashion designers expressed that they both collaborate with other designers and design on their own. Frida stated that she always collaborates with other designers when she is designing for companies, and she sometimes collaborates with others for her scholarly projects. Even though he designs by himself most of the time, Felix said that he sometimes collaborates with others. Fiona sometimes collaborates with others and, when she does so, she picks the ones who are different than her in terms of creativity. In her words:

I like to design from a problem base and whenever I do collaboration, it's with someone who's a very creative type who comes up with all these crazy ideas and everything.

First Step: Identifying a Design Idea or Problem

All of the participants stated that, their design process starts with a design idea or problem whether their clients provide it to them or they come up with it. Because instructional designers usually design for clients, they usually start with a problem that their clients provide to them. Even though it is not often the case, two of the instructional designers stated that when they design for themselves, they usually design instruction on their areas of interest. Only one game designer stated that the idea for a game is always provided by the client; whereas the other two game designers explained that they usually come up with an idea or a story that they want to explore. Even though they all start with a design problem or idea, fashion designers showed differences in terms of how they find a design problem or idea. One of the fashion designers indicated that he usually defines a problem from a customer's point of view, whereas another fashion designer stated that she usually finds a design problem from her daily life, and on occasion the people she is collaborating with provide her with the problem. The third fashion designer expressed that for her commercial projects the design idea is provided to her by clients, and for her scholarly projects she defines a design idea from a poet or based on a story.

All of the instructional designers expressed that when they are designing for clients or faculty members, the subject is given to them. Only Iris and Ileyda design instructions for personal use by choosing a subject from their areas of interest: a hobby or something they want to teach.

Two of the game designers, Gerry and Glen, expressed that their design process starts with an idea or a story that they want to explore or a problem they want to resolve.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

They also set constraints in this first step when applicable. Gerry explained that his design process for both solo and team projects starts with:

A design question or idea I want to address or solve and/or themes I want to get across narratively like political ideas or stories I want to tell.

He repeated that his solo projects “tend to be more politically oriented” and he further explained that he usually comes up with restrictions in this first step of designing. He said:

There are these games called Zelda and it is kind of like an adventure games and you click on lots of different items and equipment. So one of the design questions I was asked was “Can I make a game like this that doesn’t rely on happen to click so many items?”

In line with Gerry, Glen stated that his design process starts with an idea, an experience, and a short story he wants to explore, recreate, and criticize. He explained:

Most recently that I have been trying to think about is that frustrating moment when you're walking down a sidewalk and a car is pulling out and you have to kind of walk around a car. You know you're taking how many seconds to walk around this vehicle. By the time you're like the peak of the kind of curve you get around a car, it just pulls out. It's like you could have just waited for this car to leave. You know it is this little weird moment where it's not like a day ruiner or anything but it's like you taking time to walk around this obstacle and by the time you're halfway walking around, the obstacles is no longer there. It's this weird kind of thing to do. You know if you do not want to stop walking, so it takes something like that. I just find really interesting just that emotional is this weird

Design Thinking Across Different Design Disciplines: A Qualitative Approach

feeling or it is this mundane upset-ness, because it's just this vehicle in your way and that's gone as you're negotiating it. And try to figure out how can I recreate that feeling in a game. How can I give the player this kind of weird mundane sense of you know... upset-ness.

Glen also mentioned that he sometimes starts with a criticism to make games better and sets constraints before he starts. He provided example to this as:

Horror games are always attached to death and they have to deal with monsters jumping out of dark and they are kind of cheap and they are not really interesting. So I want to make a bunch of series of horror games that didn't have to do with darkness and didn't have to do with monsters or death.

On the other hand, Gerard expressed that as he is designing games for companies and the game idea is given to him by the client as well as the requirements.

Two of the fashion designers stated that their process starts with finding a problem. Felix stated that his design process starts with identifying the problem and he explained:

Since a lot of what I do is custom-related or that kind of work, you need to identify the problem from the customer's point of view. In other words what is important to them.

Similarly, Fiona expressed that she starts with identifying the problem. When she is collaborating with other people, they usually communicate the problem that they want her to help solve and when she is designing by herself, she usually finds her problem from everyday life. On the other hand, Frida stated that if she is designing for industry, the design idea is set up for her. But if she is designing for her herself, she usually finds

“a spark” from a book, a passage in a book, or a passage of poetry that makes her want to design clothing about that. She explained:

I was really obsessed with Snow White for a while, not from Disney, but the old German and the folklore. And I wanted to create a whole line of clothing that went back to that.

Second Step: Analysis

Except for the two game designers, all of the participants indicated that their second step in their process is analysis, where they collect all the information that will help them in the next step. In this step, all the instructional designers and one of the game designers stated that they conduct interviews, whereas all the fashion designers stated that they do research and make observations.

All of the instructional designers stated that the second step in their design process is analysis. In this step they try to gather all the relevant information they can about the project through interviews with target audience or stakeholders. Ida expressed that, as she works with faculty members, she meets with them and asks them questions about their experience with online teaching and learning, their experience with educational technology tools, the reason they need to teach the course online (are they volunteered or required to teach online), the course they are going to teach online, the materials they use to teach the course, the assessment method they use in the course, the enrollment cap for the course, and the students of the course to get the sense of “where they are in the process” and “how much support they need” and “what their attitude is about all of these”. Similarly, Iris explained that even though sometimes her clients do not pay her to do analysis, she often conducts analysis by interviewing the target learners,

Design Thinking Across Different Design Disciplines: A Qualitative Approach

holding focus groups with them, and talking with their managers and subject matter experts to find out “what is the real learning problem that we're trying to solve here with this course, and technologically what their systems can handle”. She stated that she often needs to talk with subject matter experts to understand the underlying structure of their knowledge so she could make the knowledge digestible by novices. She explained:

By the time someone becomes an expert in something, they have a very strong cognitive structure around all of these bits of information, and they understand how that all fits together to the point that they don't even know. It's an implicit structure of the knowledge that they don't even know that they know. And I come in as fresh eyes interviewing them, talking to them, and I'm not just looking for the bits of information, I'm looking for what is the underlying structure of the knowledge that they know. And I am articulating back to them that underlying structure. And when I do that they sometimes say to me “Yeah well that's what I just said”. And it's not what they just said, but they don't hear the difference. Because I'm saying back to them the way the structure is in their head, they don't understand that I had to figure that structure out and that if I don't figure that structure out, they're going to give it to the novices and the novices are not going to figure it out or it's going to be really difficult for the novices.

Among the game designers, only Gerard expressed that the second step of his design process involves gathering information about the target audience to understand what they actually want as he stated sometimes people in target audience do not communicate what they really want. He explained:

Design Thinking Across Different Design Disciplines: A Qualitative Approach

A good six months before I started actual development on one project, I started meeting with all the user groups— ‘the guilds’ as they called themselves from the prior games. This game was to be a sequel, and I discussed with them what they liked about the prior games, what they didn't like about the prior games. I met with our sysop who had to manage the users when conflicts between users got out of hand, and I asked them for their most their biggest concerns and then thought about the nature of the games and what people liked and didn't like and came up with an approach. So that I thought would satisfy everybody. It turned out that what the guilds were asking for and what they actually wanted were two different things. They all complained about people using cheat codes of various sorts, macros at that time to make their characters more powerful, and the unfair advantage they got from it. Well, it turned out that in those meetings some people were saying that but most people weren't thinking that. Most people actually like that cheat codes. And so it turned out that that I put in some encryption things that made it impossible to cheat or at least as far as we know nobody ever did manage to hack those games. The sysop loves them, because that's one of the things that they have to deal with most was accusations of their cheating, and we have no proof, but now I had proof like when someone did a hack then I could detect it and we could generate an automated letter. So they're saying you violated our terms of service and here's our here's your slap on the wrist and there's no sysop involvement. So maybe the players just hated getting caught.

Even though, all of the fashion designers stated that they conduct some sort of analysis before they actually start designing a physical product, their purpose of

Design Thinking Across Different Design Disciplines: A Qualitative Approach

conducting analysis showed differences. Frida conducts analysis to gather information to see the big picture; Felix conducts analysis to identify important aspects such as a budget range, customer shape, size, and proportion that he needs to know before he starts designing; and Fiona conducts analysis to understand what the real problem is.

Frida stated that her second step is gathering as much information as possible to see the whole picture. She explained:

I look at what's happening right now like trends, so we have these databases that have all these trend forecasts that say what's in style and what colors are in style, so I go through those databases. I see what's inspiring to me in terms of even like books or artwork or movies I saw or a bit of poetry I read and then or a photograph or something that's sort of got my juices flowing. I look at the history of something like is there some historic reference that's happening here that's inspiring but I can you know sort of pick apart at, is there another? I look at other designers that are doing it as well that I can reference in my competitors. And I just gather as much as I can and take sort of a holistic approach to seeing what the landscape is.

Felix explained his second step as analyzing important aspects that he needs to know before actually designing anything. Those aspects include customer size, shape, proportion, which have effect on aesthetics and function and materials and budget. Fiona expressed that she conducts need analysis usually through observations to understand the real problem she wants to solve; is it really apparel or something else? She stated:

An example would be you need something to protect you from the cold. Well you normally would think it's like well you'll make a coat and it's like well no maybe

Design Thinking Across Different Design Disciplines: A Qualitative Approach

the problem is not how to make a coat. The problem is how to protect you from the cold. So what are all the different ways you can be protected from the cold? You know maybe it's more of well you don't, you control the environment with heat or something like that or there's some other way. So I always approach my design problems with trying to understand what is the real problem or the real need.

Third Step: Proposing Solution(s)

All of the designers expressed that they start proposing solution(s) in this step. The instructional designers stated that after the analysis step, they start designing the course, and one of them expressed that she also starts developing a project plan in this step. Two of the game designers who skipped the analysis step stated that they start proposing ways to communicate their game idea, and one game designer expressed that he comes up with a design solution that addresses the problem he figured out in the analysis step. The fashion designers expressed that after analysis they propose several design solutions. Among all the designers, only one fashion designer stated that she creates sketches in this step.

All of the instructional designers stated that after the analysis step, they start designing the course regardless of whether it is a semester-long course or a two-hour workshop. Only Ida starts to develop a project plan in this step. Ida expressed that after the analysis step she starts working on designing the course by formulating objectives, deciding which assessment methods will be used, making sure assessments are aligned with objectives, deciding which interaction strategies will be used, figuring out how the content of the course would fit within the timeframe of a semester, and how these

Design Thinking Across Different Design Disciplines: A Qualitative Approach

elements will interplay with each other and with faculty members. When starting to design the course, Ida simultaneously starts developing a project plan based on faculty members' schedule for the semester and sets up future meetings in this step. Ileyda and Iris also stated that they start designing the instruction, after the analysis step. Iris explained that she creates a design document that involves objectives, duration of the course, content, activities, and time estimates for developing the course. She noted that she creates a design document with the purpose of making sure her clients understand what she is planning to do before she starts actually doing it so she can get an approval. She explained how she describes this document to her clients:

I tell people it's like the blueprint for the house. We haven't decided on the color of the kitchen walls, we haven't decided on, you know, what fixtures go in, but we all agree that this is what we're building.

In this step, two of the game designers, Gerry and Glen, who skip the analysis step, stated that they start proposing ways to communicate their game idea. The remaining game designer, Gerard, expressed that he comes up with a design solution that addresses the problem he figured out in the analysis step. Gerry and Glen stated that they start thinking about ways to communicate their game idea. Gerry stated that he develops a game outline that involves his initial ideas about game narrative and levels that people with different skills could play, and he keeps elaborating on it until the game is shipped. Along the same lines as Gerry, Glen stated that he starts asking himself how he can communicate his game idea. For his "vehicle in your way" game idea, he explained:

For that one particular just start thinking about things like, you know, can I make puzzles that when you just figured out how to solve the puzzle, the puzzle solves

Design Thinking Across Different Design Disciplines: A Qualitative Approach

itself or is there any way you set an obstacle in a game, so once you're done with the obstacle, you know it's not actually a big deal but if it feels like a big deal while you are trying to handle it.

After figuring out what the target audience really wants in the analysis step, Gerard stated that next he comes up with “design solutions to accomplish a specific goal of making people want to play my game”.

All of the fashion designers expressed that, after analysis, they propose several design solutions. Frida explained that if she is designing for herself she proposes “five hundred designs” in this step. But, if she is designing for industry, she stated that she cannot propose that many solutions as the design solution depends on the client, the season, and the market. She expressed that she starts setting restrictions and added:

So if it's summertime, and I work for a swimwear company, I can only really decide one thing. So you have to get really creative with your restraints in order to make something seemed fashion new again.

Similar to Frida, Felix and Fiona expressed that they propose many design ideas based on what comes out of the analysis step. While talking about proposing solutions, Frida expressed that she creates sketches of the ideas she has. She explained:

Well if I were to design a pocket, I really try to figure out what the pocket looks like by creating a CAD drawing and or a shirt to say ‘okay, it helps my brain sort of sit there and kind of go okay the stitches are going to go here, and then they stop, and the seam opens, and then I'll have the finished edge here.’ So it's a lot—that's where a lot of problem solving comes in for me.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

On the other hand, Felix mentioned that even though he is very good at drawing, he does not sketch his ideas as sketches do not help him in anything except communicating his idea to others. Similarly, Fiona stated that she does not sketch but writes her ideas so she can refer to that writing when she starts developing prototypes.

Fourth Step: Prototype – Test – Iterate

All of the designers expressed that they start developing and testing their product in this step, and they revise it based on the result of this testing as such tests usually reveals something they did not foresee. Two of the instructional designers, all of the game designers, and one fashion designer indicated that they get feedback from the target audience in this step.

Two instructional designers, Ida and Iris, stated that they start developing the course and one instructional designer, Ileyda, stated that she starts developing the storyboard in this step. They all stated that while they are developing the course or storyboard, they make changes because a problem that they were not able to see in the previous step might become apparent in this step. In developing the course, both Ida and Iris stated that they collaborate with other people, whereas Ileyda completes the storyboard by herself. Only Iris and Ileyda stated that they test the course with the target audience or stakeholders after the first development phase is over and make changes based on the result of the test. On the other hand, Ida stated that she sometimes gets feedback from the target audience after the course is published, and she use that feedback to improve the course for the coming semester.

Ida explained listed tasks she completes in this step as “creating written narratives, creating (if you need to) video lectures, getting materials that we need and

Design Thinking Across Different Design Disciplines: A Qualitative Approach

making sure that they are accessible, organizing things within the Learning Management System setting up those assessments, setting up those interactions.” Ida added that the next thing is to launch the course.

The other instructional designer, Ida, emphasized that in this phase she interacts with other people in the project team, such as graphic designers and subject matter experts a lot. She further explained that, after developing the course, she pilots it and makes changes on the course based on the pilot at which point the course enters the maintenance phase. She explained the maintenance phase:

I hand it off to the clients, and I like to hand it off to the client with a whole plan for what needs to happen to keep this up-to-date.

Ileyda stated that she creates storyboards for the instruction and runs through the storyboard in front of the stakeholders. She expressed that in both creating the storyboard and running through it, she always makes changes. She explained:

Things will always change and new ideas will pop up because things come up that you didn't anticipate and new ideas appear. And then once you actually put it in front of the client or the stakeholder and do a run through, changes are going to happen as well because something you thought that would work, and that was a great idea—when you actually run it in front of the target audience—doesn't work and you need to change it. Or something you thought would take an hour ends up taking 10 minutes.

All of the game designers explained that they start coding the game, fixing bugs as they code the game, testing the game as they develop with game players, and make changes on the game based on what they notice in testing. Gerard stated that he begins to

Design Thinking Across Different Design Disciplines: A Qualitative Approach

develop the game in this step and then he runs it with game players and observes people playing the game, and he makes improvements on the game based on what he notices in his observations. He stated:

I ran a roleplaying game in a conference room environment. So it's just the big chat room. And after the first time I ran it, I went home and I designed out specs for a whisper function so that you could have a private talk to someone else, a mute function so you could shut up someone who was talking to you too much eating up your screen space, and an upload function so that I could prewrite bunch of text in a standard notepad format at the time, and then upload it all at once so that people weren't waiting on my typing speed.

Similarly, Glen and Gerry expressed that they start coding the game in this phase and make changes on the game while they are coding as they can see how their game idea really looks and works in reality. They expressed that this cycle of coding, seeing how it works, and modifying the game continues until they release the game. Gerry further explained:

There is like a back and forth between planning and actually designing and implementing. And it is just that changes in the planning become smaller and smaller over time.

Glen noted that when he tests his games, he usually notices bugs in the code, but he does not always consider these as a negative things and he explained:

Sometimes the code doesn't work and that's sometimes a bad thing and sometimes a really great thing. Some of the coolest things that came out of games I made were unexpected little code flaws that actually made the game way more

Design Thinking Across Different Design Disciplines: A Qualitative Approach

entertaining than I had originally anticipated. Just little bugs that you realize do not have to be a flaw. So you can kind of redesign the game around those bugs and those issues you have.

All of the fashion designers stated that they, after coming up with several design ideas, narrow them down, create a prototype, test the prototype, and make changes on the prototype based on the result of testing until they produce the final product. They all expressed that in testing, a problem they did not foresee becomes apparent. Only Felix stated that he tests his prototype on his client. Frida tests her prototype on a fit model, and Fiona tests it by herself. Frida stated that after coming up with different design ideas, she starts drawing and testing them. She further explained:

After I sort of figured that out through a technical drawing and through testing things out on the dress form, I'll start creating a pattern. And from the pattern I'll discover more things and then I'll create a muslin-sort of a prototype. And from the prototype, I'll discover more things and then take a step back and then from there I'll cut it out of the real fabric and saw it and hopefully it's what I expected.

When she was asked about her discoveries she expressed that it could be the fabric that does not behave the way you drew it. She also emphasized the importance of prototyping in the fashion industry since it saves a significant amount of money. Similar to Frida, Felix also stated:

With those design ideas, you need to narrow it down to something that you can actually work on and then create a pattern, test the pattern, and cut it out of muslin—you know inexpensive common fabric—and create something to actually fit onto a mannequin or the customer or whatever you're doing. Then you test it,

Design Thinking Across Different Design Disciplines: A Qualitative Approach

you make sure the materials work and then you can actually make something into other than real materials and make sure that works properly. And all along you're considering internal structure, shape. So then you can construct the final garments, fit it on the customer and hopefully all is good, you get paid and everybody's happy.

While talking about this step, some of the designers also mentioned testing their product with the target audience as mentioned earlier. The next subsection provides more details about the designers' ways to get feedback from real users.

Getting Feedback from Target Audience (how many times, at which stages, peer feedback)

Two instructional designers, Ileyda and Iris, stated that for their commercial projects they always get feedback from the target audience while they are still developing the course. Opposed to the other instructional designers, Ida, stated that she sometimes gets feedback from the target audience after the course is published. All of the game designers explained that they get feedback from game players both during game development and after they release the game. They expressed that the feedback they get during the development phase helps them to improve the game, and the feedback they get after the game is released helps them for the next version of the game or future games. And only one fashion designer, Felix, indicated that he gets feedback from his clients during the development process.

Two of the instructional designers, Ileyda and Iris, stated that they usually get feedback from the target audience, and the other instructional designer, Ida, explained that she could get feedback from students only if the faculty member applied for course

Design Thinking Across Different Design Disciplines: A Qualitative Approach

development funds. She explained that, in this situation, they usually administer “an online course design evaluation” at the end of the semester and use that feedback to improve the course. Ileyda mentioned about alpha and beta tests where people will go through the course storyboard and provide feedback. She further explained that alpha users are people who know the topic, whereas beta users are people who are the target audience. Like Ileyda, Iris stated that she does a pilot of some of the materials and receives feedback from actual learners. She explained that her aim is “to do a pilot as closely approximates the reality as possible so that I can really get a good evaluation of whether or not this is going to work.” She noted that sometimes, clients do not want her to run a pilot due to the time constraints of the project.

All of the game designers stated that they get feedback from people both during the development of the game and after the game is released. Gerry stated that to get feedback from actual players he runs two types of tests: playtest and beta test. He explained that playtesting takes place when he has developed the introduction and a couple levels where he has something in progress and wants feedback on it. He said that he usually observes people while they are playing the game and records notes about the problems. He noted that playtesting is useful for “tweaking mechanics of the game”. He further explained that for his solo projects he tends to playtest the game with less than 10 players whereas for his bigger projects this number is usually around 10-20. He stated that beta testing takes place after the game is released. He explained that it is hard to observe people playing the game for beta testing as they download the game on their own and report issues about the game online. He noted that at this stage it is impossible to

Design Thinking Across Different Design Disciplines: A Qualitative Approach

change the core ideas of the game but he can fix bugs with the code and improve the software stability. He added:

Feedback at that point is still useful as a game designer because you can incorporate those ideas in future games. You can say all this really didn't work for some reason, so I can keep in mind when I'm designing a later game.

Glen also mentioned these two types of tests and, differently from Gerry, he expressed that for playtesting he usually sends his games to the game players he knows and trusts, while for beta testing, even though it is not always the case, he tries to get feedback from other players. And again different from Gerry, he stated that he usually runs playtesting in-game conferences where he has a chance to share his game with other people. He noted he usually sends his games to the game players he knows for playtesting three or four times over the course of development and he explained:

The first two times are like the early kind of prototype stuff. And the second one is kind of when something major is in place that communicates what I wanted to say. And a third and fourth time normally have to do with adjustments made to the system after I had been working on it. So the fourth is like if I got a lot of feedback and needed some kind of overhaul. And the third is just kind of either the incorporation of new feedback, or I normally get the music about the third test so the first ones just have sounds effects or silence.

Among the fashion designers, only Felix stated that he tests the prototype on the client for feedback. On the other hand, Frida and Fiona do not get feedback from actual users. Frida explained that she considers product returns and product reviews as user

feedback, and if the product is not sold this also gives her insights into users ideas on her design.

The Last Step

The participants were asked when their design process ends. While answering the question, one instructional designer, three game designers, and one fashion designer explained that even though they release the product at some point, they keep improving it later, and their design process never ends in this sense. The other designers expressed that they usually move to another design project after they release the product.

Ida stated that the design process never ends and explained that after launching the course, they usually improve the course based on feedback they got either from faculty members or students.

Ileyda stated that her design process usually ends when she hands the tested storyboards to the client. Because she was designing courses for government offices, she was not allowed to keep her courses or improve them. Following Ileyda, Iris stated that her design process ends after making revisions based on piloting. She added “My job ends when they're comfortable that they can run whatever this design is without me there”.

Two of the game designers, Glen and Gerard, stated that their design process ends when the game is released. Gerard added that it also ends when his clients stop asking him to do more work on the game. On the other hand, Glen stated that his design process usually ends when he cannot think of anything else he wants to add to the game. All of the game designers also said that after they release the game they usually release new

versions based on feedback from players. They stated that they usually address coding bugs at this time. Gerry explained:

I started out version .95, and as people played the game I fixed stuff and I would increment that number and upload a new version of the game.

Two of the fashion designers, Frida and Fiona, stated that their design process ends when the product is sold, if they are designing for the industry. For her scholarly projects, Frida stated that her design process ends when people she consults and trusts say “yes” she feels it is done. On the other hand, Felix explained that his design process ends for the specific iteration, when the garment meets users’ needs in terms of material and aesthetic considerations. He added that there is a possibility to go back to it at some point in the future and improve the garment. He noted, “in some ways the design process never ends”.

Design Journals

While describing their design process, two instructional, two game, and two fashion designers stated that they keep track of their ideas and progress in written form. Game designers and fashion designers called it design journals, whereas instructional designers referred to it as a to-do list. Instructional designers, Ida and Iris, expressed that they do a lot of to-do lists to keep track of where they are in the project. Game designers, Gerry and Glen, stated that they keep design journals that include game ideas and decisions about design elements, characters, and themes. Glen noted that he occasionally looked back through all his previous notes and clumped together a couple game ideas that he hasn’t started to develop yet. Fashion designers, Frida and Felix, expressed that they keep design journals, and they periodically go back and check those journals. Felix stated

Design Thinking Across Different Design Disciplines: A Qualitative Approach

that his journals contain more text than sketches, whereas Frida expressed that her design journals have both. Frida further explained how she feels when she looks back through those journals:

I am proud of my work and looking at some old books and patterning. But I always think I can do more. And I always wish that there were less self-consciousness and less toughness like sadness or anguish with the design process. Like you get in there and you're like oh I can't do this, what am I doing? what am I doing! And so sometimes it's hard to open up those old things and see them and remember how painful it was.

Design Process Across Different Design Projects

The participants were asked whether or not their design process is similar across different design projects, and while answering the question, all of the designers except one instructional designer and one fashion designer stated that their process is pretty much similar across different projects.

Ida stated that her process shows differences across different online course design projects, and she explained that every faculty is different, their attitude toward online teaching and their experience with online learning are different, and these differences influence her design process. She explained that she could skip some steps with an experienced faculty member. On the other hand, Ileyda and Iris, expressed that even though there could be minor differences, their process is pretty similar across different projects if they are designing for a client. Iris explained that she follows ADDIE process, and she customized it based on the client and the situation. She stated that if she designs an instruction that she will teach later, she will still follow the same steps but will keep

Design Thinking Across Different Design Disciplines: A Qualitative Approach

the design document shorter as she is the subject matter expert, and she is the one who will make the final decision.

All of the game designers stated that they take a similar approach when they are designing games, even when designing a game in a different genre. Two fashion designers Felix and Fiona expressed that they are consistent in terms of how they approach the design problem each time. On the other hand, Fiona expressed that she is free to be creative in her scholarly projects, and this can cause slight differences in her process, such as the number of solution she proposes or setting no restraint on her solutions.

Challenges faced During Designing

The participants were asked about major challenges they face during designing and how they overcome those challenges. Whereas all of the instructional designers defined the challenges as people and resources, such as time and money, all of the other designers mentioned different challenges.

All of the instructional designers expressed that people they need to work with and resources such as time and money can be challenging. They explained that good consulting skills could be helpful to overcome the former challenge. Ida expressed that reluctant faculty members who feel “their profession and their intellectual property is threatened” is the major challenge she faces, and she explained that developing a rapport with faculty members is the key to overcome this challenge. Similarly, Iris expressed that subject matter experts who want to teach everything they know in their own way and at the same time do not know a lot about instructional design can be challenging. She explained that good consulting skills could help to overcome this challenge and that one

Design Thinking Across Different Design Disciplines: A Qualitative Approach

method to assist subject matter experts is to explain that the course activities should be aligned with the course objectives:

So when I'm working with SMEs and I'm teaching them this mindset, I'll say to them you know just go with me for minute and I'll do this whole sort of thing on about Grilled Cheese 101 and I'll role-play for them. You know “welcome to this class and we're going to have a panel discussion on grilled cheese sandwiches and we've got a chef who's come here and he's going to give you samples of grilled cheese and we're going to watch movies and you didn't know how much grilled cheese sandwiches were in pop culture. Let's watch some video clips and blah blah blah.” And I get to the end of this little role play and I say to them, what's wrong with this picture? And they're like “Nothing—that sounds like a great course”. And I said to them “Can the students make a grilled cheese sandwich when they leave?” If they didn't know how to make it when they walked in, can they make it when they leave? And they're like “no.” Then they say to me, “Well it's not that hard to make a grilled cheese sandwich.” And that's not my point. My point is they come to your class and you talk around it. You just show them, you bring up panel—panels are such an easy thing to do in a course—we'll just bring a panel in, they'll talk about their experiences. And we never get to the thing itself. We just talk around it, and students will give you great evaluations because they got to eat a grilled cheese sandwich and they got to hear a chef. You know that's fun stuff. But it's not about the real thing.

Each game designer identified different challenges. Gerry described the first step as the biggest challenge since he needs make decisions on the game's core design

Design Thinking Across Different Design Disciplines: A Qualitative Approach

elements that must work throughout the whole game. And he expressed that he overcame this challenge by just doing it. Gerard, on the other hand, described the major challenge he is facing lately as people's illusions of considering themselves as game designers. He explained:

Everybody thinks they're a game designer. And it's like everybody wants to direct: all actors want to direct movies. Well, everybody in games thinks they are a game designer. There's a reason why most games fail: and that is because not everybody is a game designer.

He expressed that good communication and persuasion skills could be helpful to overcome this challenge. Glen listed his major challenges as his coding ability and blank canvas paralysis. In line with Gerry, he stated that he overcomes the first one by learning and coding more games and the second one by just doing it.

Similarly, each fashion designer found different challenges. Fiona stated that one challenge is the other people she has collaborated with in her scholarly or commercial projects, as well as money, time, and self-confidence. She expressed that she is an easygoing person, and she is overcoming the first challenge by not arguing with the people she collaborates with and not strongly insisting on her solution. She further explained her self-confidence challenge:

I always struggle with confidence and feeling good enough. And it's really funny because I've been created my whole life, I've been designing for many years, and I've been teaching and it never goes away. And this little evil person on your shoulder shows up at every stage of the process whether you're gathering, you're researching, whether you're doing a fitting, whether you're just drawing. There's

Design Thinking Across Different Design Disciplines: A Qualitative Approach

just so many moments where that person shows up and says “This is like really not good and you should just give up being a designer”. And I see it in my students too.

She explained how she overcomes this challenge:

In the past and recently how I teach has come up with these tools and games and ways to design where you don't realize you're designing when you're doing it.

And that has to do with like there's a design extension exercise that I do, they're just activities, there are assignments and things we do in class and at the end of it you have 50 designs there that you didn't realize were sort of happening. And you have to get over self-consciousness and you have to get over thinking that it has to be perfect, especially during the design process. It has to be perfect when it's done, but not during the design process.

Felix listed his major challenges as time, clients who do not know exactly what they are asking for, working long distance, and a customer who is difficult to fit. And he explained that he has only one way to deal with these challenges, which is not taking shortcuts and taking one step at a time. And Fiona stated that seeing a two-dimensional pattern or item and being able to see that in three dimensions could be challenging for her, and she expressed that she makes physical manipulation of the two-dimensional pattern or item to overcome this challenge.

How do the Designers define a Good Design?

The participants were asked about how they define a good design, and they described a good design with regard to what they are designing and for whom they are designing.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

All of the instructional designers expressed that a good instructional design leads to learning. Ileyda also noted that good instructional design also keeps learners engaged during the course. Iris added that a good design has to have a storyline beginning, middle, and end, where every instructional element is used for a good reason, and they are all connected. She noted that in a good design the storyline mirrors in many ways the underlying structure of the knowledge, and there could be a hundred different ways to reach a good design. Only Ida mentioned that when she designs a good instruction, usually faculty members tell her so and that is how she knows she designed something good.

Two of the game designers defined a good design in terms of the message, statement, critique in the game, whereas one game designer defined a good design with regard to game mechanics. According to Gerry, a good game should get people thinking about the game's intended message. In line with Gerry, Glen expressed that in a good game "there has to be a critique of something or it has to be a statement being made". On the other hand, Gerard said "a good game design is one that doesn't cause the mechanics to interfere with the gameplay".

The way the fashion designers define a good design showed similarities. Frida stated that a designer achieves a good design "when the aesthetics, the function, and the structure all work together". She added that she can tell if her design is successful or not by gut feeling. In line with Frida, Fiona stated that a good product "makes you feel good about using the product"—it functions, and "you just like it". She added that if her products are sold, she consider them as good products. Felix defined a good design as a design that makes everyone happy. He further explained that a good design should flatter

Design Thinking Across Different Design Disciplines: A Qualitative Approach

the human and be timeless. He expressed that he knows his design is successful when his customers truly enjoy what they're wearing and are comfortable in it and happy in every way.

What is the Designer's Definition of Design?

The participants were asked to define design. Two instructional designers defined it with regard to target audience; two game designers defined it in terms of process of developing the game; and all of the fashion designers defined it with reference to problem solving.

Ida and Iris described design with regard to learners, Ida defined design as a “creative and continuous process,” and she explained creativity in terms of “thinking ways for students to interact with each other”. Iris defined design as communicating knowledge in a different form and she explained:

taking knowledge from one format—and format might mean in a book or in someone's head or something online—taking it from that format and creating a way to communicate it for someone who needs to learn it, in a way that someone can learn it.

And Ileyda described design as “a formal approach to create something”.

Gerry and Gerard defined design in terms of their process of creating a game. Gerry described it as “the process of taking an idea and transforming it into [an] intractable thing that a player uses” and Gerard described it as “the process of answering questions about your game.” On the other hand, Glen described design as “the blueprint of a creative project, it is the soul.” And he defined creativity as saying something unique or saying something in a unique way.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

All of the fashion designers defined design in terms of problem solving. Frida defined design as “it's where commerce meets creativity,” and she explained “it's thinking outside of the box to solve a problem as well”. She explained creativity in two ways. The first one is trying something crazy and going wild, and the second one is “this little problem solving moment where your brain is like alright”. Similarly, Felix defined design:

It's bringing together a multitude of resources in order to solve a real world problem, which is a functional, aesthetic, economic, emotional, and psychological.

In line with Frida and Felix, Fiona defined design as “creating for a purpose or for a need.”

What Does Being a Designer Mean to the Designers?

The participants were asked to describe what being a designer means to them. Ida and Iris described being an instructional designer with regards to being service oriented.

Iris explained:

I think this is this is true for many instructional designers. We're the hired guns. We don't know the information, we're not the experts on the information, we're the experts on how to deliver that information, how to communicate that information—which means there's always a client that you're answering to.

Correspondingly Ileyda and Iris listed skills that are necessary for instructional designers to be successful as strong communication skills, consulting skills, ability to be persuasive, project management skills, and time management skills. Ida also added that

Design Thinking Across Different Design Disciplines: A Qualitative Approach

being an instructional designer could be quite stressful. Later in the interview, Iris emphasized that instructional designers also need to advocate for learners. She explained:

When you walk into a room as an instructional designer, you're going to sit down at a meeting with clients and stakeholders and graphic designers and subject matter experts and project managers and they're all going to be advocating for their own thing. Project managers are going to be advocating for money and budgets and trying to make this project happen. Subject matter experts are going to be advocating for content and for their ideas you know. Graphic designers are going to be advocating for particular software programs. You are the only one in the room who is actually advocating for the learner. Meaning you understand the learner and you speak for what the learner needs. Everyone else is there supposedly for the learner but their particular expertise is not about the learner. It's about this other stuff. The instructional designers are the ones advocating for the learner.

Interestingly, all of the instructional designers mentioned that because most of the time they design an instruction for clients or they help others to design an instruction, even though they do their best to make the course better, and give the best advice in terms of instructional design, at the end of the day they are being paid to do what the client wants them to do.

Gerry and Glen described being a game designer with regards to creating a system that will communicate their message, and Gerry added that being a game designer requires being aware of the responsibility in creating the system “that will take a part of somebody’s life”. On the other hand, Gerard stated that it is who he is. He explained

Design Thinking Across Different Design Disciplines: A Qualitative Approach

there was no program teaching game design when he started to design games; one day he played Dungeons and Dragons and he knew what he was going to be—a game designer.

Glen expressed that his ability to tolerate ambiguity is helpful in designing games, and Gerard emphasized that his ability to notice a lot of details helps him a lot when he designs games or talks with people to understand what they really want. He further explained:

If I'm talking to you as a user for a game I'm thinking about making, I have to be noticing that, when your body language is uncomfortable, maybe you're not really telling me how you really feel but you're telling it because other people are thinking that way.

All of the game designers expressed that their background helped them in designing games. Gerry stated that his background is very helpful in coding, and Glen explained that his background helps him in writing the game dialogue and storylines, and Gerard expressed that, thanks to his background, he has good research skills plus his background in history is extremely helpful when he designs historical games.

All of the fashion designers described being a designer from the perspectives of creating meaningful products and problem solving. Frida described being a designer as:

Putting an extreme amount of care and attention to all of the products and things we put into our lives. It's about making sure that there's a meaning behind all of those.

In line with Frida, Felix explained being a designer as “creating good stuff for people in the world around me”. On the other hand, Fiona stated that being a designer means solving problems. Frida and Felix also mentioned that being designer comes with

Design Thinking Across Different Design Disciplines: A Qualitative Approach

responsibilities toward the world we live in. They both emphasized that, while they are designing, they try to make wise decisions about materials and avoid materials that will not rot or not be recyclable when they are thrown away.

What Does Design Thinking Mean to the Designers?

The participants were asked about what design thinking means to them. One instructional designer and two game designers stated that they have never heard the term before, and one other instructional designer expressed that even though she has heard the term before, it does not mean anything to her.

Instructional designer Ida stated that she heard the term within the context of graphical design and expressed that it means creative play and taking risks to her. Game designer Gerard stated that it means considering all of the elements that the game has to deliver. The fashion designers' explanations of the term showed similarities. Fiona described it as “process of both identifying and solving problems”. Similarly, Frida explained:

It's about using the design process to solve the new problems that we are facing today. So the more we grow as a society, I think the more complicated our problems are. And I think that using design and using the brains that are created by learning how to design are the people that are going to solve these problems. Because I mean, like I said, I'm the one—the designers are the ones—that are trying to think holistically and think interdisciplinary.

In line with Fiona and Frida, Felix explained design thinking as:

Being able to look at problem solving from a foundation of experience and innovation, and learning to ask the pertinent questions – depth of experience and

Design Thinking Across Different Design Disciplines: A Qualitative Approach

listening to others more than imposing your own ideas on a situation. This applies to any situation, really.

Chapter 5: Discussion

The purpose of this qualitative study is to explore the design process of professionals from different design disciplines in order to understand the similarities and differences between their process and the design activities proposed by the design thinking literature. To this end, interviews were conducted with nine designers practicing in the fields of instructional design, fashion design, and game design. This chapter presents a discussion of the findings with regards to the following central research question.

“How do designers in the fields of instructional design, fashion design, and game design go through the design process?”

This chapter also presents limitations of the study and recommendations for future research. To see the summary of the participants’ answers to the interview questions and how the findings were compared to design thinking see Appendix F.

Discussion of the Findings

Design Process

The participants were asked to describe their design process. While answering the question, the participants mention collaboration. The findings showed that most of the participants collaborate with other designers or other people if they are designing a commercial product either for the client or the market. The participants were also asked about software they use while designing. The results revealed that the designers use software while designing for different purposes. The instructional designers use software to communicate the instructional design solution to other people in their team. Similarly, one of the fashion designers needs to use software to better understand the design

problem and to communicate her design ideas to the clients. On the other hand, the game designers use software to develop their games.

The findings also indicated that the designers follow these steps while designing: identifying a design idea or problem, analysis, proposing solutions, and prototype – test – iterate. The steps the designers follow showed similarities with the design steps proposed by the design thinking models of d.school (Stanford University Institute of Design, 2016), IDEO (IDEO, 2016), and NoTosh (Notosh, 2016).

The results showed that all of the participants start their design process by identifying a problem or idea. When designing a commercial product, all the designers, except for one fashion designer, are provided with the design idea by their clients. If they are designing noncommercial products, either they or people they are collaborating with provide the idea or problem. The activities the designers engage in during this step are parallel the activities of the inspire step of IDEO's (IDEO, 2016) design thinking model.

The findings indicated that except for the two game designers, all of the participants continue their design process by conducting analysis, during which they collect all the information that will help them in the next step. The activities the designers engage in for this step are in line with the activities of the empathize and define steps of d.school's (Stanford University Institute of Design, 2016) design thinking model. Similarly, they are consistent with the activities of the immersion and synthesis steps of NoTosh's (Notosh, 2016) design thinking model.

The results showed that all of the participants start proposing solution(s) after the analysis. These findings revealed that fashion designers tend to propose more solutions than other designers. The number of solution they propose depends on if they are

designing for a client or not. If they are designing for a client, the number of proposed solutions tends to be smaller as they have more restraints defined by the client. The activities the designers engaged in during this step are in line with the activities of the ideate step of d.school's (Stanford University Institute of Design, 2016), and IDEO's (IDEO, 2016), and NoTosh's (Notosh, 2016) design thinking models.

The findings revealed that all of the participants start developing the product and test their product after proposing solution(s). The results showed that designers develop the first prototype based on the solution(s) they proposed in the previous step, and then they test it, and they notice something about the solution or problem that they didn't notice before in these testing sessions, and they revise their product based on the results of testing. These findings corroborate the ideas of Dorst and Cross (2001), who suggested that designers continuously move between problem space and the solution space in a parallel fashion, therefore problem and solution co-evolve. Most of the designers (6 out of 9) stated that they test their product with the target audience. The designers keep going through the cycle of testing their product and creating another iteration of their prototype until they reach a solution that makes them or their stakeholders happy. These results support the studies indicating that designers go through the design process in an iterative fashion rather than a linear one (Akin, 1979; Nelson, 2003; Visser, 2006). Designers first create an idea and then test the idea and finally revise it based on the result of testing (Adams, 2002). Designers go through a continuous cycle of idea formulation, idea testing, and idea revision (Akin, 1979). These results are also in agreement with the ideas of Lawson (2004, 2006) and Cross (2011) who emphasized the importance of sketching and modeling in design practices and education, and they stated that it constitutes a

Design Thinking Across Different Design Disciplines: A Qualitative Approach

cognitive aid and supports designers' dialogue with the problem, and it helps transformations between problem and solution.

The activities the designers engaged in during this step are in line with the activities of the prototype and test steps of d.school's (Stanford University Institute of Design, 2016) design thinking models, and these activities are consistent with the activities of the ideate step of IDEO's (IDEO, 2016) design thinking model, and finally these activities are also consistent with the activities of the prototyping and feedback steps of NoTosh's (Notosh, 2016) design thinking model.

The participants were asked when their design process ends. While answering the question, one instructional designer, three game designers, and one fashion designer explained that even though they release the product at some point, they keep improving it later, and their design process never ends in this sense.

The participants were asked whether their design process is similar across different design projects. While answering the question, all of the designers except one instructional designer and one fashion designer stated that the steps they follow are consistent across different design projects.

While describing their design process, two game and two fashion designers stated that they keep track of their ideas and progress in a written form. These results are consistent with the ideas of Schön (1983) who mentioned about reflection-in-action, which refers to designer's ongoing mindfulness of his/her actions and design decisions during the design process.

The overall findings discussed so far further support the idea of design as ill-structured problem solving which requires higher-order skills such as *analysis*:

Design Thinking Across Different Design Disciplines: A Qualitative Approach

identifying what factors could be critical for the solution, *synthesis*: emerging new factors that have potential to affect the solution, *what-if analysis*: evaluating the potential impact of the solution, *argumentation*: validating possible other solutions based on what-if analysis, and *reflection*: having understanding about the actions to solve the problem and the results of those actions (Choi & Lee, 2009; Cuban, 2001; Frensch & Funke, 1995; Jonassen, 1997; Sinott, 1989; Voss 1988).

Challenges Faced During Design Process

The participants were asked about major challenges they face during designing and how they overcome those challenges. Whereas all of the instructional designers defined the challenges as people and resources, such as time and money, all of the other designers shared different challenges. The findings are in accord with recent studies indicating that designers are engaged in creative thinking during the design process, and one aspect of creativity is the ability to persuade others (Kozbelt et al.; 2010). On the other hand, it has been suggested that designers have the ability to visualize (Owen, 2007), and they are self-confident and not afraid to be a failure (Lawson, 2004, 2006). Some of the results revealed that this is not the case for all of the designers.

Good Design

The participants were asked how they define a good design, and they described a good design with regard to what they are designing and for whom they are designing. These findings corroborate Owen's (2007) who suggested that design products should work and be sustainable, and reflect the sense of aesthetic of the culture they were created for, and be appropriate, which is determined by human factors.

Design

The participants were asked to define design and two instructional designers defined it with regard to target audience, two of the game designers defined it in terms of the process of developing the game, and all of the fashion designers defined it with reference to problem solving. The results corroborate the ideas of Jonassen (2000), Rittel (as cited in Buchanan, 1992), Cross (2011), and Lawson (2006) who defined design as an ill-structured problem.

Being a Designer

The participants were asked to describe what being a designer means to them. The findings corroborate the ideas of Lawson (2004, 2006), who listed characteristics of designers as follows: their awareness is high, their sensitivity to the changes in their environments is also high, and they are good at dealing with ambiguity and different lines of thought. The results are also consistent with the characteristics of environment-centered concern, which is defined by Owen (2007).

Design Thinking

The participants were asked about what design thinking means to them. One instructional designer and two game designers stated that they have never heard the term before, and one other instructional designer expressed that even though she heard the term before, it does not mean anything to her. All of the fashion designers described design thinking from the perspective of the complex problem solving aspect of designing, and their descriptions were similar to how design thinking is explained by the studies that define design thinking as a cognitive style (Kimbell, 2011). A possible explanation for

Design Thinking Across Different Design Disciplines: A Qualitative Approach

this might be that all of the fashion designers are teaching at a university and two of them are focusing on design process.

Intended Contribution of the Research Study to the Field of Instructional Design

This study revealed that even though they follow the same steps the other designers follow during designing, unlike other designers, instructional designers defined themselves as being service oriented, they rarely design instruction for themselves, and they stress the value of having project management and communication skills.

Limitations of the Study

The major limitation of this study is the number of design fields it investigates. The study focuses on the three design fields of instructional design, game design, and fashion design. This study could have been improved by including other participants who are practicing in other design fields. Their approaches to solve design problems could have provided an additional perspective.

Recommendations for Future Research

Based on the study's findings and limitations, several recommendations for further research can be made. For example, a further study could include designers from different design fields in order to add a broader perspective. Additionally, it would be interesting to explore experiences of people who received design thinking training and that apply design thinking steps to solve the problems they face at their work, for example educators and business people.

References

- Adams, R. S. (2002). Understanding design iteration: Representations from an empirical study. Paper presented at the International Conference of the Design Research Society, London.
- AECT (2014). *Curricula Data of Degree Programs in Educational Technology*, Retrieved from <http://aectorg.yourwebhosting.com/Curricula/>
- Akin, O. (1979). An exploration of the design process. *Design Methods and Theories*, 13(3/4), 115-119.
- Alexander, C. (1964). *Notes on the synthesis of form*. Cambridge: Harvard University Press.
- Ambrose, G., & Harris, P. (2010). *Basic Design 08: Design Thinking*. AVA Publishing.
- Aspelund, K. (2010). *The Design Process* (2nd ed.). New York, NY: Fairchild Books.
- Bayazit, N. (2004). Investigating design: A review of forty years of design research. *Design Issues*, 20(1), 16-29.
- Bogdan, R., & Biklen, S. K. (2003). *Qualitative research for education: An introduction to theory and methods*. Boston: Allyn and Bacon.
- Bogdan, R., & Taylor, S. J. (1975). *Introduction to qualitative research methods: A phenomenological approach to the social sciences*. New York: Wiley

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Bonsiepe, G. (2007). The uneasy relationship between design and design research. In R.

Michel (Ed.), *Design research now* (pp. 25-39). Retrieved from

<http://link.springer.com.ezproxy.lib.vt.edu/book/10.1007/978-3-7643-8472-2>

Bransford, J. D., & Stein, B. S. (1993). *The Ideal Problem Solver: A Guide for Improving Thinking, Learning, and Creativity* (2nd ed.). New York: W. H. Freeman.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, 8(2), 5-21.

Bureau of Labor Statistics, U.S. Department of Labor (2014). *Occupational Employment Statistics*, Retrieved from <http://www.bls.gov/oes/current/oes131151.htm>

Choi, I., & Lee, K. (2009). Designing and implementing a case-based learning environment for enhancing ill-structured problem solving: Classroom management problems for prospective teachers. *Educational Technology Research and Development*, 57(1), 99-129.

Clark, K., & Smith, R. (2008). Unleashing the power of design thinking. *Design Management Review*, 19(3), 8-15.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. California: Sage Publications.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, Calif: Sage Publications.

Cross, N. (2004). Expertise in design: An overview. *Design Studies*, 25(5), 427-441.
doi:10.1016/j.destud.2004.06.002

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Cross, N. (2007). From a design science to a design discipline: Understanding designerly ways of knowing and thinking. In Michel R. (Ed.), *Design research now: Essays and selected projects* (pp. 41-54). Basel: Birkhäuser Basel. doi:10.1007/978-3-7643-8472-2_3

Cross, N. (2011). *Design thinking: Understanding how designers think and work*. Oxford; New York: Berg.

Cuban, L. (2001). *How Can I fix it?: Finding Solutions and Managing Dilemmas : An educator's road map*. New York: Teachers College Press.

Dorst, K. (2011). The core of 'design thinking' and its application. *Design Studies*, 32(6), 521-532. doi:10.1016/j.destud.2011.07.006

Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem-solution. *Design Studies*, 22, 425-437.

Duncker, K. (1972). *On Problem Solving*. Westport, Conn: Greenwood Press.

Finn Connell, S. E. (2013). *Exploring operational practices and archetypes of design thinking* (Doctoral dissertation). Retrieved from ProQuest. (UMI Dissertations Publishing)

Frensch, P. A., & Funke, J. (1995). Definitions, transitions, and a general framework for understanding complex problem solving. In Frensch, P. A., & Funke, J. (Eds). *Complex problem solving: The European perspective*. Hillsdale, N.J: L. Erlbaum Associates.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

- Funke, J. (1995). Experimental research on complex problem solving. In Frensch, P. A., & Funke, J. (Eds). *Complex problem solving: The European perspective*. Hillsdale, N.J: L. Erlbaum Associates.
- Gick, M. L. (1986). Problem-solving strategies. *Educational Psychologist*, 21(1&2), 99-120.
- Goel, V. & Pirolli, P. (1992). The structure of design problem spaces. *Cognitive Science*, 16, 395-429.
- Greeno (1978). Natures of problem solving. In W. K. Estes (Ed.), *Handbook of Learning and Cognitive Processes*. Volume 5: Human Information processing John Wiley & Sons, Inc
- Hayes, J. R. (1981). *The Complete Problem Solver*. Franklin Institute Press.
- Henderson, K. B. & Pingry, R. E. (1953). Problem solving in mathematics. In H. F. Fehr (Ed.), *The learning of mathematics: Its theory and practice (21st Yearbook of the National Council of Teachers of Mathematics)* (pp. 228-270). Washington, DC: National Council of Teachers of Mathematics.
- Heskett, J. (2005). *Design: A Very Short Introduction*. Oxford: Oxford University Press.
- Johansson-Sköldberg, U., Woodilla, J., Çetinkaya, M., (2013). Design thinking: Past, present and possible futures. *Creativity and Innovation Management*, 22(2), 121-146. doi:10.1111/caim.12023

Design Thinking Across Different Design Disciplines: A Qualitative Approach

- Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational Technology Research and Development*, 48(4), 63-85. doi: 10.1007/BF02300500
- Jonassen, D. H. (2004). *Learning to Solve Problems: An Instructional Design Guide*. San Francisco, CA: Pfeiffer.
- Jonassen, D.H. (1997). Instructional design model for well-structured and ill-structured problem-solving learning outcomes. *Educational Technology: Research and Development*, 45 (1), 65-95.
- Julian, M. F., Kinzie, M. B., & Larsen, V. A. (2000). Compelling case experiences; performance, practice, and application for emerging instructional designers. *Performance Improvement Quarterly*, 13(3), 164-201.
- Kimbell, L. (2011). Rethinking design thinking: Part I. *Design and Culture*, 3(3), 285-306. doi:10.2752/175470811X13071166525216
- Kozbelt, A., Beghetto, R. A., & Runco, M. A. (2010). Theories of creativity. In Kaufman, J. C., & Sternberg, R. J. (Eds.), *The cambridge handbook of creativity* (pp. 20-47). New York: Cambridge University Press.
- Krems, F. J. (1995). Cognitive flexibility and complex problem solving. In Frensch, P. A., & Funke, J. (Eds). *Complex problem solving: The European perspective*. Hillsdale, N.J: L. Erlbaum Associates.
- Kruger, C., & Cross, N. (2006). Solution driven versus problem driven design: Strategies and outcomes. *Design Studies*, 27(5), 527-548. doi:10.1016/j.destud.2006.01.001

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Larson, M. B. (2005). Instructional design career environments: Survey of the alignment of preparation and practice. *TechTrends*, 49(6), 22-32.

Lawson, B. (2004). *What designers know*. Burlington, MA; Oxford [England]: Elsevier/Architectural Press.

Lawson, B. (2006). *How designers think: The design process demystified*. Oxford; Burlington, MA: Elsevier/Architectural.

Liu, Y. (1996). Is designing one search or two? A model of design thinking involving symbolism and connectionism. *Design Studies*, 17(4), 435-449.

doi:10.1016/S0142-694X(96)00018-X

Mann, C., & Stewart, F. (2000). *Internet communication and qualitative research: A handbook for researching online*. Retrieved from <http://srmo.sagepub.com/view/internet-communication-and-qualitative-research/SAGE.xml>.

Marcus, G. H. (2002). *What is design today?*. New York: Harry N. Abrams.

Marks, T., & Porter, M. (2009). *Good design: Deconstructing Form and Function, and What Makes Good Design Work*. Beverly, Mass: Rockport Publishers.

Mayer, E. M. (1983). *Thinking, Problem Solving, Cognition*. San Francisco: W. H. Freeman and Company.

McAlpine, L., & Weston, C. (2000). Reflection: Issues related to improving professors' teaching and students' learning. *Instructional Science*, 28(5), 363–385.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco: Jossey-Bass.

Nelson, H. G., & Stolterman, E. (2012). *The design way: Intentional change in an unpredictable world* (2nd ed.). Cambridge: MIT Press.

Newell, A., & Simon, H. A. (1972). *Human Problem Solving*. Englewood Cliffs, N.J.: Prentice-Hall.

Novick, L. R., & Bassok, M. (2005). Problem solving. In Holyoak, K. J., & Morrison, R. G., Jr. (Eds.), *The Cambridge Handbook of Thinking and Reasoning*. New York: Cambridge University Press.

O'Connor, H., Mage, C., Shaw, R., & Wellens, J. (2012). Internet-based interviewing. In N. Fielding, R. M. Lee, & G. Blank (Eds.), *The SAGE handbook of online research methods*. (pp. 271-290). London: SAGE Publications.

Owen, C. (2007). Design thinking: Notes on its nature and use. *Design Research Quarterly*, 2(1), 16-27.

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, Calif: Sage Publications.

Plucker, A. J., & Makel, M. C. (2010). Assessment of creativity. In Kaufman, J. C., & Sternberg, R. J. (Eds.), *The cambridge handbook of creativity* (pp. 48-73). New York: Cambridge University Press.

Polya, G. (1948). *How to Solve It*. Princeton New Jersey: University Press.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

- Razzouk, R., & Shute, V. (2012). What is design thinking and why is it important? *Review of Educational Research*, 82(3), 330-348.
- Reitman, W. R. (1965). *Cognition and Thought: An Information-Processing Approach*. New York: Wiley.
- Rith, C., & Dubberly, H. (2007). Why horst W. J. rittel matters. *Design Issues*, 23(1), 72-91. doi:10.1162/desi.2007.23.1.72
- Rittel, H. W. (1987). *The reasoning of designers*. Montreal: IGP.
- Rittel, H. W. J., & Webber, M. (1973) Dilemmas in a General Theory of Planning *Policy Sciences* Vol 4, pp. 155–169
- Rossman, G. B., & Rallis, S. F. (2003). *Learning in the field: An introduction to qualitative research*. Thousand Oaks, Calif: Sage Publications.
- Rowe, P. G. (1987). *Design thinking*. Cambridge, Mass: MIT Press.
- Rowland, G. (1993). Designing and instructional design. *Educational Technology Research and Development*, 41(1), 79-91. doi:10.1007/BF02297094
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- Simon, H. A. (1996). *The sciences of the artificial* (3rd ed.). Cambridge, MA: MIT Press.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

- Sinnott, J. D. (1989). A model for solution of ill-structured problems: Implications for everyday and abstract problem solving. In J. D. Sinnott (Ed.), *Everyday problem solving: Theory and applications* (pp. 72–99). New York: Praeger
- Sternbers, R. J., & Kaufman, J. C. (2010). Constraints on creativity. In Kaufman, J. C., & Sternberg, R. J. (Eds.), *The cambridge handbook of creativity* (pp. 467-482). New York: Cambridge University Press.
- Tracey, M. W., & Boling, E. (2013). Preparing instructional designers and educational technologists: Traditional and emerging perspectives. In M. Spector, D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (4th ed., pp. 653–660). New York: Springer.
- Tracey, M. W., Hutchinson, A., & Grzebyk, T. Q. (2014). Instructional designers as reflective practitioners: Developing professional identity through reflection. *Educational Technology Research and Development*, 62(3), 315-334.
doi:10.1007/s11423-014-9334-9
- Verstegen, D., Barnard, Y., & Pilot, A. (2008). Instructional design by novice designers: Two empirical studies. *Journal of Interactive Learning Research*, 19(2), 351-383.
- Villachica, S. W., Marker, A., & Taylor, K. (2010). But what do they really expect? Employer perceptions of the skills of entry-level instructional designers. *Performance Improvement Quarterly*, 22(4), 33-51.
- Visser, W. (2006). *The cognitive artifacts of designing*. New Jersey: Lawrence Erlbaum.

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Voss, J. F. (1988). Problem solving and reasoning in ill-structured domains. In C. Antaki (Ed.), *Analyzing everyday explanation: A casebook of methods* (pp. 74–93).

London: SAGE Publication.

Appendix A: IRB Approval



Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website <http://www.irb.vt.edu>

MEMORANDUM

DATE: October 12, 2016
TO: John K Burton, Zeynep Ondin
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires January 29, 2021)
PROTOCOL TITLE: Design Thinking Across Different Design Disciplines: A Qualitative Approach study
IRB NUMBER: 16-911

Effective October 12, 2016, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at: <http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 5,6,7**
Protocol Approval Date: **October 12, 2016**
Protocol Expiration Date: **October 11, 2017**
Continuing Review Due Date*: **September 27, 2017**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

Design Thinking Across Different Design Disciplines: A Qualitative Approach

IRB Number 16-911

page 2 of 2

Virginia Tech Institutional Review Board

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

Appendix B: Interview Protocol

Interview Protocol for the Design Thinking Across Different Design Disciplines: A Qualitative Approach study

Interviewer: _____

Participant pseudonym: _____

Time: _____

Date: _____

Consent form

The participant has received an electronic copy of the consent form and signed it before scheduling the interview.

Introduction

Overview of project: I am conducting a research study entitled “Design Thinking Across Different Design Disciplines: A Qualitative Approach”. The purpose of this study is to explore the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and design activities proposed by the design thinking approach. You are one of the nine participants in this study and I will ask questions about your background and design process and challenges you face during designing.

Begin audio recording

- Ask the participant if he or she has any questions before the interview commences.
- Inform the participant that the study will begin when starting the recording.

Begin with Interview Questions:

Background Questions

- What is your age?
- What is your education level?
- Can you tell me what is your profession?
- Can you tell me what you design?
- How long have you been involved with design?
- Can you tell me how you are involved in design?
 - Do you have formal design training?
- Do you use software while designing?
 - If so which software?

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Design Process and Challenges Questions

- *Can you describe your design process in as much detail as possible?*
 - Walk me through the way you solve a design problem.
 - Where does your design process begin?
 - Where does your design process end?
- Is your design process similar across different design problems/ projects or specific to the individual design problems/projects?
 - How so?
- What are some of the major challenges you face with designing?
 - Could you tell me an example of a memorable challenge you have encountered?
 - How do you overcome these challenges?

Ideal Position Question

- How do you define a good design?
 - How do you know you got it?
 - How do you know it is finished?
 - How do you know you have designed something that is good?

Opinion and Values Questions

- What is your definition of design?
- What does being a designer mean to you?
- What does design thinking mean to you?

Stop recording and thank the participant for participating.

Appendix C: Consent Form

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Informed Consent for Participants
in Research Projects Involving Human Subjects

Title of Project: Design Thinking Across Different Design Disciplines: A Qualitative Approach

Investigator(s): Dr. John Burton
Email: jburton@vt.edu Phone: 540-231-7020

Zeynep Ondin
Email: zeynep@vt.edu Phone: 540-642-9049

I. Purpose of this Research Project

The purpose of this interview study is to explore the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and design activities proposed by the design thinking approach. The study aims to articulate design strategies of experts in the field from different disciplines in relation to the activities proposed by the design thinking. Interview data will be collected from a purposeful sample of nine designers. Nine designers from instructional design, fashion design, and game design with at least 5 years of experience in designing will be included in the study. Results will be used for a dissertation of the researcher.

II. Procedures

If you agree to participate, you will be asked to participate in a 60-minute audio-recorded interview that will be conducted online. Interview will be scheduled at your convenience and Skype video conferencing software will be used. The interview will include questions about your background and design process and challenges you face during designing. The Skype session will be audio-recorded with your permission. This recording is required to participate in the study. Please note that the audio is only for analysis purposes and your confidentiality will be strictly protected. After the interview, you will get an email from the researcher including the transcript of your interview. You will be allowed to make changes or revisions to this document if you choose so. After sending your revisions, the study will be completed.

III. Risks

Participation in this project does not place you at more than minimal risk of harm. Risks to participants are no greater than the risks associated with normal conversation and using a computer. In addition, you have the right to withdraw from participation at any time by notifying the researcher.

IV. Benefits

There are no direct benefits to you for participation in this study. No promise or guarantee of benefits has been made to encourage you to participate.

V. Extent of Anonymity and Confidentiality

The results of this study will be kept strictly confidential. No one outside the research team will be able to connect any data with your name. The information you provide will have your name removed and only a pseudo name will identify you during analyses and any written reports of the research. No reference will be made in oral or written reports that could link you to the data nor will you ever be identified as a participant in the project. At no time will the researchers release identifiable results of the study to anyone other than individuals working on the project without your written consent. An audio recording will be made of the interview session and will be kept in a secure place where only researchers will have access to them. Zeynep Ondin will transcribe the recordings. Audio recordings will be destroyed after 5 years of the completion of the study.

The Virginia Tech (VT) Institutional Review Board (IRB) may view the study's data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.

VI. Compensation

Your participation is voluntary. There will be no compensation for your participation.

VII. Freedom to Withdraw

It is important for you to know that you are free to withdraw from this study at any time without penalty. You are free not to answer any questions that you choose or respond to what is being asked of you without penalty.

Please note that there may be circumstances under which the investigator may determine that a subject should not continue as a subject.

Should you withdraw or otherwise discontinue participation, you will be compensated for the portion of the project completed in accordance with the Compensation section of this document.

VIII. Questions or Concerns

Should you have any questions about this study, you may contact one of the research investigators whose contact information is included at the beginning of this document.

Should you have any questions or concerns about the study's conduct or your rights as a research subject, or need to report a research-related injury or event, you may contact the VT IRB Chair, Dr. David M. Moore at moored@vt.edu or (540) 231-4991.

IX. Subject's Consent

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

Date: _____

Subject printed name: _____

(Note: each subject must be provided a copy of this form. In addition, the IRB office may stamp its approval on the consent document(s) you submit and return the stamped version to you for use in consenting subjects; therefore, ensure each consent document you submit is ready to be read and signed by subjects.)

Appendix D: Recruitment Letter

Hello,

My name is Zeynep Ondin and I am a Ph.D. candidate at Virginia Tech. I am conducting a research entitled “Design Thinking Across Different Design Disciplines: A Qualitative Approach”. The purpose of his study is to explore the design process of professionals from different design disciplines, in order to understand the similarities and differences between their process and design activities proposed by the design thinking approach. To this end I am looking for individuals to participate in my study.

If you agree to be in this study, I will conduct 60-minute online interview with you. The interview will be conducted at your convenience. The interview will include questions about your design process and challenges you face during designing. The interview will take approximately 60 minutes to complete and will be audio-recorded with your permission.

Rest assured that all of your answers will be confidential and I will make sure your name will not be revealed in any report related to this study. The study will conform to the policies regarding human subjects’ research as mandated by the Institutional Review Board of Virginia Tech.

I am looking for individuals:

- Who are practicing designers in one of the following fields:
 - instructional design, fashion design, or game design
- Who have at least five years of experience in designing

I encourage people of all genders and ethnicities to participate. If you are interested in participation in this study, please send me an email at zeynep@vt.edu for further information such as interview scheduling or any additional information that may aid you in making a decision about participating.

Additionally, if you know of other individuals fitting the criteria of joining the study, please forward this email to them. If you would prefer to discuss the study and/or your participation on the telephone, please call Zeynep Ondin (540-642-9049).

Due to the limited timeframe for the study completion, I earnestly hope to hear from you soon!

Sincerely,
Zeynep Ondin
Instructional Design and Technology & Human Centered Design
Virginia Tech
zeynep@vt.edu
540 642 9049

Appendix E: Thank You and Snowballing Email

Dear [participant's name]

I would like to thank you for participating in “Design Thinking Across Different Design Disciplines: A Qualitative Approach” study. You provided me with valuable data. I am writing to ask whether you would be willing to pass along the below email to the designers you know who may also be interested in participating in this study. You are under no obligation to share this information.

Thank you again for your time and consideration.

Sincerely,
Zeynep Ondin
Instructional Design and Technology & Human Centered Design
Virginia Tech
zeynep@vt.edu
540 642 9049

Enclosed- Recruitment Letter

Appendix F: The Summary of the Findings

Participant Pseudonym	Designing for	Collaboration	Software	Design Steps	
				Identifying a Design Idea or Problem	Analysis
Ida	faculty members	always	none	faculty members provide	conducts interviews to see the big picture
Iris	client	always	to develop a storyboard	client provides	conducts interviews to understand the real problem
	herself	never		she picks a topic from her areas of interest	
Ileyda	client	always	to develop a storyboard	client provides	conducts interviews to understand the real problem
	herself	never		she picks a topic from her areas of interest	
Gerry	himself	never	to develop a game	idea or a story he wants to explore	skips this step
	market	always	to develop a game		
Glen	himself	almost always	to develop a game	idea or a story he wants to explore	skips this step
Gerard	client	always	to develop a game	client provides	conducts interviews to understand the real problem
Frida	client	always	to understand the problem and communicate her solution to the client	client provides	does research to understand what the real problem is
	scholarly projects	sometimes		she defines it from a poet or story	
Felix	client	rarely	none	customer provides	conducts interviews to identify budget, customer size, shape
Fiona	market	sometimes	none	she finds a problem from her daily life or people she is collaborating provides the problem	makes observation and does research to understand what the real problem is
	scholarly projects	sometimes			
Consistent with				<i>inspire</i> (IDEO)	<i>empathize, define</i> (d.school) <i>immersion, synthesis</i> (NoTosh)
Inconsistent with					

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Participant Pseudonym	Design Steps			Design Journals
	Proposing Solution(s)	Prototype Test Iterate	The Last Step	
Ida	starts designing the course and the project plan	sometimes gets feedback from target learners after the course is published	keeps improving the course	to-do list to keep track of the project
Iris	starts designing the course	tests the course with the target learners	moves to another project	to-do list to keep track of the project
		tests the course by herself	keeps improving the course	
Ileyda	starts designing the course	tests the storyboard with the target learners	is not allowed to improve the course	
		tests the course by herself	keeps improving the course	
Gerry	starts proposing ways to communicate his game idea	conducts beta and playtest with game players (10-20)	keeps publishing new versions of the game	design journal includes game ideas, and decisions about design elements, characters, and theme
		conducts beta and playtest with game players (less than 10)		
Glen	starts proposing ways to communicate his game idea	conducts beta test with payers he knows and playtest with any player	keeps publishing new versions of the game	design journal game ideas, and decisions about design elements, characters, and theme
Gerard	comes up with a design solution	conducts beta and playtest with game players	keeps publishing new versions of the game	
Frida	proposes several design solutions	tests her design on a testing model	moves to another project	design journal includes design ideas and solutions
Felix	proposes several design solutions	tests his design on customers	keeps improving his design	design journal includes design ideas and solutions
Fiona	proposes several design solutions	tests her design by herself	moves to another project	none
Consistent with	<i>ideate</i> (d.school) (IDEO) (NoTosh)	<i>prototype, test</i> (d.school), <i>ideate</i> (IDEO), <i>prototyping feedback</i> (NoTosh) co-evolution of problem and solution (Dorst & Cross, 2001), iteration (Visser, 2006; Nelson, 2003. Akin, 1979), sketching and modeling (Lawson, 2004, 2006; Cross, 2011)		reflection (Schön, 1983)

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Participant Pseudonym	Challenges	Good Design	Design	Being a Designer Means	Skills a Designer Needs
Ida	faculty members, time	should lead learning	continuous creative process	being service oriented	strong communication skills, consulting skills, ability to be persuasive, project management skills, and time management skills
Iris	SMEs, time, money	should lead learning	transforming a knowledge from one format to another		
Ileyda	stakeholders, time	should lead learning	process of crating something		
Gerry	the first step	should get people to think about the message, statement, and critique	transforming an idea into intractable medium	creating a system that will deliver their message and being aware of its responsibility	
Glen	coding, blank canvas paralysis	should get people to think about the message, statement, and critique	transforming an idea into intractable medium		tolerance ambiguity
Gerard	people he collaborates	mechanics should not interfere with the game play	the process of answering questions about your game	who I am	being able to notice a lot of details
Frida	money, time, people she collaborates with, lack of self-confidence	aesthetic, function, and structure should work together	problem solving	creating meaningful products and solving problems without harming the earth	
Felix	time, customers, working from long distance	it should be timeless and make customers happy	problem solving		
Fiona	seeing a two-dimensional pattern and being able to see that in three-dimensions	should work and people should like to use it	problem solving		

Design Thinking Across Different Design Disciplines: A Qualitative Approach

Consistent with	creative persuasion (Kozbelt et al.; 2010)	design products should be sustainable, appropriate, aesthetic (Owen, 2007)	design as ill-structured problem (Jonassen, 2000; Rittel, as cited in Buchanan, 1992; Cross, 2011; Lawson, 2006)	high awareness, high sensitivity to the changes in their environments, being good at dealing with ambiguity (Lawson, 2004, 2006), environment-centered concern (Owen, 2007)	
Inconsistent with	ability to visualize (Owen, 2007), self-confident Lawson (2004, 2006).				