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UNDERSTANDING INSTRUCTORS' SYNCHRONOUS ONLINE COURSE DESIGN ACTIVITY

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To the Graduate Council:

I am submitting herewith a dissertation written by Jaewoo Do entitled "UNDERSTANDING INSTRUCTORS' SYNCHRONOUS ONLINE COURSE DESIGN ACTIVITY." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

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UNDERSTANDING INSTRUCTORS' SYNCHRONOUS ONLINE

COURSE DESIGN ACTIVITY

A Dissertation Presented for the

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ABSTRACT

I come to this dissertation with my experiences on synchronous courses as a student and an instructional designer. Through these direct experiences I have come to realize the benefits of synchronous online courses as a course delivery format, and observed the difficulties of designing and delivering synchronous online courses. I have come to recognize the limited support of synchronous online course design. Even though there is an increased interest and use of synchronous courses, existing studies on synchronous online courses are limited, and offer little practical support to instructors about synchronous course design. The purpose of this study is to understand synchronous course design activities in order to support instructor's effort to develop their own synchronous courses. To achieve this purpose, this dissertation looks at how five instructors design their synchronous online course with two goals: first, to identify design constraints and second, to capture the design experience and knowledge embodied in the synchronous course design cases. With a multiple case study approach, I collected data though interview, course materials and website resources about course design environments from five instructors. I analyzed the data with constant comparative method and activity system analysis. As a result, this dissertation identified various design constraints that emerged in the overall synchronous online course design process. I identified 48 design constraints and categorized those into eight categories: adaptation of synchronous course formats; converting existing face-to-face courses; instructor (designer) characteristics; learner characteristics; technology; organizational rules; environmental and cultural factors; and physical learning environments. In addition, I wrote five design cases about participants' synchronous course design experiences. Each synchronous course design case includes information about the designer, the design situation, related design strategies, design tensions, and identified solutions to specific tensions.

Specifically, I describe how the design constraints interact with one another and how interactions lead to further design tensions, and instructors' solutions to those tensions. I will present common characteristics of synchronous course design, and implications for both designing synchronous online courses and supporting synchronous online course design at universities.

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CHAPTER ONE

INTRODUCTION

This study is about understanding synchronous online course design activity with the overarching research question, how do instructors design synchronous online courses? I start this dissertation with an introduction of synchronous online course in order to improve understanding on synchronous online course. Based on that, I provide statement of problem with a necessity of investigating synchronous course design activity, the purpose of the study with a research question, and definition of key terms of this study such as a synchronous course, video conferencing tool, a design constraint, a design case, and activity system analysis.

This topic was born from my direct experiences in synchronous online courses. I have taken five synchronous online courses while pursuing a master's degree at the University of Tennessee, Knoxville. Before coming to UT Knoxville, I worked as an instructional designer, and I had the experience of designing asynchronous online courses. By taking these synchronous online courses and comparing my experience designing asynchronous courses, I have found as a student that synchronous courses are more effective and engaging than asynchronous courses. I realized the effectiveness and necessity of synchronous online courses as an online course delivery format. I am currently working as a member of the instructional design unit at UT Knoxville. By performing my role which is supporting instructors' course design, I have met several instructors who are finding difficulties in teaching synchronous course activities. In addition, I also realized that there is only a small amount of literature that provide design resources for synchronous courses. From these experiences, I started to think about how to support instructors' synchronous course design.

The purpose of this study is to understand synchronous course design activities in order to support instructor's effort to develop their own synchronous courses. To address this purpose, I identified design constraints and described them in design cases. Design decisions are influenced by a wide and complex variety of constraints and constraint operations (Jonassen, 2008; Silber, 2007). Though this dissertation, I identified design constraints, systematized them into categories, and compiled a list of design constraints. While providing the list of design constraints, I also wrote design cases for each participant's design activity. Design case is a description of a real artifact and or experience that has been intentionally designed (Boling, 2010, p.2). This design case is a way to disseminate design precedent which is a representation of the knowledge from past design that can be reused in new or similar situations (Boling, 2010, Flemming & Aygen, 2001). Each design case I wrote includes descriptions of designers, situations, problems, decisions, and the rationales of synchronous course designs and instructors' experiences and reflections.

I chose a multiple case study as my methodology. A multiple case study has allowed me to capture rich and authentic descriptive contexts of synchronous course design and to examine in-depth instructors' design experiences. I collected the synchronous course design experiences of five instructors and analyzed them. For data analysis, I used constant comparative method and activity system analysis.

The conceptual framework of this study draws from design thinking and social constructivism. This study views synchronous online course design as a wicked problem which is complex and ill-defined. With this view, I focus on instructor's design thinking which is a meaningful approach to address wicked problems. I assume that instructor's design thinking is embedded in instructors' design strategies and solutions what they develop to handle their design

constraints and tensions. In terms of understanding online learning, social constructivism serves as the theoretical framework, and it also serves as lens for understanding human activities.

Background of Study

Online learning became a viable mode of teaching and learning and a substantial supplement to traditional teaching (Palloff & Pratt, 2009, Yamagata-Lynch, 2014). According to U.S. News Education (2018), there are 357 schools that provide online bachelor's degree programs in the U.S. There are two types of online course format: an asynchronous online course and a synchronous online course. An asynchronous online course can be defined as an online course that is facilitated by communication media, such as email and discussion boards, and that supports work relations among learners and with teachers even when participants are not online at the same time (Hrastinski, 2008, p.51). A synchronous online course can be defined as an online course supported by communication media such as videoconferencing and chat (Hrastinski, 2008, p.51). A key characteristic of synchronous courses is real-time communication and interaction through a video conferencing tool (Benshoff & Gibbons, 2011; Butz, Stupnisky, Peterson, & Majerus, 2014; Hrastinski, 2008). In synchronous courses, all participants are logged on video conferencing platform at the same time and communicate directly with each other (Shi & Morrow, 2006; Redmond, Parkinson, Mullally, & Dolan, 2007). In other words, synchronous online courses are place-independent, but not time-independent.

The most common form of online course has asynchronous format (Butz & Stupnisky, 2016; Gibson, 2011; Yamagata-Lynch, 2014). Flexibility and convenience of asynchronous courses have contributed to the popularity of asynchronous courses in online learning (Ching-Wen, Hurst, McLean, 2015). As compared with asynchronous courses, synchronous courses

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have received much less attention due to various limitations such as high costs, bandwidth limitations, the difficulty of implementation, insufficient tools, and scheduling issues (Anderson, 2003; Branon & Essex, 2001; Lowenthal, Dunlap & Snelson, 2017; Park & Bonk, 2007).

Over the years, by implementing asynchronous online courses, educators and researchers have found several limitations of asynchronous courses such as the isolation students feel, delayed feedback, barriers to interpretation and the lack of bodily communication (Derks, Bos, & Von Grumbkow, 2007; El Mansour & Mupinga, 2007; Bolliger, Supanakorn, & Boggs, 2010). In asynchronous learning environments, learners are likely to report feelings of isolation because of the limited opportunities for social interaction (Cunningham, 2014). A lack of shared context, body language or writing style can lead to an interpretation of written text not intended by both instructors and students (Howard, 2012). This miscommunication may reduce a learner's connectivity and sense of belonging (Giesbers, Rienties, Gijselaers, Segers, & Tempelaar, 2009; Hara & Kling, 2001). Given these limitations of asynchronous course, online instructors have begun to show interest in using synchronous course elements in their class (Levin, He, & Robbins, 2006).

Synchronous courses have several advantages over an asynchronous course such as immediate feedback, immediate interactive clarification of meaning, high motivation, more engagement, a greater sense of presence and the obligation to be present and participate (Hastie, Chen, & Kuo, 2007; Hines & Pearl, 2004; Martin & Parker, 2014; Ng, 2007; Rienties, Tempelaar, & Gijselaers, 2013; Skylar, 2009). Researchers argue that synchronous online instruction allows students to enjoy the benefits of both face-to-face and online courses (Bower, Dalgarno, Kennedy, Lee, & Kenney, 2015; Romero-Hall & Vicentini, 2017). Students can attend class at their convenient place while also enjoying social interactions, immediate feedback, and

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intensive learning activities. With this understanding of the limitations of asynchronous courses and strengths of synchronous courses, a number of researchers and practitioners have started including one or two synchronous sessions as course activities in online courses with primarily asynchronous instructional delivery (Chen & Jones, 2007; Gibson, 2011; Hughes, 2007; Lowenthal, Snelson, & Dunlap, 2017; Roseth, Akcaoglu, & Zellner, 2013).

Recently, the increasing bandwidth of the Internet and improvements in information and communication technologies have made synchronous online instructional delivery more popular and effective (Martin & Parker, 2014; Olson & McCracken, 2015). Increased interest in synchronous courses have motivated the development of various video conferencing tools such as Zoom, Ultra, and Acrobat Connect. There is evidence of an emerging instructor preference toward synchronous online courses (Ahmad & Bokhari, 2011). The number of university programs that deliver online synchronous course is increasing (Bell, Sawaya, & Cain, 2014; Butz, Stupnisky, Peterson, & Majerus, 2014). Through a conversation with a course delivery team member who is in charge of video conferencing tool training in UT Knoxville, I found that UT Knoxville has more than 40 courses that are designed with synchronous online course delivery format. It is still a small number compared to the whole number of courses in this university. However, the course delivery team member said the number of synchronous online courses continue to increase.

The instructional technology program at the UT Knoxville has a fully online masters' program of all synchronous online courses, of which I have taken five courses. This program has been providing synchronous online courses since 2012. Before coming to the UT Knoxville, I worked as an instructional designer, and I had the experience of designing asynchronous online courses. By taking these synchronous online courses and comparing my experience designing

asynchronous courses, I have found synchronous courses to be more effective and engaging. For example, when I designed asynchronous online courses, I worried about the limitations of asynchronous online courses that many studies have pointed out such as lack of interaction, delayed feedback, feelings of isolation among students. However, in a synchronous online course I was able to interact with my peers and instructors actively, I received prompt responses, and by seeing my instructors face and hearing their voice in real-time, it felt as though I was in a classroom. By taking these synchronous online courses, I, among others in my field, realized the effectiveness and necessity of synchronous online courses as an online course delivery format. By coming to this realization and choosing to engage in this study, I am aware that I have a perception that synchronous online courses can be designed and delivered effectively, even though there is still only a small amount of literature that agrees with this point of view.

Statement of the Problem

There is a demand among instructors and students for synchronous courses because of the unique merits related to educational effectiveness (Bower et al., 2015; Coy, Marino, & Serianni, 2014; Lowenthal, Dunlap & Snelson, 2017; Romero-Hall & Vicentini, 2017). Through a review of university information, I found that more than 50 universities in the U.S. are using video conferencing tools for synchronous online course sessions. UT Knoxville is one of the universities that adopted synchronous online course delivery format.

Instructors need to approach synchronous courses design differently than when designing asynchronous courses and face-to-face courses (Bower et al., 2013; Melkun, 2012; Olson & McCracken, 2015; Piskurich, 2004). For example, when instructors design synchronous courses, they must prepare a lot of activity over a small amount of time where everyone can interact. This

is because synchronous online courses are full of real-time interactions between the students and instructors (Butz et al., 2014). There are differences in learner behavior, use of tools, delivery of learning contents, design of learning activities, roles of instructors, and instructional strategies between asynchronous courses and synchronous courses (Earnshaw, 2017; Lowenthal, Dunlap & Snelson, 2017; Romero-Hall & Vicentini, 2017). These differences will serve as a great obstacle to the application of synchronous courses to instructors and require online researchers to investigate new instructional design strategies for synchronous online courses.

Furthermore, designing synchronous online course is a wicked problem which is ill-defined, and complex that cannot be solved by existing rational systematic processes. Designing synchronous courses is a type of wicked problem because it is a course format that integrates technology into teaching practices. Researchers have asserted that integrating technology into teaching practice is difficult due to technology attributes, instructors' personal beliefs, social and the institutional contexts in which instructors work, and opportunities inherent in new tools (Koehler & Mishra, 2009; Tsai & Chai, 2012; Zhao, Pugh, Sheldon, & Byers, 2002). Each technology has its own propensities, biases, affordances and constraints (Ertmer, 1999, 2005; Howard, 2012; Mishra & Koehler, 2007). These inherent attributes make it difficult for instructors to apply them in their course design. Mishra and Koehler (2007) maintain that integrating technology into teaching practice is a complex and ill-structured problem. They actually cite teaching with technology as a "wicked problem." Synchronous course design can be regarded as a wicked problem because it is a design activity related to instructional design work which is ill-defined (Jonassen, 2011, Yamagata-Lynch, 2014).

As a member of instructional design and training team at UT Knoxville, I have met instructors who were experiencing difficulties from designing and delivering synchronous

courses without the necessary training and the experience of having taken online synchronous courses themselves. They faced many complex problems in teaching synchronous online course such as promoting students' participation, managing various communication channels, scheduling, and using synchronous teaching tools. Those difficulties are different from the difficulties that they face in either face-to-face or asynchronous online courses. Therefore, they asked for practical support for teaching synchronous online courses.

However, there is limited recourse related how to design and deliver these courses. Most previous studies of online learning examine strictly asynchronous online course delivery (Oyarzun & Martin, 2013; Shea & Bidjerano, 2009; Szeto, 2015). With increased interest and use of synchronous courses, researchers have started to conduct studies on synchronous online course delivery. In 2017, Martin, Ahlgrim-Delzell and Budhrani conducted a systematic review of research on synchronous online learning from 1995 to 2014. They analyzed 157 articles that met their screening criteria (e.g. articles that referred to use any synchronous online technology and were published in peer-reviewed journals). They found that the most common independent variable in the 157 articles was the "synchronous tools" (n=109), and the most common dependent variable was "perception and attitude" (n=96) followed by "interaction" (n=71) (Martin, Ahlgrim-Delzell & Budhrani, 2017). As this study shows, most of the existing studies on synchronous courses focus on the students' perception and attitude on synchronous courses and introduces a specific synchronous courses or tools. Existing studies advocate a synchronous course as a possible way to deliver online courses. However, these studies are too abstract to offer potential instructors practical strategies about how to design synchronous online courses.

Recently, several researchers have begun to discuss instructional strategies for successful design and implementation of synchronous courses in peer reviewed articles (Bower et al., 2013,

2015; Butz & Stupnisky, 2016; Chen et al., 2015; Szeto & Cheng, 2016; Tabak & Rampol, 2014). However, these studies have common limitations. First, they tend to investigate synchronous online sessions within asynchronous online courses instead of online courses mainly designed for the synchronous format. Second, they investigate specific design tasks in synchronous course design such as how to build a learning community and how to promote interactions instead of the taking a comprehensive view of course design. Third, it is difficult to find studies about instructors' experiences.

Specifically, it was difficult to find a study that investigates instructors' synchronous course design processes with in-depth explanations of design decisions, design challenges, and reflection on design processes. In most studies, the authors would introduce their own courses and then show the finished product without explaining their design process. Particularly, investigating design process was not a famous research topic in the field of instructional technology due to the characteristics of the field. Generally, many studies on instructional design (ID) have explained their design process by mentioning a specific instruction system model (e.g. ADDIE model, Dick & Carey model) that are consisted of specific design steps instead of explaining those process with their experiences. There was no explanation of why they made certain design decisions, what difficulties they faced during design process, how they handled difficulties, or what factors affected course design. About this limitation, there is now a movement of people in ID who want to hear about design processes. Boling (2010) emphasize the importance of understanding design process in instructional design by pointing out limited approach to design process. Yamagata-Lynch and Paulus (2015) share their online course design experiences that how the first author made design decisions about a course within the context of shared design intentions for the program. But yet, it was difficult to find research that discuss

instructors' design processes in online course design. There is a gap between interest and insight of teaching synchronous online courses (Bower et al., 2015; Hewett, 2006; Lowenthal, Dunlap & Snelson, 2017).

Purpose of Study

The purpose of this study is to understand synchronous course design activities in order to support instructor's effort to develop their own synchronous courses. To address this purpose, I investigated experienced instructors' synchronous course design activities with two goals: first, to identify design constraints and second, to capture the design experience and knowledge embodied in the synchronous course design cases.

First, I identify a wide variety of design constraints that emerged during the design process of synchronous courses. Understanding design constraints is an important task in preparing for design because instructors can make appropriate design decisions based on the constraints in their design situations (Jonassen, 2008). Existing studies of design have emphasized the importance of identifying design constraints for design (Cross, 1982; Dorst, 2015; Gross, 1986; Jonassen, 2008; Silber, 2007). Gross (1986) defines constraints as "the formal and informal rules, requirements, conventions, and principles in the design space" (10). He explains that the design process is about exploring constraints and finding solutions to each set of them. Silber (2007) states that design constraints should be examined because design decisions are influenced by a wide and complex variety of constraints and constraint operations in design spaces. Jonassen (2008) introduces seven types of design constraints in instructional design by explaining how they affect an instructor's design decisions. These studies explain the importance of identifying design constraints for making design decisions. By checking design

constraints in synchronous courses, instructors who will teach synchronous online courses can improve their understanding of synchronous courses and prepare their course design better because they will be able to anticipate the possible design constraints in their course design.

Second, this study chronicles five experienced instructors' synchronous course design stories and captures the knowledge embodied in their complex design decisions, the sum of which are known as design cases. A design case is a description of a real artifact or experience that has been intentionally designed (Boling, 2010, p.2). Particular design knowledge is embedded in design cases, and that type of design knowledge is called design precedent. Design precedent introduced in design cases is a critical form of design knowledge comprised of a designer's awareness, experiences, and decisions regarding existing designs (Boling & Gary, 2017; Nelson & Stolerman, 2012). It is knowledge from past designs that can be reused in new or similar situations (Flemming & Aygen, 2001). By writing design cases focusing on design precedent, I can support the readers' understanding of the participants' synchronous course design activities and help them become aware of design precedents. This in turn can be used in their own future decision-making processes.

For example, Yamagata-Lynch (2014) shares her teaching experiences and student reflections from her synchronous online course by adapting a design case. She said, "I framed the reporting of this study following the traditions of design case studies where the goal is to build design knowledge based on precedents" (190). I, as a reader, was able to understand what synchronous online courses are and develop ideas for solutions to possible issues in teaching synchronous online courses by reading her article. Despite these meaningful roles of design cases in instructional design, there is limited discussion of the creation and use of design case in this area (Smith & Boling, 2009).

To identify design constraints in synchronous course design and write design cases, this study investigated instructors' experiences and views related to synchronous courses. In this process, I examined each instructor's design situations including context and culture, design constraints, design strategies, design problems, solution to those problems, and reflections on their design activity. I explored instructors' synchronous design activity with one broad research question: how do instructors design synchronous online courses? With a broad research question, the following sub-questions guided data collection and analysis of this study.

- What are design constraints that affect a synchronous course design?

- What are instructors' design principles and strategies for synchronous course design? And how do they apply those into design process?

- What design problems do instructors face when they design a synchronous course? And what design decisions do instructors make to handle those problems?

- How do instructors' previous design and delivery experiences with synchronous courses affect their design decisions?

To answer the questions above, I chose a multiple case study as my methodology. A multiple case study has allowed me to capture rich and authentic descriptive contexts of synchronous course design and to examine in-depth instructors' design experiences. Specifically, this methodology allows me to 1) identify design constraints in each case, and compare the similarities and differences of identified constraints, 2) identify how contextual and environmental factors affect instructors' course design activities, and 3) write design cases which are description of design experiences based on instructor narratives of their experiences and other sources of data (Baxter & Jack, 2008; Stake, 1995). I investigated five instructors' synchronous course design experiences. Because the instructors' design experiences were the

most important data source for this study, I recruited instructors who had more than 5 years teaching experiences in synchronous courses and were willing to share their design story. This yielded very rich narratives.

Definition of Terms

Synchronous online course. A synchronous online course as an online course format in which planned learning events take place in real-time between a remote instructor and geographically dispersed students by means of video conferencing tools. In a synchronous online course, course participants including the instructor and students interact and communicate with each other in real-time through text, audio-, and/or video-based communication of two-way media by using a video conferencing tool (Redmond et al., 2007).

Video conferencing tool. Video conferencing tool is a platform that allows users in different locations to have face-to-face meetings together. Video conferencing tool is commonly included following functions: Voice Over Internet Protocol (VOIP), synchronized Web and shared browser, interactive whiteboards, 2D/3D chat tools, two-way audio and video conferencing, application sharing, presentation slide facility, polling and feedback tools, and group break out rooms (Butz & Stupnisky, 2016).

Asynchronous online course. An asynchronous online course is as an online course format in which instructor and students are participating in learning activities that do not require participants to be online at the same time and same place (Hrastinski, 2008). Course participants communicate with each other through asynchronous communication tools such as email and discussion boards.

Wicked problem. Wicked problems are a class of social systems problems with a fundamental indeterminacy without a single solution and where much creativity is needed to choose a course of action (as cited in Buchanan, 1992). This study refers wicked problems as ill-defined, complex and high-level problem that cannot be solved by existing rational systematic processes (Whelton & Ballard, 2002). This study regards synchronous course design is a wicked problem because synchronous online course design is a type of instructional design works which is ill-defined and complex problem (Jonassen, 2011, Yamagata-Lynch, 2014) and is a course format that integrates technology into teaching practices (Ertmer, 1999, 2005; Mishra & Koehler, 2007).

Design thinking. Design thinking is a creative process to solve complex problems and find desirable solutions by reframing the problems (Cross, 2011; Dorst, 2015). Design thinking is a meaningful approach when addressing wicked problems (Buchanan, 1992; Owen, 2007; Rittel & Webber, 1973). In this study, design thinking is defined as the instructors' design decisions what they made to address design constraints and tensions which are design problems in their synchronous online design process. To handle design constraints and tensions, the instructors developed their own adequate solutions by integrating their experiences, knowledge, and skills. This problem-solving process is design thinking, and it can be represented as design decisions.

Design constraints. Design constraints are defined as the formal and informal "rules, requirements, conventions, and principles that define the context of learning" (Gross, 1986, p.10). In other words, design constraints are design limitations that affect an instructor's design decisions. In this study, design constraints of a synchronous course represent the various constraints that emerge in the design process and affect the instructor's synchronous course

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design activity. These include imposed limitations that instructors can't control as well as limitations that are self-imposed as a way to improve course design.

In this study, I have viewed design constraints in three ways. First, they were design limitations that needed to be addressed when instructor made design decisions. Second, they were design problems as themselves. Some of them acted as simple design problems that required an instructor's design solutions. And last, they were factors that created complex and tricky design problems which acted as design tensions. In synchronous course design, some different and contradictory design constraints created design tensions by interacting and/or conflicting with each other.

Design tension. In this study, design tensions are high-level design problems which are difficult and complex as well as unpredictable. In other words, they can be understood as wicked problems. They are created by the interaction of contradictory design constraints. The inherent constraints of design clash with each other, thus creating design tensions. These tensions are typically higher-level problems too complex to solve with simple solutions.

Design consideration. Design considerations are factors that need to be anticipated in regard to design as well as factors that might affect decisions made by the designer. Design considerations are not limitations like design constraints but rather things which simply add design tasks or factors that create design tensions by interacting with other design constraints and considerations.

Design decision. Design decisions refer to decisions made by instructors to handle various design constraints and design tensions. Course design includes numerous design decisions regarding structure, elements, assignments, assessments, and teaching strategies. These are essentially design tasks in the course design. However, in this study, the concept of design

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decisions focuses on decisions regarding design problem-solving instead of decisions regarding design tasks. Design decisions are based on various constraints and constraint operations in the design (Jonassen, 2008, p.23). With this claim, in this study, design decisions included instructors' design strategies to handle various design constraints as well as their solutions to address design tensions.

Design case. A design case is a description of a real artifact or experience that has been intentionally designed (Boling, 2010, p.2). In this study, design cases for synchronous course design take the form of narratives that include descriptions of designers, situations, problems, decisions, and the rationales of synchronous course designs and instructors' experiences and reflections. In this dissertation, I regard the design cases of synchronous online courses as a method that improves the understanding on design activities and authentic design recourses for synchronous online courses. This is a key outcome of this dissertation. Design cases embed particular design knowledge which is referred to as design precedent.

Design precedent. Design precedent introduced in design cases is a critical form of design knowledge comprised of a designer's awareness, experiences, and decisions in reference to existing designs (Boling & Gary, 2017; Nelson & Stolerman, 2012). Design precedent can be reused in new or similar situations as a representation of knowledge from past designs (Flemming & Aygen, 2001). Specifically, designers can use precedent in their current designs either by choosing to make similar design decisions, avoiding poor decisions that were made by others, or choosing alternative options. In this study, design precedent has captured design knowledge embodied in instructors' complex design decisions and their rationale regarding synchronous course design.

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Learning management system. Learning management system (LMS) is a web-based software application for the administration, documentation, tracking, reporting, managing and delivery of online courses (Ellis, 2009, p.1). Most colleges and universities use various LMSs to deliver online courses. LMS act as an online classroom for online courses.

Activity system analysis. Activity systems analysis is an analysis method that originated from Cultural Historical Activity Theory (CHAT). This analysis method supports researchers to identify how the individual and the context affect one another and understand human activity situated in a collective context (Yamagata-Lynch, & Haudenschild, 2009). An activity system consists of the following components: subject, tool, object, rules, community, division of labor, and outcome (Engeström, 1987). The interactions among the components cause tensions that are inherent in human activities. Tensions can hamper or assist in the attainment of the object as a facilitator or an obstacle to human activity (Yamagata-Lynch, 2003). To understand activity, researchers identify components of activity and tensions between components, and represent identified components and tensions as a triangular model which is called an activity system. This study used activity system analysis as an analysis method.

Affordance. Affordances are the perceived and actual properties of a thing, primarily those fundamental properties that determine just how the thing could possibly be used (Norman, 1988, p. 9). In other words, an affordance is an object's possible uses by a user to achieve an objective. Studies have presented and highlighted the various benefits of synchronous courses. The identified benefits are affordances of synchronous online course. When instructors include synchronous sessions in their online course, they have perceived uses of those sessions which are affordances of synchronous courses. Affordances of synchronous online course are including developing a sense of community, creating social, cognitive, and teaching presences, promoting

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interactions, enhancing engagement, providing immediate feedback, increasing motivation, expressing opinions and emotions, and applying various teaching strategies.

Limitations

This study examined instructors' experiences with synchronous online course design. To gain a good understanding of the design experience, this study recruited five participants who had experience teaching synchronous online courses through purposeful sampling. Thus, this dissertation was limited by this small sample, and caution should be taken to not overgeneralize its contents to a broader population. The goal of this study was not to generalize findings but to share design cases that can be interpreted by readers as fit to their design situations.

In this study, I adapted the multiple case study approach and investigated each course as a separate design case. Finding potential participants was difficult because teaching synchronous online courses is not a common phenomenon in higher education at this time. I used two purposeful sampling strategies that included intensity sampling and chain sampling for participant selection, and with these strategies, I found five participants. However, these participants shared common characteristics as instructors, and those characteristics contributed to creating limitations within this dissertation.

First, among the five participants, four were teaching their synchronous courses in instructional technology programs. Synchronous online instruction is an academic topic in the field of instructional technology, thus most instructors who teach their courses with synchronous online course formats belong to instructional technology programs at this time. This study was not able to investigate synchronous online course design in other subject areas.

Second, in line with the limitations mentioned above, the participants were skewed toward instructors who had academic backgrounds in instructional technology. They had received their doctoral degrees in instructional technology or related fields. Instructional technology is an academic area that investigates instructional design, including online course design, and the use of technology in learning. In addition, they were researchers who had investigated online course design and the use of tools for teaching and learning. And so, all participants recognized the effectiveness of synchronous online courses, were familiar with using tools for teaching, and had a solid knowledge of online course strategies. Due to the skewed population of participants, though, findings did not include design issues related to the instructors' technological proficiency, training for using tools, becoming online instructors, their attitudes toward synchronous online course formats, or any difficulty for addressing technological issues, all of which have been introduced by researchers as potential issues in teaching synchronous online courses (Bower et al., 2015; Butz & Stupnisky, 2016; Piskurich, 2004; Romero-Hall & Vicentini, 2017). This dissertation shares the design stories of positive, skillful, and knowledgeable instructors teaching online courses.

And finally, all participants had at least five years' experience in teaching synchronous online courses. To share design cases of experienced designers' design experiences, I recruited participants who had rich experiences in synchronous course design. During my interviews with each participant, I felt that their teaching experiences have had made them confident and comfortable in designing and teaching synchronous online courses. With several years' teaching experience in synchronous online courses, they each had their own strategies and concrete views regarding synchronous course design and understood the characteristics of their students, institutions, and teaching environments. And with their experience, they mostly shared about

course designs that had reached stable, productive stages. I was able to investigate the design

cases of individuals who were familiar with teaching synchronous online courses, however it was

difficult to identify any particular design issues that a first-time instructor might experience.

In this chapter, I explained the concept and characteristics of a synchronous online

course, the necessity of investigating synchronous course design activity, the purpose of this

study, and defined the key terms and limitations of this study. In the following chapter, I will

discuss the results of the literature review regarding synchronous online course, online course

design, design thinking and social constructivism. Next chapter will provide a better

understanding of those topics which are related to my overall research.

CHAPTER TWO

LITERATURE REVIEW

Literature review includes four topics: synchronous online course, online course design, design thinking for instructional design, and social constructivism. Synchronous online course section includes the concept and affordances of synchronous online courses. Online course design section provides the summary of online course design strategies, and review and limitations of existing studies on synchronous course design. This study considers synchronous course design as a wicked problem that requires instructor to engage in design thinking. I include literature review on social constructivism because social constructivism serves as a theoretical framework for understanding online learning and lens for understanding human activities in this study.

Synchronous Online Courses

Synchronous Online Course

A synchronous online course is a format in which planned learning events take place in real-time between a remote instructor and students by employing video conferencing tools. The video conferencing tools commonly included in such course platforms are Voice over Internet Protocol (VoIP), synchronized web and shared browsers, interactive whiteboards, 2D/3D chat tools, two-way audio and videoconferencing, application sharing, presentation slide facilities, polling and feedback tools, and group break-out rooms (Butz & Stupnisky, 2016; McBrien, Cheng, & Jones, 2009).

Various video conferencing tools that consists above functions that support synchronous course have been developed such as Elluminate, Interwise , Adobe Acrobat Connect, Zoom and

Blackboard Collaborate (Butz & Stupnisky, 2016). These platforms enhance the learning

experiences by increasing interactions between participant and building social, cognitive and

teaching presence (Barron, Schullo, Kromrey, Hogarty, Venable, Barros & Loggie, 2005;

Clauzel, Sehaba, & Prié, 2011). Figure 1 and 2 show a screenshot of one video conferencing
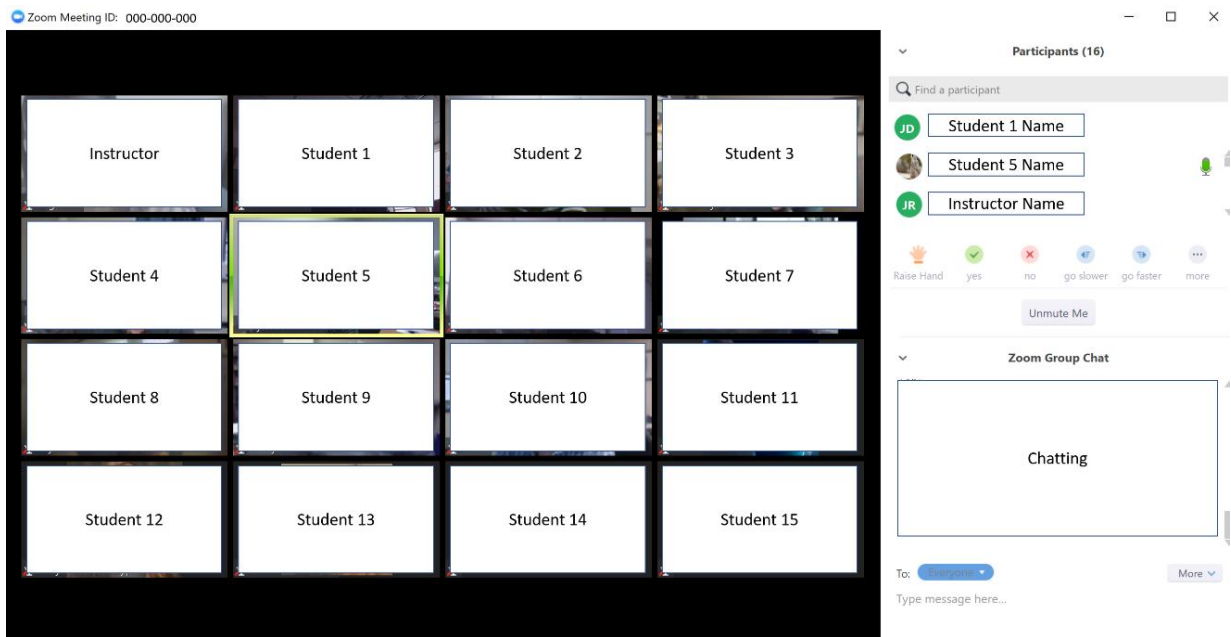
tool.

Figure 1. Video Conferencing Tool Interface 1 (Video, List and Chatting)
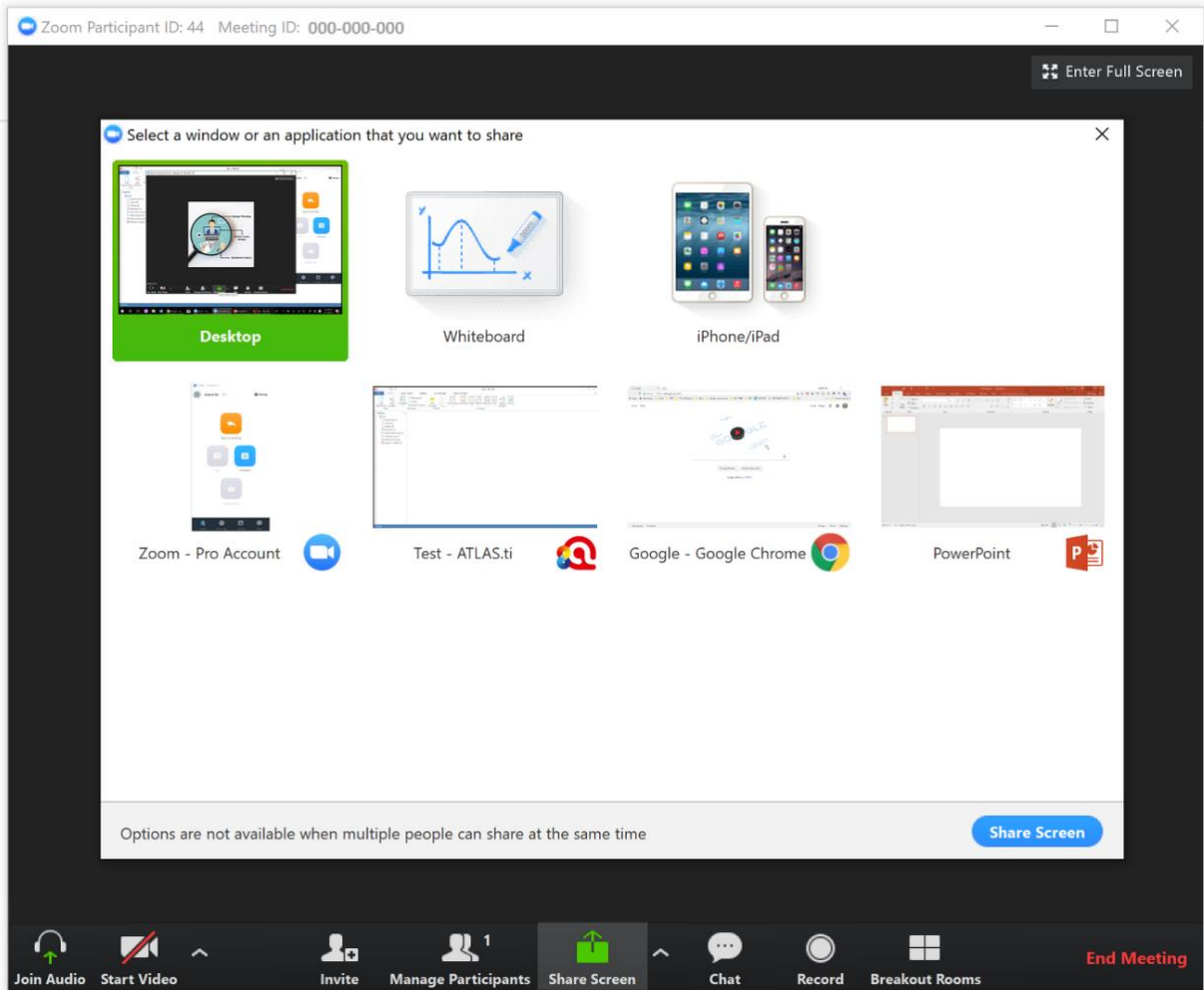
Figure 2. Video Conferencing Tool Interface 2 (Share Screen)

Using closed circuit television for teaching in the 1940s can be regarded as the starting

point of synchronous courses, but the discussion regarding a synchronous course became more

widespread in the 1980s (Johnson, 2006). In the 1980s ~ 90s, various technologies were

developed that could allow students to take a lecture, ask questions, and discuss concepts by

connecting to remote classrooms by means of technologies including videoconferencing and

interactive television (Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, & Huang, 2004).

Researchers investigated the effectiveness of synchronous course lecture compared to face-to-

face lecture and developed learning platforms for synchronous courses (Fetterman, 1996; Knox,

1997; Walther, 1996; Yamagata-Lynch, 2014).

However, the interest in and application of a synchronous course decreased due to

various limitations and constraints in implementing this course format. High costs, bandwidth

limitations, insufficient tools, a lack of reflection time, and scheduling issues, inherent issues of

synchronous courses, have contributed to their lack of popularity (Park & Bonk, 2007, p.245).

One specific limitation was the difficulty in arranging the same time and virtual place for all

students to participate (Lowenthal, Dunlap & Snelson, 2017). Branon and Essex (2001) pointed

out that a limitation associated with a synchronous course was getting students online at the same

time. This type of environment requires a precisely set date and time for meetings, but this

contradicts the promise of "anytime, anywhere" learning that online courses have traditionally

promoted (Skylar, 2009, p.71).

Additionally, in the 1990s and early 2000s, classroom videoconferencing equipment

could only be used in designated classrooms. The students and instructor had to be those specific

locations, directly contradicting the promise of "anywhere" (Rowe, Ellis, & Bao, 2006). Due to

expenses associated with required videoconferencing equipment, it was difficult to establish

learning environments for implementing synchronous courses. A lack of network infrastructure also hampered the growth of synchronous courses and contributed it be location specific. In the early 2000s, the bandwidth of internet access was still insufficient to support an effective synchronous course (Chen et al., 2003; Lowenthal, Dunlap & Snelson, 2017).

Recently, the increasing bandwidth of the Internet and improvements in information and communication technologies have made synchronous online instructional delivery more popular and effective (Martin & Parker, 2014; Ng, 2007; Olson & McCracken, 2015). High quality technologies allow for teaching and learning experiences similar to face-to-face classes (Romero-Hall & Vicentini, 2017). For example, most synchronous course platforms have "Breakout Rooms" function that allows an instructor creates smaller groups within an online classroom. In a breakout room, students can engage in team-based activities by collaborating with their team members just like they do in face-to-face classroom. In addition, advanced technology adds an additional convenience to synchronous courses delivery: "any device" (Clawson, Korns, Decker, & Piper, 2016). These days, students can access a synchronous course through their computer, tablet or even cellular phone. Many postsecondary institutions now have a number of programs that deliver online courses with a synchronous format (Bell, Sawaya, & Cain, 2014; Butz et al., 2014). Increased interest in synchronous courses have prompted the development of various synchronous course platforms to be developed such as Eluminate Live, Adobe Acrobat Connect, Zoom, and Ultra.

Comparison of Asynchronous and Synchronous Courses

The main differences between an asynchronous and a synchronous course are the nature of communication and the simultaneity of interaction (Hrastinski, 2008). In an asynchronous course, participants communicate through asynchronous computer-mediated communication tools such as email and discussion boards. They do not need to be online at the same time, and there are time gaps between action and response as well as action and feedback. In a synchronous course, participants communicate through two-way media such as chat and video-conferencing tools. Students and an instructor are logged on video-conferencing tools at the same time and interact each other.

A lot of studies that compare synchronous and asynchronous courses have been conducted, and these studies introduce 1) the difference between asynchronous and synchronous communication (e.g. Branon & Essex, 2001; Davidson-Shivers, Muilenburg, & Tanner, 2001; Hrastinski, 2008; Oztok, Zingaro, Brett, & Hewitt , 2013), 2) instructors' and students' preferences regarding particular formats of online courses (e.g. Buxton, 2014; Brierton, Wilson, Kistler, Flowers, & Jones, 2016; Johnson, 2006; Levin, He, & Robbins, 2006), and 3) advantages of particular formats over others (e.g. Baker, 2010; Brierton et al., 2016; Clark, 2015; Falloon, 2011; Han, 2013; Hrastinski, 2008; Laat, Lally, Lipponen, & Simons, 2007; Levin, He, and Robbins, 2006; Skylar, 2009; Wang, 2008).

Many studies above point out the benefits of a synchronous course over an asynchronous one. Levin, He, and Robbins (2006) found that most people before online discussion stated that they would rather use asynchronous discussion but that afterward the majority noted that they would instead favor more synchronous discussions. Their reasons included that they received quick feedback, real-time discussion, the advantage of finishing the chat in one sitting, and the

challenge of thinking critically. They stated overall that the use of synchronous discussions was more productive than asynchronous discussions (Levin, He, and Robbins, 2006). In his research, Wang (2008) compared and explored the possibilities of a synchronous communication tool building a sense of a community. Laat, Lally, Lipponen, and Simons (2007) discovered that sustaining communication and expressing emotions is easier with web videoconferencing compared to discussion forums. And Han (2013) found that implementation of video casting in courses was found to attract greater interaction between instructors and peers. Clark (2015) investigated whether asynchronous communication and synchronous communication create higher levels of social and teaching presence. The results of student interviews, surveys, and self-reported perceptions showed that social and teaching presences were significantly higher when student communicate though synchronous communication tool.

Affordances of Synchronous Courses

Studies have presented and highlighted various benefits of synchronous courses. The identified benefits are affordances of synchronous online course. When instructors include synchronous sessions in their online course, they have perceived uses of those sessions which are affordances of synchronous courses. Instructors have used synchronous online sessions to use following affordances of synchronous online sessions: developing a sense of community, creating social, cognitive, and teaching presences, promoting interactions, enhancing engagement, providing immediate feedback, increasing motivation, expressing opinions and emotions, and applying various teaching strategies. Table 1 shows affordances of synchronous online courses along with information about related studies. These affordances are regarded as important values to modern online instructors and researchers because most online courses designed in an asynchronous

format are missing the same benefits (Bower, Dalgarno, Kennedy, Lee, & Kenney, 2015; Lowenthal, Snelson, & Dunlap, 2017; Olson & McCracken, 2015).

However, sophisticated design is required to implementing the affordances of synchronous courses into a real classroom. Instructors need to approach synchronous course design differently than the approach used in designing asynchronous courses and face-to-face courses (Anderson, Fyvie, Koritko, McCarthy, Paz, Rizzuto, & Sawyers, 2006; Bower et al., 2013; Melkun, 2012; Olson & McCracken, 2015; Romero-Hall & Vicentini,2017). Schullo and his colleagues (2005) assert that there are instructors and instructional designers of synchronous course who are considering using or implementing such aforementioned affordances, and they need to be guided in how to properly implement them in their courses. In addition, designing those affordances requires extensive preparation (Anderson et al., 2006; Bower et al., 2013; Chen, Xiang, Sun, Ban, Chen, & Huang, 2015; Piskurich, 2004).

Table 1. Affordances of Synchronous Courses

Affordances	Explanations	Research
Developing a sense of community	Synchronous communications tools play a part in the development of a sense of community in a synchronous online learning environment	Butz et al, 2014; Han, 2013; Hratinski, 2008; Shield, Atweh, & Singh, 2005; Wang, 2008
Creating the presences	There are three types of presence: social, cognitive, and teaching. These are essential in successful online learning. The positive relationship between each presence and synchronous courses has been determined.	Baker, 2010; Clark, 2015; Giesbers, Rienties, Gijselaers, Laat, Lally, Lipponen, & Simons, 2007; Han, 2013; Segers, & Tempelaar, 2009; Szeto & Cheng, 2016
Promoting interactions	Synchronous courses improve interactions between student and students, students and instructors, and students and contents through various video conferencing tools.	Bower, 2011; Butz et al., 2014; Chen et al., 2005; Duemer et al., 2002; Han, 2013; Hastie, Chen, & Kuo, 2007; RoSkylar, 2009; Vu & Fadde, 2013
Enhancing engagement	Synchronous online courses assist and enhance student engagement in learning activities by providing immediate feedback and increasing their motivation.	McBrien, Cheng, & Jones, 2009; Wang, 2005; Hrastinski, 2008
Providing immediate feedback	In synchronous online courses, instructors can provide immediate feedback to students. So students can immediately correct their understanding of a given topic and clarify its meaning.	Chen, Ko, Kinshuk, & Lin, 2005; De Laat, Lally, Lipponen, & Simons, 2007; Schutt, Allen & Laumakis, 2009
Increasing motivation	Benefits of synchronous courses include immediate feedback and a strong sense of community that can enhance student motivation. This affects the incensement of enrollment positively.	Chen, Ko, Kinshuk, & Lin, 2005; Hrastinski, 2008; White, Ramirez, Smith, & Plonowski, 2010, Lowenthal, Dunlap & Snelson, 2017
Expressing opinions and emotions	By using various synchronous tools, instructors and students can express their opinions and emotions more easily.	Clauzel, Sehaba, & Prié, 2011; De Laat, Lally, Lipponen, & Simons, 2007
Applying various teaching strategies	Unlike asynchronous courses which have limited teaching environments, instructors can use various teaching strategies in synchronous courses much like those in face-to-face courses.	Bower, 2011; Lowenthal, Dunlap & Snelson, 2017

Online Course Design

In online learning, a lot of features related to teaching and learning have changed in comparison to face-to-face learning (Moore & Thompson, 1997; Murphy, Harvell, & O'Donnell, 1998). Moore and Thompson (1997) claimed that online learning is more complex than just adding a new communication technology to an existing face-to-face course, and adapting online learning requires changes in light of pedagogical, instructional, and philosophical implications. There are big differences in the delivery methods, a type of human interaction and communication, and learning paradigms between the traditional classroom and online learning (Creasy & Liang, 2004; Trottier & Bakerson, 2013). For example, in online courses, all learning activities and interactions between participants occur through the use of technology. Due to these differences, instructional strategies that served well in a traditional classroom do not work quite so well in an online course (Milam, Voorhees & Bedard-Voorhees, 2004; Conole, White, & Oliver, 2007; Palloff & Pratt, 2009). Researchers have asserted that online learning requires different and specific instructional strategies based on the characteristics of online learning (Moore & Thompson, 1997; Mortera-Gutierrez, 2002; Murphy, Harvell, & O'Donnell, 1998; Garrison & Cleveland-Innes, 2005).

Online Course Design Strategies

With the necessity of different approaches to design and implementation in regard to online learning, several theories and strategies have been developed. These theories have contributed to the expansion and popularity of online learning. One traditional and primary online learning theory is Moore's theory of transactional distance. Transactional distance refers to the psychological space of potential misunderstandings between the behaviors of instructors and

students who are geographically separated (Moore & Kearsley, 1996, p.200). In other words, it is the sense of distance a learner feels during the learning process in an educational setting, particularly in distance education. This cognitive space between instructor and student is created by the physical distance inherent to online learning. This theory provides a broad perspective that applies to most distance education situations, and so to provide a meaningful online learning experience, instructors should minimize this distance. Moore (1993) identifies key interactive components of transactional distance theory as dialogue, structure, and learner autonomy.

- Dialogue (or interaction): two-way communication between the instructor and the student
- Structure: the flexibility and design of the course
- Learner autonomy: the student's perception of both independent and interdependent participation in the course and the student's degree of self-directed learning

Instructors and instructional designers can close transactional distance by balancing three key interactive components. That is, instructors can reduce transactional distance by increasing dialogue, developing well-structured courses, and increasing the student's autonomy.

Another famous and traditional study that provides online course design strategies is Chickering and Ehrmann (1996)'s seven principles for a technology integrated classroom. Those seven principles are 1) increasing interaction between instructors and students, 2) increasing collaboration among students, 3) promoting active learning, 4) providing prompt feedback, 5) facilitating students´ time on task, 6) communicating high expectations and 7) considering students' diverse talents and ways of learning.

Online learning has become an alternative mode of instruction and a substantial supplement to traditional teaching (Tallent-Runnels, Thomas, Lan, Cooper, Ahern, Shaw & Liu,

2006). According to U.S. News Education (2018), there are 357 schools that provide online bachelor's degree programs in the United States. In regard to this trend, considerable research has been conducted into online course design. Online learning researchers have developed and suggested essential components for successful online learning. By analyzing existing studies on this topic, I have derived the most popular components that have been introduced as essentials components for successful online learning by researchers. The components I have chosen are increasing interactions; creating social, cognitive, and teaching presences; building online learning communities; providing students support services; promoting students' motivation; and developing openness in online learning. These components can be regarded as design tasks to instructors. The following shows each design component and related studies in greater detail.

- Increasing interactions: Cavanaugh, Barbour, Brown, Diamond, Lowes, Powell & Van der Molen (2009), Moore (1989)

- Building online learning communities and virtual teams: Martins, Gilson, Maynard (2004); Palloff, & Pratt (2007), Shea, Li, Swan, & Pickett (2005), Shiue, Chiu, & Chang (2010)

- Creating social, cognitive and teaching presences: Conrad & Donaldson (2012), Garrison, Anderson, & Archer (2001), Garrison, Cleveland-Innes & Fung (2010), Lehman & Conceição (2010), Palloff, & Pratt (2011)

- Providing students support services: Muilenburg & Berge (2005), Stewart, Goodson, Miertschin, Norwood, & Ezell (2013)

- Promoting students' motivation and engagement: Bennett & Lockyer (2004), Conrad & Donaldson (2012), Miltiadou & Savenye (2003)

Increasing interactions. As Moore's theory of transactional distance states, increasing interactions can reduce transactional distance in online learning. Online learners can create knowledge through interactions with one another, the content, and their teachers (Moore 1989). Palloff and Pratt (2007) differentiate online and distance learning environments from traditional classrooms, noting that, "Key to the online learning process are the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning that results from these interactions" (p. 4).

Creating social, cognitive and teaching presences. Palloff and Pratt (2011) said that establishing presence is the first-order task when designing successful online courses. In relation to presences, three types were noted to be successful in online courses. Garrison, Anderson, and Archer (2000) presented the model with three aspects of a successful educational experience: social, cognitive, and teaching. Social presence incorporates the expression of emotion, open communication, and the development of group cohesion. Moreover, social presence comments on the capability of bringing student and instructor personalities into the learning community. On the other hand, cognitive presence is the potential to understand and interpret meaning from educational experiences. Teaching presence, meanwhile, touches upon the design, delivery, and facilitation of course content in consideration of three aspects: instructional management, creating understanding, and direct instruction. Online presence is an essential concept for successful online learning. In an asynchronous course, students cannot see their peers or professor. Thus, creating a sense of presence is a crucial factor of asynchronous course design and requires the professor's efforts (Lehman & Conceição, 2010). A professor's prompt feedback can be regarded as an instructional design strategy for creating teaching presence in an online course (Coll, Rochera & de Gispert, 2014).

Building online learning communities. In relation to the online learning community, Palloff and Pratt state, "The key to successful online learning is the formation of an effective learning community as the vehicle through which learning occurs online" (2007, p. 4). Much research has been conducted to prove the importance of community in online courses and identify effective ways of building online learning (Johnson, 2001; Rovai, 2001; Swan, 2002; Tasi, Laffey, & Hanuscin, 2010)

Providing students support services. Student support can be understood as assisting students, so they can take their online course successfully without any problems. Particularly, in an asynchronous learning environment, learning occurs through the use of technology, and this can be problematic if participants are unfamiliar or uncomfortable with the technology required (Muilenburg and Berge, 2005). Muilenburg and Berge (2005) identified technical problems as one of the main barriers to online learning and therefore thought that developing technical support was an essential design task. Student support services include admissions and registration, advising, orientation, learning support, scholarships and awards, library resources, computing and technology resources, career placement, and communication (Stewart, Goodson, Miertschin, Norwood & Ezell, 2013, p.290).

Promoting students' motivation. Students' motivation is crucial to academic success (Keller, 1987, 2009; Wentzel & Wigfield, 1998). According to Miltiadou and Savenye (2003), instructors should motivate online learners to ensure student success in online courses. Motivational design is an essential design component in online course design. In an online learning environment, there is the possibility that students feel isolated from the instructor and other participants due to their physical and social distance (Hrastinski, 2008; Bolliger, Supanakorn, & Boggs, 2010; Rovai & Jordan, 2004; Song & Hill, 2007). With the characteristics

of an online learning environment, researchers maintained that instructors should develop new strategies and change their teaching practices in order to maintain online learners' motivation (Bennett & Lockyer, 2004). Miltiadou and Savenye (2003) suggest six motivational design components in online learning: (a) self-efficacy, (b) locus of control, (c) attributions, (d) goal orientation, (e) intrinsic versus extrinsic motivation, and (f) self-regulation. Among these components, designing an online course that promotes and sustains students' self-regulated learning (SRL) is a crucial motivational design component to instructors. The flexibilities and convenience of online learning environments make sure online learners are in control of their own learning (Kim, Olfman, Ryan, & Eryilmaz, 2014; Moore, 1993, 2013). Researchers have maintained that online learners should have and use SRL strategies for successful online learning (Adeyinka & Mutula, 2010; Lehmann, Hähnlein & Ifenthaler, 2014).

Numerous standards and rubrics have been developed to evaluate the quality of online learning such as "Model for Quality in Distance Education", "Quality Matters", and "Five Pillars" (ACODE, 2010; Jung, 2012: MarylandOnline, 2010; Puzziferro & Shelton, 2008; Stewart et al., 2013; Wang, 2006). For example, "Quality Matters" includes eight general standards and 41 specific benchmarks to measure the quality of online courses. These standards include the aforementioned components as evaluation items. Jaggars and Xu (2016) developed an online course design assessment rubric by synthesizing existing studies in online course design and analyzing 23 online courses.

Online learning researchers have conducted numerous studies that show the application of these theories and strategies into course design. These studies share design strategies for applying successful online course components and the effectiveness of developed strategies. These studies provide practical ways to design successful online courses under specific course

design situations. However, the application of theories and development of design strategies were based on asynchronous online courses. Research has since shown how to design the aforementioned components in an asynchronous course.

Synchronous Course Design

As there are differences between face-to-face and asynchronous courses, there are also differences in behaviors of learners, delivery methods and tools, types of human interaction and communication, design of learning activities, roles of instructors, and affordances between asynchronous courses and synchronous courses (Branon & Essex, 2001; Hrastinski, 2008; Themelis, 2014; Romero-Hall & Vicentini, 2017). For example, asynchronous online courses are open for a long period of time to allow students to participate at their leisure. However, synchronous online courses are full of real-time interaction between students and instructors. Interactions in synchronous online courses have their own unique characteristics such as multiple simultaneous communication channels, immediate reaction, and various functions of video conferencing tool (Anderson et al., 2006; Butz & Stupnisky, 2016; Tabak & Rampol, 2014). Many studies have compared synchronous and asynchronous courses, and explained the difference and affordances of both course formats (Baker, 2010; Brierton et al., 2016; Han, 2013; Oztok et al., 2013).

The differences between asynchronous and synchronous courses requires different types of instructional design strategies (Mortera-Gutierrez, 2002; Hrastinski, Keller, & Carlsson, 2010). Due to the differences between asynchronous and synchronous courses, existing studies of online course design strategies based on asynchronous courses do not cover design strategies for synchronous courses. For example, existing studies on online course design based on

asynchronous courses do not explain how to use break-out room for group activities and how to use various communication channels in synchronous sessions. In addition, it is difficult to apply the same design strategies to a synchronous course as one would to an asynchronous course despite both being online courses due to the inherent differences of both formats. Design strategies for synchronous courses need to be developed.

However, there is limited resource about how to design and deliver these courses. Most previous studies of online learning have been limited to asynchronous online course format (Oyarzun & Martin, 2013; Szeto, 2015). Studies investigating synchronous online courses have pointed out the limited discussion inherent in synchronous online courses in comparison to asynchronous online courses (Palloff & Praff, 2007; Szeto, 2015; Yamagata-Lynch, 2014). With increased interest and use of synchronous courses, researchers have begun to discuss instructional strategies for successful design and implementation of synchronous courses in their peer reviewed articles (e.g. Bower et al., 2013, 2015; Butz & Stupnisky, 2016; Szeto & Cheng, 2016; Tabak & Rampol, 2014). Table 2 below shows a summary of existing studies on synchronous course design. I analyzed these studies to identify the current status of studies of synchronous course design and limitations of those studies. Table 2 includes topic of each study and its implication of synchronous course design.

Table 2. Existing Studies on Synchronous Course Design

Researcher	Topic	Design implication
Bower, Dalgarno, Kennedy, Lee, & Kenney (2015)	Designs and implementation factors in blended synchronous learning environments	• The blended synchronous learning design framework.
Bower, Kenney, Dalgarno, Lee, & Kennedy (2013)	Blends synchronous learning designs and articulates principles for implementation	• Examples of blended synchronous learning • Preparation strategies
Butz, Stupnisky, Peterson, & Majerus (2014)	Shows the relations between synchronous learning, need satisfaction, motivation, and perceived success	• Motivation design strategies
Chao, Hung, & Chen (2012)	Describes the design of online synchronous assessments in a synchronous cyber classroom	• Synchronous assessments design strategies
Coy, Marino & Serianni (2014)	Applications of universal design for learning(UDL) in a synchronous course	• Universal design for learning as instructional design strategies
Giesbers, Rienties, Gijselaers, Segers, & Tempelaar (2009)	Relations between web videoconferences and social presence	• Course assessment items
Hastie, Chen & Kuo (2007)	Instructional designs for best practice in the synchronous cyber classroom	• Best practice in instructional design
Hrastinski, Keller, & Carlsson (2010)	Design exemplars of synchronous learning activity: use of benefits of a synchronous course and related theories	• Design exemplars of a synchronous course • Strategies for applying benefits of a synchronous course
King, Greidanus, Carbonaro, Drummond, Boechler & Kahlke (2010)	Adapts problem-based learning into a synchronous course	• Application of a specific pedagogy to a synchronous course (PBL)
Lee, Nakamura & Sadler (2016)	Designs and implements videoconferencing-embedded flipped classroom	• Application of a specific pedagogy to a synchronous course (Flipped learning)
Little, Passmore & Schullo (2006)	Develops and integrates synchronous classroom software into an ongoing online program	• Synchronous learning platform

Table 2. Continued

Researcher	Topic	Design implication
Lowenthal, Dunlap & Snelson (2017)	Integrates live synchronous web meeting into asynchronous online courses for virtual office hours	• Design recommendations to use synchronous meeting in virtual office hours
Hyder, Kwinn, Miazga, & Murray (2007)	Explains 'How to' design for the synchronous classroom and preliminary planning for synchronous course	• Media selection strategies • Interactions strategies • Use of synchronous tools • Instructional design support strategies
Pfister and Oehl (2009)	Shows the impact of goal focus, task type and group size on a synchronous net-based collaborative learning	• Task design strategies • Group work design strategies
Piskurich (2004)	Develops a synchronous course facilitator	• Preparation of a synchronous course
Szeto & Cheng (2016)	Focuses on framework of interactions in the blended synchronous learning environment	• Social presence creation principles and strategies
Tabak & Rampol, (2014)	Designs, developments, and deliveries of a synchronous course	• Design considerations • Use of synchronous tools
Turani & Calvo (2006)	A software application that supports a synchronous collaborative learning	• Synchronous learning platform
Wang (2007)	Question skills facilitate online synchronous discussions	• Task design strategies

I identified common limitations of these studies. First, most of those studies investigate design strategies of synchronous sessions in asynchronous course instead of a full synchronous deliver course (e.g. Bower et al., 2015; Bower et al., 2013; Butz et al., 2014; Giesbers et al., 2009; Hrastinski, Keller, & Carlsson, 2010; Lee, Nakamura & Sadler, 2016; Little, Passmore & Schullo, 2006; Szeto & Cheng, 2016; Tabak & Rampol, 2014). In these studies, instructors designed their courses as an asynchronous course format, and design one or two synchronous sessions as a learning activity with a specific purpose such as providing a collaboration place, answering students' questions, and creating a social presence. Hrastinski, Keller, and Carlsson (2010) introduced synchronous instruction cases as a design exemplar. These exemplars were from blended online courses that combined asynchronous and synchronous instruction. Exemplars focused on when and how to use and design synchronous instruction. Bower et al. (2015) analyzed seven cases of blended synchronous courses that face-to-face students and remote students attend together and identified design and implementation factors in these blended synchronous courses. Design strategies and principles derived from these studies are for designing synchronous course activities rather than synchronous online courses.

Additionally, there is a difference in design approaches and elements between blended online course and synchronous online courses because each delivery format has its own perceived uses and characteristics in communication, interaction, and learning environments. For example, a blended synchronous course consists of face-to-face and synchronous course interactions; instructors can create a strong teaching presence during face-to-face instruction. In this design situation, instructors do not need to think about creating a social and teaching presence as an essential design task. Bower et al. (2015) contended that face-to-face and remote students in a blended synchronous course feel a sense of co-presence with one another, and as a

result they did not include a strategy for creating social presence in their design framework for a blended synchronous course design.

Second, these studies focus on a specific synchronous course element such as a learning community and interaction instead of a comprehensive view of course design. As mentioned above, most of the studies of synchronous courses have used synchronous instruction as a learning activity, not an entire course format. Those studies focused on a pedagogical aspect of synchronous course design such as the application of one or two affordances of synchronous course. They shared their strategies for creating a learning community or how to design collaboration task in a synchronous session. To design a synchronous course that uses various benefits of synchronous courses, instructors must make many design decisions regarding how to use these affordances to design a properly synchronous course. Thus, even though there are strategies for implementing specific affordances of synchronous course, instructors will face difficulty when designing a cohesive synchronous course that blends various affordances of synchronous course.

In addition, there are many factors that affect synchronous course design beyond pedagogical design factors. Themelis (2014) identified contextual factors that affect instructors and students in a synchronous course, including technological implications, synchronous tool choices, course topics, contextual factors, institutional support, teaching style, confidence with technology, cultural background and personality. These factors are different in each course. Instructors take these factors into account in their synchronous course design. We need to understand synchronous course design with a comprehensive view for practical implications of a synchronous course in real world.

Third, these studies do not investigate the design process or the instructor's experience. In other words, it is hard to find a study that investigates an instructor's synchronous course design process with in-depth explanations of design decisions, challenges, and reflections on design processes. In most studies of synchronous course design, instructors would introduce their design strategies and the course they developed as the finished design product without explaining their design process. There was no explanation of how they developed the course, why they made certain design decisions, what difficulties they faced during the design process, how to handle the difficulties they may have had, or what factors affected their course design. Design exists merely in the time and space of its implementation (Howard, Boling, Rowland & Smith, 2012). Thus, it is hard for other instructors to apply the introduced design strategies into their own course designs without understanding the context and environment in which the design strategies were developed.

One example of such limitations is the blended synchronous learning design framework by Bower et al. (2015). They developed this framework by analyzing cases of blended synchronous courses that consisted of face-to-face students and remote students. Table 3 show a part of the blended synchronous learning design framework. This design framework can provide an understanding of a synchronous course. However, this framework also has some limitations, namely: It is too abstract to apply to course design practice; it is based on a blended online course; there is no explanation of how to apply those strategies; and it is focused on implementations. As this example shows, existing studies on synchronous course design do not offer practical support to instructors in a synchronous course design which is a complex and an ill-defined task to instructors. With insufficient discussion on synchronous courses, although there are instructors who would benefit from synchronous courses, instructors overall are having

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difficulty designing synchronous courses (Bower, et al., 2015; Lowenthal, Dunlap & Snelson,

2017). There is an urgent need of guidance when it comes to synchronous course design

(Hrastinski, Keller, & Carlsson, 2010).

Table 3. The Blended Synchronous Learning Design Framework (Adapted form Bower et al., 2015)

	Design	Implementation
Pedagogy	• Clearly define learning outcomes • Design for active learning • Determines whether to group remote with F2F students • Utilize general design principles	• Encourage regular student contribution • Distribute attention between remote and F2F students • Identify the focus of learning and discussion • Avoid duplication of explanations • Circulate among groups • Draw upon existing pedagogical knowledge • Be flexible, adaptive, and composed • More active learning • Enhanced sense of community • More flexible access to learning
Technology	• Match technologies to lesson requirements • Set up and test the technology in advance	• Know how to use and troubleshoot the technologies • Appropriately utilize audio/visual modalities • Advise students on how to use the technology • Ensure students have correct permissions • Use mobile devices to facilitate visual input if required
Logistics/ setup	• Be highly organized in advance • Solicit the right institutional support • Prepare students • Prepare self • Establish a learning community	• Start lessons 10 min early for technology testing • Log in to a second computer • Apply tactics to work with text chat contributions • Seek teaching assistance where possible and desirable

Importance of Synchronous Course Design

Instructors need to approach synchronous course design differently than how they approach the design of asynchronous and face-to-face courses (Anderson et al., 2006; Melkun, 2012; Olson & McCracken, 2015; Romero-Hall & Vicentini,2017). Researchers have emphasized the importance of extensive preparation when it comes to synchronous courses (Bower et al., 2013; Chen et al., 2015; Piskurich, 2004). Anderson and his team (2006) identified several problems in managing synchronous course activities, including unfamiliar tools to participants, multiple communication tools, a short-time frame in which to cover the contents, and technical problems. They emphasized the importance of planning in order to solve identified problems. Bower and his team also emphasized careful design of synchronous instruction because multiple communications and cognitive overload can be caused by split attention. Piskurich (2004) insisted that implementing a synchronous course requires 20%-30% more preparation time than other course delivery options. Chen et al. (2015) found that there are significantly higher interactions in a synchronous course than in a face-to-face course. And the researchers pointed out the importance of developing instructional designs to promote and manage interactions. These studies support the claim that instructors should put more effort into designing synchronous courses than other course formats.

Design Thinking for Instructional Design

Jonassen, who was a prolific scholar in instructional technology, shared in his work that design is one of the most complex ill-structured problem-solving activities (Jonassen, 2011, p.21). He claimed that in instructional design there are various constraints such as technology availability,

organizational rules, and environmental factors. He suggested that designers should distinguish the constraints and make proper design decisions based on them (Jonassen, 2008). Design thinking is a meaningful approach for addressing complex and ill-structured problems which are called wicked problems (Buchanan, 1992; Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013). Design thinking is a creative process to solve complex problems and find desirable solutions by design through synthesizing separate elements of the design situation (Cross, 2011; Sarbazhosseini, Adikari & Keighran, 2016)

This study regards synchronous online design as a wicked problem, being ill-defined, complex, and unsolvable through existing rational systematic processes (Rittel & Webber, 1973; Whelton & Ballard, 2002). Several studies supported this assumption because synchronous online course design is a type of instructional design work which is ill-defined and complex (Jonassen, 2011, Yamagata-Lynch, 2014). Synchronous course is a course format that integrates technology into teaching practices which is a wicked problem (Ertmer, 1999, 2005; Mishra & Koehler, 2007). The lack of popularity of synchronous online courses also contributes to the complexity and difficulty of synchronous online course design because it creates issues such as limited design resources and a lack of understanding of synchronous online courses overall.

In addition, I observed design tensions which were higher-level and complex problems in synchronous course design by taking synchronous courses and supporting course design. For example, I met one instructor who was suffering from designing group activities in synchronous online course. The instructor worried about issues in using a break-out room function in a tool, preventing connecting issues during group work time, assigning groups, facilitating group activities, and assigning time to activities. All these issues were occurring in designing group activities. Existing studies of synchronous online courses also have introduced the complexity

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and difficulty of implementing group activities in synchronous online course (Bower et al., 2015; King et al., 2010; Pfister & Oehl, 2009; Robinson, Kilgore, & Warren, 2017). Based on these academic discussions and my experience, I regard the design of synchronous courses as a wicked problem that can be addressed by designing thinking.

This section provides an understanding on what wicked problems are, introduce design thinking as a way to make solutions to wicked problems, and explains the relationship between design thinking and course design. At last, I introduce the concept of design case which is one of outcomes of this study by connecting with design thinking.

Wicked Problems and Design Thinking

Wicked problems. Horst Rittel, a design theorist, coined the concept of the wicked problem in the 1960s (Buchanan, 1992). He defined it as a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing (as cited in Buchanan, 1992)." Rittel and Webber (1973) identified ten characteristics of wicked problems:

- There is no definitive formulation for a wicked problem, but the solution and formulation of a wicked problem corresponds to each other;

- There are no stopping rules for wicked problems;

- The solutions can only be good or bad, true or false;

- In the process of solving a wicked problem there are no exhaustive lists of admissible operations;

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- There are multiple explanations, depending on the Weltanschauung of the designer, possible for a wicked problem;

- Every wicked problem is a "higher level" problem;

- There are no definitive tests for a wicked problem;

- There is no room for trial and error when solving a wicked problem. It is considered a "one shot" operation;

- All wicked problems are distinct unique;

- The wicked problem solver is accountable for their actions, and they have no right to be wrong (p.161~167).

Design thinking. With the concept of wicked problems, Buchanan (1992) conceptualized design thinking as the new liberal art of technological culture, and claimed that design thinking can develop adequate solutions to wicked problems of design by integrating the knowledge of the natural, social, and humanistic sciences. Wicked problems are too complex to be solved by existing rational systematic processes (Whelton & Ballard, 2002). Design thinking has been regarded as a meaningful approach for facing wicked problems, which are ill-defined or tricky (Buchanan, 1992; Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013; Owen, 2007; Rittel & Webber, 1973).

There are different theoretical perspectives on design thinking. The theoretical perspectives of design thinking can be categorized into five sub-discourses: design thinking as the creation of artifacts, as a reflexive practice, as a problem-solving activity, as a way of reasoning/making sense of things, and as creation of meaning (Johansson-Sköldberg et al., 2013). Table 4 shows comparison of five perspectives of design thinking.

Table 4. Comparison of Five Discourses of Design Thinking (Adapted form Johansson-Sköldberg et al., 2013 p.124~126)

Approach to Design thinking	Background/ Epistemology	Key Concepts
The creation of artifacts (Simon, 1969).	Economics & political science/ Rationalism	• Design encompass all conscious activities to create artifacts • Design is the transformation of existing conditions into preferred ones • This approach distinguished between activities that create something new and activities that deal with existing reality
A reflexive practice (Schön, 1992)	Philosophy & music/ Pragmatism	• Design is a reflective practice • Reflection-in-action is the reflective form of knowing-in-action • Design is one of a series of activities in domains that involve reflective practice
A Problem - solving activity (Buchanan, 1992; Rittel & Webber, 1973; Jonassen, 1997, 2011)	Art history/ Post-modernism	• Wicked problems are a class of social systems problems with a fundamental indeterminacy without a single solution and where much creativity is needed to find solutions. • Design thinking has been regarded as a meaningful approach for facing wicked problems
A way of Reasoning / making sense of things (Lawson, 2006; Cross, 2011).	Design & architecture/ Practice perspective	• Design thinking is a practice-based activity and way of making sense of things. • Lawson and Cross use abductive processes to make sense of and generalize from observations, and hence find patterns that are grounded in practical experience and can be described through practical examples
Creation of meaning (Krippendorff, 2006)	Philosophy & semantics/ Hermeneutics	• Design thinking is a matter of creating meaning rather than creating artefacts • Meaning is the core of the design process and the artefact becomes a medium for communicating these meanings

Among these five views on design thinking, I regard design thinking as a problem-solving activity, is a meaningful approach for facing wicked problems and also the most dominant of the five views in instructional design as a field of study (Jonassen, 1997, 2011).

Design Thinking and Integrating Technology into Teaching

Recently, instructors are under a lot of pressure to integrate technology into teaching practice (Mishra & Koehler, 2007). Many studies show that teaching with technology is a complex activity (Koehler & Mishra, 2005; Koehler, Mishra, & Yahya, 2007; Tsai & Chai, 2012; Zhao, Pugh, Sheldon, & Byers, 2002). Researchers have asserted that integrating technology into teaching practice is difficult due to technology attributes, instructors' personal beliefs, social and the institutional contexts in which instructors work, and opportunities inherent in new tools. Each technology has its own propensities, biases, affordances and constraints (Ertmer, 1999, 2005; Howard, 2012; Mishra & Koehler, 2007). These inherent attributes make it difficult for instructors to apply them in their course design. To use technology appropriately, instructors need to have an ability to identify inherent attributes of the technology (Koehler & Mishra, 2009).

Mishra and Koehler (2007) maintain that integrating technology in the classroom is a complex and ill-structured problem. They actually cite teaching with technology as a "wicked problem", one that as Rittel and Webber (1973) state, contains incomplete, contradictory, altering demands, and cannot be solved in a traditional linear fashion. The solutions are neither correct nor incorrect; it is merely "better," "worse," "good enough," or "not good enough." The solutions will always be custom designed (Rittel & Webber, 1973).

Design thinking is instructors' essential skill to integrate technology in classrooms (Tsai & Chai, 2012). Ertmer (1999) suggests first-order barriers and second-order barriers for

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technology integration in classrooms. According to him, the first-order barriers consist of external factors such as lack of time, training, institutional support and access issues. The second-order barriers include intrinsic factors of instructors such as instructors' pedagogical beliefs, technology preference, and passion to change. With these barriers, Tsai and Chai (2012) argue that a lack of design thinking skills and disposition is the third-order barriers. They insisted that even if first-order and second-order barriers have been removed, instructors face difficulties integrating technology in a classroom. Each classroom has its own context and different students. Due to this dynamic of a real classroom, instructors should design learning materials and activities differently by reflecting the instructional needs for different contexts and varying groups of learners. With design thinking, instructor can use technology for instruction at the right time and right place (Tsai & Chai, 2012). To effectively integrate technology, it is essential for instructors to develop design thinking skills.

The Relationship between Design Thinking and Instructional Design

Instructional design (ID) is a system of procedures for developing education and training programs in a consistent and reliable fashion (Reiser & Dempsey, 2012, p.8). Instructional design can be understood as a design activity. Murphy (1992) make this case by comparing of the general practice of design and instructional design, and he reaches the conclusion that instructional designers are truly involved in design activities and need to recognize links between instructional design and with the world of design. Also, Rowland (1992) similarly states that planning and preparing to instruct could be exhibited as a subset of designing and the defining characteristics of all the types of design that holds to be true for ID (p.87).

With an understanding on instructional design as a design activity, instructional design is also one of most complex and ill-structured kinds of problem solving (Jonassen, 2011; Yamagata-Lynch, 2014). Rowland (1992) also found that expert instructional designers surfaced to comprehend and treat problems as ill-defined. A problem that requires instructional design has an unlimited number of possible instructional solutions, although only a subcategory of the various solutions may be practical (Jonassen, 2008).

Gross (1986) characterize design as a constraint exploration. He defines constraints as the formal and informal "rules, requirements, conventions, and principles that define the context of learning (p.10)." Most design decisions, especially instructional design decisions, are based on various constraints and constraint operations in the design space (Jonassen, 2008, p.23). In instructional design, all forms of analysis are targeted to recognize and adapt to the various constraints. To determine the parameter values of the design process this includes the complete reasoning of the constraints (Brown & Chandrasekaran, 1990). Analysis methods in instructional design such as needs assessment, task analysis, learning analysis, and contextual analysis are used by instructional designers to distinguish the design constraints in the form of goals, objectives, contextual factors, and learner requirements affecting the design (Jonassen, 2008, p.23). The constraints distinguished by Jonassen (2008) are 1) technologies availability, preference, and accessibility, 2) funds, 3) political and organizational rules, 4) environmental factors, 5) learner characteristics, 6) learning goals, and 7) physical context of learning environment. He argues that constraints appear during each cycle of the design process, and instructional designers make decisions based on the constraints as they emerge. During the design process, making design decision is not only the cognitive activity that affects the design

decisions, but also the beliefs with personal, cultural, or organizational biases that come into play (Gray, 2013).

As I mentioned above, instructional design problems are complex and ill-defined. Design decisions are influenced by personal, cultural, and environmental factors, especially if all of the constraints categorized by Jonassen (2008) are different in each class. Instructional designers make different design decisions depending on each course's constraints. Thus, instructional design problems are wicked problems that need design thinking to develop an adequate solution. However, there has been only little effort to understand the importance and use of design thinking in the instructional design process (Boling, 2010).

Design Precedent and Design Cases

Since design thinking takes place in a designer's mind, it can be hard to put concepts into words. One way to capture designer's design thinking is to write about design precedent. Design precedent in the form of design cases is a type of design knowledge comprised of a designer's awareness, experiences, decisions, and rationales regarding existing designs (Boling & Gary, 2017; Nelson & Stolerman, 2012). Specifically, design precedent includes a designer's decisions and in-depth explanations of design rationale (Boling, 2010; Nelson & Stolerman, 2012). Oxman, a design scholar, views design precedent as design knowledge about previous solutions which can be adapted to new situations (1996). Smith (2010) explains that design decisions and the reasoning behind them are at the heart of design precedent. With this view of design precedent, I believe that designers' design thinking as regards the solution of wicked problems can be presented as a form of design precedent.

Design precedent is a representation of knowledge from past designs that can be reused in new or similar situations (Flemming & Aygen, 2001). Boling and Gray (2017) refer to design precedent as a critical form of design knowledge comprising a designer's awareness and direct or vicarious experience with existing designs (p. 259). Design precedent in the form of design cases is a critical component of learning and practicing design because it provides an understanding of a design situation and facilitates the creation of new solutions based on previous solutions (Boling, 2010; Boiling & Gray, 2017; Lawson & Dorst, 2009). Novice designers can learn and practice design by reading, evaluating, and using a core set of precedents (Boling, Gray, & Smith, 2015).

Design precedent is embedded in design cases, and it explains their value (Oxman, 1996). Design cases are a way of presenting design precedent. That is, design cases are the way of disseminating design precedent (Boling, 2010; Howard, 2011). They are a description of real artifacts or experiences that have been consciously designed (Boling, 2010, p.2). According to Boling (2010), design cases offer in-depth explanations of design rationales, rich and multi-dimensional descriptions of designed artifacts and experiences, and full reflection on design processes (p.6). By analyzing design cases, designers can have a fuller understanding of design, including design situations, processes, decisions, and rationales, and can evaluate the degree to which such cases do or do not match their own situations as well as the degree to which strategies and solutions may or may not be applicable (Smith, 2010, p.14).

In synchronous course design, instructors can utilize design cases. They can fully understand other instructors' synchronous course design cases by reading and using them in their own course designs either by choosing to make a similar design decision, avoiding a particular decision, or choosing an alternative option based on precedent. However, in an instructional

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design area, there is limited discussion regarding the creation and use of design cases (Smith & Boling, 2009). In this dissertation, I regard the design case of synchronous online courses as a method that improves the understanding of design activities, and authentic design recourses can be used in their design decision-making of synchronous course designs. And so, this is one of the key outcomes of this dissertation. In this study, design cases for synchronous course design take the form of narratives that include descriptions of designers (perspectives and relevant past experiences), situations (related people, cultures, organizations, and environments), problems, decisions, and rationales for synchronous course designs and instructors' experiences and reflections.

According to Boling (2010), the utility of design cases is judged by readers. She says that design cases can be used in various ways according to readers. Thus, design cases must have in-depth and thorough descriptions and explanations of designs including design contexts, design decisions, and their rationales for readers (Howard. 2011, Smith, 2010). This is because readers can make informed design decisions based on the results of their investigation of design cases. To support their decision-making, researchers who write design cases must provide thorough descriptions of design situations, processes, and decisions. Based on this information, other designers can make decisions regarding how to most appropriately use design cases in their own design situations (Smith, 2010). Considering the importance of this description of design, Smith (2010) introduces several questions for writing descriptions of designs.

- What key decisions were made?
- At what points in the design process did these decisions arise?
- Who was involved in the making of these decisions?
- What was the rationale or reasoning behind these decisions?

- How were key design decisions judged to be useful or not?

- What key changes were made during the design process?

- Why was the proposed design solution believed to be the best? (p. 14)

When I wrote the design cases, I used these questions to write quality design cases.

Social Constructivism

In this study, social constructivism serves as a theoretical framework for understanding online learning and lens for understanding human activities. Social constructionism refers to the way in which individuals create knowledge through social interactions. Berger and Luckman (1966) assert that all knowledge is socially attained, including knowledge needed to determine what is real. Thomas Kuhn, author of *The Structure of Scientific Revolutions*, asserts that knowledge is "the common property of a group", meaning that a group—or social interaction—has attained knowledge through their interactions (1962). Franklin (1995) outlines differences and similarities in order to distinguish between the use of social constructionism and constructionism. Similarities between the two include that they both emphasize capacity by asserting reality is socially constructed, do not believe in objective realities, emphasize the importance of language and social processes, and see the direct impact these processes have in knowing reality and comprehending it. These thoughts are different in that constructivists are more experimental and focus more of a clinical approach, while social constructivists focus on social context and how social variables contribute to an individual attaining knowledge. To summarize, social constructivism focuses on the individual who makes meaning of knowledge within a social

context. In this study, social constructivism serves as a theoretical framework for understanding online learning and lens for understanding human activities.

Social Constructivism as Theoretical Framework for Online Learning

  Social constructivist view of learning. Social constructivists claim that learners arrive at what they know by participating in social activities through collaboration in various communities (Woo & Reeves, 2007). According to Vygotsky (1978), learning is not only the assimilation and accommodation of new knowledge but also the process by which learners are integrated into a knowledge community. He believed that learning occurs first on the social level and then on the individual one (Vygotsky, 1978). He emphasized the role of language and culture in knowledge construction. According to Vygotsky, humans experience, communicate, and understand reality through language and culture, and thus language and culture play essential roles in both cognitive development and perceiving a sense and meaning of the world. The zone of proximal is an important concept of his theory that refers to the gap between a learner's independent learning abilities and the learning that is guided by an instructor or in collaboration with peers (Vygotsky, 1978). Lave and Wenger (1991) asserted that learning is socially situated with members' active participation in their routines and patterned activities. They put an emphasis on situated contexts in learning, viewing learning as a situated activity. Lave and Wenger (1991) developed their theory about situated learning and developed the concept of legitimate peripheral participation (LPP) and community of practice. Legitimate peripheral participation is explained as a viewpoint on learning in which engagement in social practice leads to learning. The scholars mentioned above commonly emphasize the importance of engagement in social practice and participating in community for meaningful learning. Learners

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should become part of a community of practice through communication and co-construction for effective learning (Bronack, Riedl, & Tashner, 2006, p.221).

Online learning and social constructivism. There are many studies that apply the view of learning and knowledge based on social constructivism to online learning (e.g. Bay, Bagceci & Cetin, 2012; Bronack et al., 2006; Bryceson, 2007; Gulbrandsen et al., 2015; Papastergiou, 2006; Woo & Reeves, 2007). Papastergiou (2006) conducted a study to understand the use of the course management system (CMS) in creating online learning environments. He claimed that course management systems support the social constructivist approach to learning. According to the author, CMS was designed on the basis of the social constructivist theory which supports the needs of online learning communities. This study found that CMS supported students' collaborative knowledge building activities by giving them much more opportunities to interact with their peers and providing structure for promoting online interactions as well as monitoring and scaffolding students' learning to instructors. This is aligned with the social constructivist view of learning. Most universities are now using CMS, though it is commonly referred to as a learning management system.

Bryceson (2007) developed appropriate scaffolding mechanisms for enhancing and extending learning in an online environment based on the social constructivist approach. In this research, the author used a concept of zone of proximal development and scaffolding and analyzed five years of student reflections on the scaffolding mechanisms used to promote and encourage learning in five online courses. As a result, Bryceson (2007) suggested a new model of knowledge acquisition in online learning environments. This article explains the suitability of a social constructivist approach toward learning for knowledge acquisition in online learning environments.

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Bronack, Riedl and Tashner (2006) introduced social constructivism as a framework for distance education with the concept of a three-dimensional virtual world. They designed a three-dimensional virtual world to support a community of practice among online students and instructors. They designed virtual worlds by relying on a social constructivist conceptual framework. Their design principles were 1) learning is participatory, 2) knowledge is social, 3) learning leads development through predictable stages via shared activity, 4) a useful knowledge base emerges through meaningful activity with others, and 5) learners develop dispositions relative to the communities in which they practice. By examining their experiences with this three-dimensional virtual world, they found that students interacted with each other more actively and naturally. They found that designed virtual worlds provide rich environments for engaging students in meaningful communities of practice.

Each of the above studies pointed out the importance of a social constructivist approach to learning for effective online learning in their papers, and designed online courses based on the social constructivist approach to learning. Many studies have shown the appropriateness and effectiveness of adapting the social constructivist approach to learning into online learning, and many studies have shown that the use of a social constructivist approach to learning in online course design elicits positive learning outcomes (Barak, 2017; Bay, Bagceci & Cetin, 2012; Gulbrandsen et al., 2015; Oztok et al., 2013; Parkes & Fletcher, 2017; Woo & Reeves, 2007).

In the "Online Course Design Strategies" section I derived the essentials and the most famous components for successful online learning by analyzing existing studies in online course design. Those are increasing interactions; building online learning communities; creating social, cognitive, and teaching presences; providing students support services; promoting students' motivation; and developing openness in online learning. Online courses can contain all of these

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elements by adapting the social constructivist approach of learning (Pailey, 2013). By analyzing

existing studies on online learning that used the social constructivist approach to students'

learning, I found the advantages of the social constructivist approach in online learning,

particularly an increase in students' motivation to learn, an increase of interactions, greater

responsibility for their own learning and development of collaborative skills, and problem-

solving skills. I agree that a social constructivist approach is an effective and meaningful

approach to online course design.

Social Constructivism as Lens for Understanding Human Activity

Individuals are beings who develop subjective meanings of their experiences. Each individual's

subjective meanings are varied and multiple. People negotiate these subjective meanings by

interacting with one another and their environment, and it can create shared meanings (Creswell,

2013). These shared meanings are shared understandings about the world developed by people's

understandings of the world and from their social interactions (Hutchison & Charlesworth,

2003). The development of understanding the world is brought by emphasis on the nature of

social interactions including language and gestures that are used as symbols, and these symbols

take on different meanings depending on the situation and context in which they are situated

(Hutchison & Charlesworth, 2003).

Social constructionists acknowledge no true reality but rather shared subjective realities

that are created as people interact, meaning that reality is dependent on a person's understanding,

and since different people have different understandings there are multiple existences of social

and cultural realities (Hutchison & Charlesworth, 2003). The interaction between people and

their social environments provide dynamic structures for knowledge to develop. This study

adapts specific philosophical assumptions such as ontology and epistemology associated with social constructivism. The ontology of social constructivism is that multiple realities are constructed through our lived experiences and interactions with others, while the epistemology of social constructivism is that reality is co-constructed between the researcher and the researched and further shaped by individual experiences (Creswell, 2013, p.36).

The researcher can use social constructivism as an interpretive model. The main rationale for this use is that meanings are created, learned, and interpreted within social interactions instead of assuming that the meaning of things are inherent (Blumer, 1973). This approach assists researchers investigate the research problem within contexts and relationships in this social interaction (Hutchison & Charlesworth, 2003). Social constructivists put the importance on understanding specific contexts in order to understand the historical and cultural settings of the research place. With this approach, researchers need to interpret the phenomenon rather than describing it (Hutchison & Charlesworth, 2003). Interpretation is used to make sense of how others view the world (Creswell, 2013). Researchers are influenced by their experiences and backgrounds as they interpret their findings. The researcher, then, is aware that his or her experiences influence resulting interpretations and use that awareness to acknowledge the way they interpret their participants' meanings of the world (Creswell, 2013).

Cultural Historical Activity Theory (CHAT)

This study chooses activity system analysis within the context of the Cultural Historical Activity Theory (CHAT) as a qualitative data analysis tool for identifying instructors' synchronous course activity in its social context. CHAT originates from the ideas of the Russian psychologist Lev Vygotsky. Vygotsky developed his theory when in Russia Marxist ideas controlled the

development of collective exchanges. Vygotsky's ideas came to be explained as mediated

actions where the processes between a subject, artifact, or tool, and objects were used to explain

how individuals learn to function in shared activities (Yamagata-Lynch, 2007). Unfortunately,

Vygotsky succumbed to an illness, dying in his thirties and leaving his work unfinished. Two

main successors would take on the task of furthering Vygotsky's work: Leontiev (1974) and

Engestrom (1987, 1993).

The main idea of Vygotsky's work is mediated action. Mediated action is method of

explaining learning, namely how individuals construct their own understanding of their

environment while participating in activities with a particular goal in mind (Vygotsky, 1987).

This process is constructed by noting the individual (subject), the artifact/tools (stimuli), and the

object (goal), as is illustrated in the diagram below. In this process, the subject is the individual

or individuals who are engaged in an activity. The meditating artifact/tool is an item, person, and

knowledge that contributes to the subject's mediated action experience within the activity. The

object is the goal of the activity (cited from Yamagata-Lynch, 2010, p.16). This process is not

saying that the subject is dependent on the artifact/tool in order to reach the object but instead

shows a dynamic relationship in which each part of a mediated action can affect another. The

interaction of these varying parts ultimately shapes the individual mind and continues doing so

over time (Vygotsky, 1987). Figure 3 shows Vygotsky's mediated action triangle.

Mediating Artifact/Tool

Subject

Object
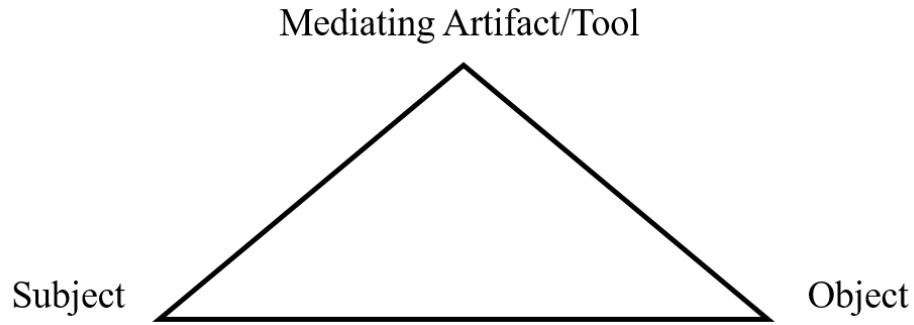
Figure 3. Vygotsky's Mediated Action Triangle (adapted form Cole & Engeström, 1993)

Leontiev built upon Vygotsky's initial construction by further distinguishing between actions and activities. He stresses that actions are temporary and can be considered parts of activities, such as when taking different actions or steps in order to complete an activity (Leontiev, 1978). In addition, he explained that a "subject's activity and its conditions and means are a middle link between the organism and its environment" (cited from Yamagata-Lynch, 2003, p.102). To identify the conditions, goals, and mean which are not visible, Leontiev (1974) developed a three-level scheme that addresses the relationship between a subject's activity, action, and operation.

Engeström (1987) expands the concept of mediated action from an individual perspective to a more analytical and sociocultural one with the development of activity systems. He adds the rules, community, and division of labor to the original process of mediated action (Engeström, 1999). Rules can be both informal and formal and affect the subject's experiences. Division of labor is any task that can be distributed among members of a community, which in turn is the group or organization to which the individual/subject belongs. The addition of these parameters allows for a more methodical analysis of the system by which the individual learns. Thus, the

evolution of Vygotsky's initial mediated action into Engeström's activity system model consists of six components: subject, tool, object, rules, community, and division of labor.

Tool

Subject

Object → Outcome

Rules

Community

Division of Labor
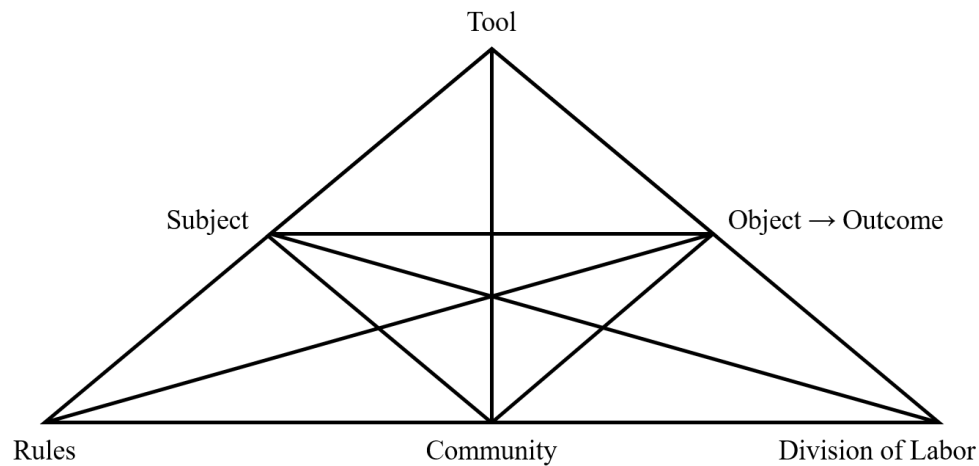
Figure 4. Activity Systems (adapted from Engeström, 1987)

Engeström's original motivation for the activity system model is to allow researchers to identify the tensions that affect the subject's activity. These tensions are brought from systemic contextual contradictions within activity, and those ultimately force participants to adapt the nature of an activity to overcome the issue the tension presents (Yamagata-Lynch, 2010). These tensions interconnect with the six components of the activity system model and present imbalances to the original activity that invoke investigation on the part of the researcher to determine how the participant overcomes the tension (Engeström, 1987). Engeström (1987) identifies four levels of inner tensions or contradictions:

- Primary contradiction: participants encounter more than one tension linked to an element within an activity;

- Secondary contradiction: a new element is discovered, and that element brings about a tension as it is incorporated into the primary activity;

- Tertiary contradiction: a tension arises when participants attempt to incorporate a new method into achieving the object;

- Quaternary contradiction: when participants encounter a change to an activity that results in a tension in an adjoining activity.

CHAT and the activity system model have been used as a framework to examine instructional design outcomes such as courses, educational programs, and learning environments (Jonassen, 2000, Jonassen & Rohrer-Murphy, 1999; Yamagata-Lynch, 2010, 2014).

This chapter focused on summarizing and displaying the results of my literature review. I have reviewed the topics of synchronous online courses, online course design, design thinking and social constructivism. In the following chapter I will discuss the methodology I used in order to complete my research. I will explain rationale for choosing a case study as my methodology, and data collection methods as well as data analysis methods that I used in this study.

CHAPTER THREE

METHODOLOGY

This dissertation is a multiple case study using interviews and content analysis from a constant comparative analysis and a Cultural Historical Activity Theory perspective to identify constraints and design cases of synchronous course design. A multiple case study allows researchers to capture a rich and real descriptive context in research and allows for in-depth examinations of the phenomena being investigated (Baxter & Jack, 2008). The results of a multiple case study allow readers to understand the findings that they can then implement the study in their own research (Stake, 1995).

I recruited five experienced instructors of synchronous online course with specific criteria by using intensity sampling and chain sampling strategies. I relied on three sources of primary data: participant interviews, course materials, and website resources about their course design environments. Particularly, I conducted interviews with participants via video-conferencing software. I used the constant comparative method and activity systems analysis for data analysis. This chapter provides the rationale for choosing a multiple case study and its data collection methods and data analysis process.

Multiple Case Study

Rationales for Choosing Multiple Case Study

There are several reasons to make this a multiple case study and adopt its methodology. The first is the purpose of this study, which is to understand instructors' synchronous course design activities. To gain a holistic and realistic view of synchronous course design, I needed to look

deeper into synchronous courses from multiple sources and consider all the evidence available. A case study allows researchers to collect data from multiple sources such as surveys, observations, interviews, computer transcripts, and participant debriefings to show readers an in-depth and well-reasoned view of investigated phenomenon (Yin, 2013). In this study, I collected data through interviews including instructors' narratives of design experiences and reflection, course documents, and online resources about design space and environment. In addition, there are lack of discussions of synchronous courses because it is an unpopular academic topic that has not been explored yet. A multiple case study allows researchers wider exploring of research question (Gustafsson, 2017, p.3). With a multiple case study, I was able to investigate synchronous course design more widely and so have a broader understanding on synchronous course design activity.

Additionally, one of the goals of this study is to identify wide and complex design constraints in synchronous course design from five instructors' design experiences, and then compares the similarities and differences between each. A multiple case study allows researchers to understand the differences and the similarities between cases (Baxter & Jack, 2008; Gustafsson, 2017; Stake, 1995), and I specifically searched for design constraints in each case and their compare the similarities and differences. Additionally, researchers are able to analyze their data both within each situation and across situations by adapting a multiple case study approach (Gustafsson, 2017; Yin, 2003).

Next, I chose a multiple case study to investigate the context of investigated phenomena. According to relevant literature, pedagogical factors such as course contents as well as contextual and environmental factors such as design situation, technology, and university culture affect online course design (Jonassen, 2008; Yamagata-Lynch & Luetkehans, 2014). A case study is useful in capturing the emergent and immanent properties of real context (Noor, 2008).

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By choosing a multiple case study, I was able to explore the real context and environment of synchronous course design and then use that data to identify how contextual and environmental factors affect instructors' course design activities.

Furthermore, the academic foundation of synchronous course research is weak due to a lack of in-depth discussions of synchronous courses as a whole. From the literature review on synchronous courses, I also found the foundation to be weak and felt the necessity of developing a theory exclusively related to synchronous courses. It was challenging to find studies that provide a basic and essential understanding of synchronous online courses that supports instructors' application of synchronous courses into their own courses. In this aspect, the case study is an appropriate methodology for this study because it has often been viewed as a useful tool for the preliminary exploratory stage of a research project and is well-suited to new research areas (Eisenhardt, 1989). Particularly, a multiple case study allows researchers make more convincing suggestions based on several empirical evidence (Gustafsson, 2017). This study can contribute to develop the academic foundation of synchronous course research with the results from multiple synchronous design cases.

By choosing a case study methodology, I relied on my reflections when interpreting and making meaning of the data. Contextualized focus and subjective reflection have been considered as a unique quality of case studies (Hodkinson & Hodkinson, 2001; Luo, 2011). Researchers' reflections on their experiences can also be an important source of data in a case study (Luo, 2011, p. 9). According to a given case study's epistemological assumption, reality is co-constructed between the researcher and the researched and is shaped by individual experiences (Creswell, 2013). I have a lot of experience with designing online courses as an

instructional designer and have taken five synchronous online courses as a student. I have used these experiences to interpret collected data.

Researchers have more freedom to discover and address issues in the findings with the case study approach (Baxter & Jack, 2008; Becker et al., 2012). This is because case studies focus on exploration about a phenomenon rather than generating prescription or prediction about a phenomenon. A case study allows researchers to start their research with broad questions and narrow and focus their study as their study progresses. In this study, I started with one broad research question: How do instructors design synchronous online courses? But as the study progressed, which included interviewing instructors and evaluating relevant documents, I have narrowed my research focus and as a result specified and developed sub-questions. Hence, one new sub-research question in particular emerged during data collection: How do instructors' previous design experiences with synchronous courses affect their synchronous course design decisions?

Finally, a case study often involves narrative as a course of data (Baxter & Jack, 2008). One of the goals of this study was to write design cases which include designer's information, design situation, design problems, design decisions, its rationale, and designers' experiences with success and failure in design. While materials will provide evidence regarding the product of their design thinking, they cannot encapsulate all of it; important decisions are contained only in the narrative. This is the why all design cases contain narratives (Boling & Smith, 2010; Howard, 2012). Narratives can express the rationale behind why some decisions were made and executed and some were not. To explain instructors' design decision fully and appropriately, I included instructors' narratives about their design decisions based on interview data. A narrative can refer

to the interview data, field notes, and transcriptions that compose qualitative research

(Polkinghorne, 1995).

Case Selection Strategy

This study combines two purposeful sampling strategies that included intensity sampling and

chain sampling for participant selection. Intensity sampling strategy involves selecting

information-rich cases that manifest the phenomenon of interest intensely, while chain sampling

selects cases from people who know people who know which cases are information-rich (Patton,

1990, p.183). Finding potential participants was difficult because teaching synchronous online

course is not a common phenomenon in the field of higher education. To find potential

participants, I used two strategies.

First, I found instructors who have shared their synchronous online courses by

publishing papers. Through the literature review on synchronous online courses between 2015

and 2017, I created a list of instructors who have taught synchronous online courses. Among

those, I found one instructor who shared her teaching experience in detail in the studies and has 6

years teaching experiences in synchronous online courses. I contacted and recruited her as a

participant. She recommended instructors who have experience in teaching synchronous courses,

and I was able to identify two more potential participants. As a result, I recruited three

participants.

Second, I was seeking potential participants at the AECT conference, which is the

biggest conference on instructional design and technology field. This is where researchers and

educators who are interested in the use of technology in learning participate. At the conference, I

met several faculty members who were teaching synchronous online courses, hence identifying additional potential participants. I recruited two participants from this conference.

Participants

Among potential participants, I recruited five instructors from four different universities who had experiences in teaching synchronous courses. I set three criteria to select appropriate participants. First, I chose faculty members and lecturers who had more than three years' experience teaching synchronous online courses. This study investigated instructors' design experiences in regard to synchronous course design. Particularly, one of goals of this study is to write design stories based on instructors' design experiences. Thus, instructors' design experiences were the most important data source for this study. Thus, I recruited experienced instructors who had more than 5 years teaching experiences in synchronous courses.

Second, I selected faculty members and lecturers who were willing to share their design experiences. One of goal of this study is to write design cases that include instructors' design experiences of success and failure rather than to introduce best practices in synchronous course design. To that end, the participants' willingness to share their experiences is vital.

And third, I chose individuals from different universities. Based on the literature review of online course design because I found that cultural, environmental, and organizational factors affect instructors' course design activities (Jonassen, 2008; Yamagata-Lynch & Luetkehans, 2014). It is important to understand those factors in to understand synchronous course design activities. Thus, I tried to recruit participants from different universities to identify and compare the influence of cultural, environmental, and organizational factors on online course design. Table 5 shows the information of selected participants.

Table 5. Participants Information

Name (pseudonym)	April	Chloe	Jane	Kailee	Lorie
Years teaching at a university in general	17 years	13 years	6 years	7 years	15 years
Years teaching synchronous course	6 years	7 years	6 years	5 years	7 years
Area of teaching	Instructional Technology	Instructional Technology	Instructional Technology	Education Policy	Qualitative Research
Academic background	Instructional Technology	Instructional Technology	Instructional Technology	Instructional Technology	Instructional Technology
Position	Professor	Adjunct Assistant Professor & Staff	Associate Professor	Assistant Professor	Professor
University (pseudonym)	T university	T university	H university	I university	G university

All participating instructors regarded their online courses as synchronous online courses. Even though their design included some asynchronous learning activities, they delivered the main portion of learning activities by using synchronous sessions. According to the participating instructors, they use asynchronous activities to improve the effectiveness of the synchronous learning activities. Each participant acknowledged their course was designed with a synchronous course format in mind; thus all participating instructors had at least two hours of synchronous sessions in each week of their course.

Case Study and Social Constructivism

According to Hyett and his colleague (2014) and Yazan (2015), there are two popular case study approaches in qualitative research. The first, proposed by Stake (1995) and Merriam (2011), is situated in a social constructivist paradigm, whereas the second, by Yin (2013) approaches case study from a positivist viewpoint. Yin demonstrates positivistic leanings in his perspective on case study. According to Yazan (2015, p. 137), Yin does not explicitly articulate his epistemological orientation in his text, but by the way he approaches a case study, and research in general, and the aspects he emphasizes most indicate that his philosophical stance leans toward the positivistic tradition. In Yin's book, he continually emphasizes constructing validity, internal validity, external validity, and reliability to ensure the quality of inquiry. These four factors are fundamental in positivistic orientation in research (Crotty, 1998).

According to both Stake and Merriam's philosophical assumptions, one purpose of qualitative research is to understand the way people make sense of their world and their experiences in this world. Stake claimed that knowledge is constructed rather than discovered (Stake, 1995, p.99). In Stake's perspective, qualitative case study researchers act as interpreters and gatherers of interpretation, and this requires them to report their rendition or construction of the constructed reality or knowledge that they gather through their investigations (Yazan, 2015, p.137). Because the philosophical perspective of this study is social-constructivism, this study adapts Stake's approach to case study methodology among others. Stake (1995) claims that case study research is an investigation and analysis of cases to capture the complexity of the object of study. And researchers' goal who conduct a case study is make readers understand the finding and implement the study in their own situation.

Researcher's Role

In this study, I am a researcher co-constructing the understanding phenomena together with participants, and I am also an interpreter who interprets the participants' experiences through my own related experiences, having worked as an instructional designer for ten years. In this role, I have designed many online courses, supported instructors' course designs and delivery, and examined many theories and studies related to online course design. In addition, as a student, I experienced synchronous online courses by taking five synchronous online courses. I have both positive and negative experiences regarding this course format. I had the opportunity to observe and discuss with instructors their difficulties regarding teaching synchronous courses. These experiences affect collecting data and interpreting findings.

During data collection, I called upon my own synchronous course experiences in order to develop suitable interview questions for my participants. When conducting the interviews, I asked questions and responded to the interviewee's answers with my own experiences in efforts to elicit rich, in-depth responses to the questions. For example, one interviewee shared her experiences with a particular video conferencing program with me, including things she had trouble with and things she liked about the program. Based on her responses, I shared a similar experience that I had with the same program. After my response, she shared more experiences with a synchronous tool, following up on the what I had shared with her. Each interview was an active dialogue on synchronous course, not just simple questions and answers.

My experiences as an instructional designer allowed me to interpret my findings and create a cohesive story to share my data. These experiences allowed me to fill in the gaps and read between the lines of my research because I could understand the theories, strategies, process, and terminology participants referred. This also allowed me to empathize with their

approaches to and perspectives on course design. I was an interpreter of data who combined, analyzed, and reorganized collected data, then formed design stories of each instructor's experiences.

In addition, I used the activity systems analysis framework to understand participant design experiences. This allowed me to pinpoint components of activities and tensions that even the instructors themselves may not have recognized. For example, one interviewee did not explicitly state that she had design problems related to an organizational culture, but upon reviewing the dictated interview notes with the activity systems I drafted, I was able to find tensions inherent in a course design activity that was influenced by an organizational culture.

Data Collection

I relied on three sources of primary data: participant interviews, course materials, and website resources about their course design environments. The procedures involved in data collection was broken down to the following activities:

- Online interviews with instructors with a videoconference tool

- Course documents, including syllabi, presentation materials, handouts about instructional activities

- Website recourses about their course design environments, including each instructor's program, department, and university website, universities course support department webpage, website of each instructor's video conferencing tool and LMS

In addition, I also used published articles by three participants whom have published articles that introduced their synchronous courses and design strategies.

Course Documents

I collected course documents from the five participants in order to tailor my interviews. Documents are a rich source of the information that a researcher wants to know (Lindlof & Taylor, 2010). Collected course documents provided a basic understanding of each participant's synchronous courses. In particular, I identified each course's unique characteristics and design features by analyzing the collected documents. Based on analysis results, I developed interview questions tailored to each participant. I collected their course documents though a Qualtrics survey. I provided the informed consent to recruited participants and collected participants' demographic data and their course documents via the survey. Course documents included syllabi, handouts for learning activities, schedules for course assignments, lecture PowerPoint files, and related documents from the recruited instructors.

All participants shared their course syllabus with me. Syllabi included course schedules, course objectives, expectations, characteristics of each course (e.g., synchronous learning environments), assignments, learning activities, course etiquette as a synchronous learner, and information about how to use synchronous tools and how to handle technical troubleshooting. Among five participants, two instructors granted me the right to access their course LMS page, and those pages included more detailed course information such as weekly course materials (e.g., PowerPoint files, handouts for learning activities, and reading materials), announcements, videoconferencing meeting links, course ground rules, and students group information.

Web Resources: Course Design Environments

To understand each participant's design environments, I collected web resources about their design environments such as program, department, and university webpages, university's course

support department webpages, video conferencing tool provider webpages, and LMS provider webpages. These materials developed my understanding of the characteristics of each online program that participants were affiliated, the characteristics of synchronous tools participants used, the LMS they used to design synchronous courses, and university and department culture and supports for synchronous course design.

Online Interviews

The interview was the main data recourse of this study. I conducted interviews with participants to collect their perspective, experiences, decisions and reflections on synchronous course design. The reason why I used the interview as the main data collection method was because the interview method is an appropriate method for exploring and understanding individuals' experiences and perspectives in qualitative research (Lindlof & Taylor, 2010). In addition, this is an appropriate data collection method with a small number of participants. In this study, I collected data from five participants. Conducting in-depth interviews with a small number of the right people will provide significant insights into a research issue (Bradshaw & Stratford, 2000, p.43). By collecting data through interviews, I was able to uncover meaningful and reasonable results.

I engaged in semi-structured interviews in this study. I conducted interviews based on Roulston's *Reflective interviewing: A guide to theory and practice* (2010). I first devised the interview questions. I created nondirective questions including tour questions, example questions, and experience questions which could extract the information that I needed. After writing an initial draft of interview questions, I received feedback from professionals in online course design and qualitative research and revised the questions. The questions focused on

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various aspects of instructors' synchronous online course design methods including perspectives, processes, situations, constraints, problems, and decisions revolving around course design and their reflections. Appendix A is the interview protocol that I used for interviews. In addition, depending on the instructors' answers, I then asked follow-up questions based on my own synchronous course experiences.

I conducted interviews with participants via video-conferencing software. Prior to conducting the interviews, I sent an electronic informed consent contract to all participants Appendix B is an informed consent contract that I used for this study. Each participant signed and scanned it, then sent it back to me. The interviews were recorded using video-conferencing software's record function, and this included audio as well as video. However, in regard to my study I used only the audio as data. I transcribed my interview results using a transcription feature on a video sharing website, which uses speech recognition technology to automatically create captions for uploaded videos. I uploaded the interview files to a video sharing website and established private settings. This setting made the files private where only the person who uploaded the file can view it. After several hours, I checked the subtitles, and then I downloaded those subtitles and edited everything further by listening to the recorded files. Figure 5 shows how I used a transcription feature on a video sharing website.

Figure 5. A Transcription Feature on a Video Sharing Website

Published Articles by Interviewees

Among the five participants, three instructors shared details about their synchronous courses by publishing articles. Those articles include the design situations, strategies, and characteristics of their synchronous online courses. I collected those articles and included them in my data. Table 6 shows a list of articles I used as data.

Table 6. Published Articles by Participants related to Synchronous Course

Name (pseudonym)	Information about synchronous course in participant's article(s)
April	• Sharing synchronous design case with instructor's design decisions and experiences • Sharing a teaching strategy (learning activity) related to synchronous online course with examples
Jane	• Sharing how to design synchronous online course with a specific approach and the successes and challenges of implementing a course
Lorie	• Sharing synchronous design case with instructor's design decisions and experiences

Data Analysis

I used the constant comparative method and activity systems analysis for data analysis. The constant comparative method was used to code data and identify overall themes that contributed to my identification of finding regarding synchronous course design activities. One of the goals of this study was to identify a wide variety of design constraints from the five instructors' design experiences and then compare the similarities and differences of constraints between each synchronous course design experience. The constant comparative method allows researchers to find similarities and differences between each case (Yamagata-Lynch, 2010), and in this way I

was able to identify and systematize constraints for synchronous course designs into various categories. As a result, I identified eight categories of design constraints in synchronous online courses: adaptation of synchronous course formats, converting existing F2F courses, instructor characteristics, learner characteristics, technology, organizational rules, environmental and cultural factors and physical learning environments.

I also relied on activity systems analysis to understand synchronous course design activities in detail and write design cases. The other goal of this study was to write design stories that crystalize an understanding of a complex synchronous course design activity. Activity systems analysis can support researchers to understand human activity situated in a collective context (Yamagata-Lynch, & Haudenschild, 2009). In particular, activity systems analysis allows researchers to classify six components of human activity, identify tensions in activities, and determine how participants overcome them (Engeström, 1987). With this method, I wrote each instructor's synchronous course design story and included designer's information, design situations, constraints, design tensions, and design decisions to constraints and tensions.

Constant Comparative Method

I engaged in a constant comparative method to code data and make to reach an understanding of participant synchronous course design activities. The constant comparative method is a systematic qualitative analytical method that allows researchers to engage in an intense examining and re-examining of the data (Glaser & Strauss 1967; Yamagata-Lynch, 2010). With this method, a researcher can find similarities and differences between sources. In this research, with the constant comparative method I identified the similarities and differences of design constraints in each instructor's design experiences. In particular, I identified similar and different

design constraints among cases through the constant comparative method. I analyzed collected data following four steps using ATLAS.ti 8.0 software: organizing and familiarizing data, identifying categories, coding the data, and then generating themes and interpreting them.

Organizing and familiarizing data. I organized the data to conduct a proper analysis. I first cleaned it up to make interview results, then collected documents and web resources that could potentially be analyzed. I conducted minor editing. I deleted from the transcripts all the extraneous chats and comments that occurred during each interview. I transformed collected data into a manageable format. For example, I converted web resources to PDF files. By organizing the data in this manner, I became better familiarized with it.

Identifying categories. After organizing and becoming familiar to the data, I identified emerging categories in the data. A category is a segment of data that is relatively discrete (Rossman & Rallis, 2003). To identify the categories, I took both inductive and deductive approaches. Rossman and Rallis (2003) explained the use of both inductive and deductive approaches for identifying categories in their book. First, I identified categories before data analysis based on existing study. According to Rossman and Rallis (2003), researchers may rely on categories they have developed through related literature and previous experiences that are expressed within a conceptual framework (p.278). Following this recommendation, I identified categories based on Jonassen's existing study on design constraints and used those as pre-identified categories for coding data. Jonassen (2008) introduces seven types of design constraints in instructional design: technologies available/preferred/accessible, economic (funds), political/organizational rules, environmental, learner characteristics, learning goals, and physical context. Jonassen's theory applies to instructional design work in general, and since this includes synchronous online course design, this allowed me to apply his theory to my investigation as pre-

identified categories of design constraints, and so I coded data with these pre-identified

categories (deductive approach).

Reflecting on my analysis results, I modified these pre-identified categories from

Jonassen's theory. Among the pre-identified categories, I removed the "funds" category, as the

courses selected for this study were allowed to be delivered in a synchronous online course

format, meaning that the universities decided to support the courses by both allowing them to

happen and providing guaranteed funding, which ensured that the instructors did not need to

worry about purchasing synchronous platforms on which to support their courses. I also removed

the "learning objectives" category, one of Jonassen's design constraints. According to their

responses, the instructors used specific teaching theories and strategies to design courses that

help students achieve learning objectives. However, among the interviewees' responses I was not

able to find any design constraints in learning objectives. Participants talked about issues related

to funds as a design constraint, though, so I sorted those issues into the "organization rules" or

"environmental and cultural factors" categories. I changed the names of specific categories to

allow them to more clearly represent the characteristics of the categories: technology;

organizational rules; environmental and cultural factors; and physical environments.

Furthermore, I generated new categories that covered other design constraints that could

not be included within the pre-identified categories (inductive approach). According to Rossman

and Rallis (2003), researchers identify indigenous categories which are expressed by the

participants. A researcher can discover categories through analysis of how language is used

(p.277). By reading collected data over and over again, I generated new categories that covered

other design constraints that could not be included within the pre-identified categories:

adaptation of synchronous course formats, instructor (designer) characteristics, and converting

existing face-to-face courses. These are not listed in Jonassen's existing study on design constraints, but adaptation of synchronous course formats and instructor (designer) characteristics are more frequent types of design constraints than other categories.

As a result, I identified eight total categories that explain the different types of design constraints: adaptation of synchronous course formats; converting existing face-to-face courses; instructor (designer) characteristics; learner characteristics; technology; organizational rules; environmental and cultural factors; and physical environments.

Coding the data. With the identified categories, I coded the data. For coding, I followed three steps: open coding, axial coding, and selective coding (Strauss, 1987). I started my data analysis with open coding. I coded particular words and sentence relevant to the research question. I kept an open mind while conducting open coding. Each code was undetermined prior to my analysis but emerged and was continually refined throughout my interaction with the data. By doing open coding, I developed ideas for grouping and organizing identified codes according to the characteristics of each code. I coded and re-coded the data until I could no longer find new codes, and as a result of open coding I defined each code and developed a rough draft of relationships between codes. Figure 6 is an example of coding results related to design constraints. That is one instructor's response when asked why she decided to not include a synchronous session in their course. As can be seen, with her answer as a guide I identified various types of design constraints that affected the instructors' design decisions.

After open coding, I conducted axial coding. In this stage, I tried to discover and identify the relationships between each code, family of codes, and sub-family of codes. At the end of axial coding, I identified themes and categories among the codes that I had discovered.

There's several reasons that I did not. We changed platforms. The university supports Blackboard
Tool change

Ultra but they have no support for it. And it's very glitchy there's a lot of bugs in it. So it was
Lack of support — **Technological issues**

very frustrating last fall when my colleague tried to use it. We used Adobe Connect and that was

great but our department paid for that separately. The university doesn't support it so, but it was

very stable and it always worked well so once. I was comfortable with it. That was great, but
Tool change: positive with previous tool

changing to a new tool without the support. I just get tired of always having to learn the new
Tool change + Lack of support — **Tool change: learning new tool**

tools and so that was part of it. I haven't had any downtime to really test out the tool. And then
Tool change: learning new tool

because I'm doing two online courses. I knew scheduling would be a real nightmare because
Scheduling

there's a lot of students in both of those courses so to find a night that both of them. I think that
Scheduling + Night class (learner characteristics)

using the synchronous classroom is pedagogically better like to have both synchronous and
View on synch

asynchronous. But it's also kind of twice as much work as a face to face class.
More workload

Figure 6. Design Constraints Coding Example

Finally, I conducted selective coding. The next step of constant comparative analysis was activity system analysis. To use that analysis method. I conducted selective coding that identified the subject, tool, object, rule, community, and division of labor in design activity. Yamagata-Lynch (2010, p.75) provides a list of questions for selective coding that can be used in research that uses activity systems analyses. Those questions are:

- What is the activity setting in which these activities are situated?

- Who are the subjects of these activities?

- What is the shared object of these activities?

- Do different subjects participating in the same activity view the activity and the object differently? If yes, why?

- What tools, rules, community, and division of labor are involved in these activities?

- What systemic contradictions are bringing tensions into these activities?

- What are the outcomes of these activities?

- What historical relationship does one activity have with another?

- How does one activity interact with another?

By answering each question, I identified the subject, tool, object, rule, community, and division of labor of each case roughly for the next step of data analysis.

Generating themes and interpreting. With all of the identified categories and codes, I proceeded to generating themes and interpreting them. I compared the similarities and differences of codes about constraints between cases and systematized constraints for synchronous course design into categories. I described themes about identified constraints, similarities, and differences of constraints in the form of declarative statements and then

interpreted them. As a result, I conceptualized twelve common characteristics of synchronous online course design based on design constraints.

Activity System Analysis

I engaged in activity systems analysis to understand each instructor's synchronous course design activity in detail. Specifically, I wanted to understand what kind of constraints existed in each participant design activity, how those constraints created tensions by interacting with each other, and how participants made design decisions to work with tensions. Activity systems analysis is a method that originated from cultural-historical activity theory (CHAT). With activity systems analysis, researchers can identify six components of an activity and tensions (subject, tool, object, rules, community, and divisions of labor) and represent identified components and tensions as a triangular model which is called an activity system (Engeström, 1987). I chose this analysis method because in my past experience it had been an effective and efficient strategy in identifying tensions, factors that caused tensions, and solutions to those tensions in instructors' synchronous course design activities, and writing design stories.

In addition, this method helps researchers understand human activity situated in a collective context (Yamagata-Lynch, & Haudenschild, 2009). Existing studies on online course design often conclude that designing online learning is related to various cultural and environmental elements such as community, organizational culture, rules, course design support, course tools, and people (Jonassen, 2008; Themelis, 2014). Activity systems analysis considers cultural and environmental influences as essential factors that affect human activity and support researchers in identifying those influences. With activity systems analysis, I was able to identify

how cultural and environmental factors affected instructors' synchronous course design activities and how similar constraints and tensions worked differently in different design situations.

While engaging in activity systems analysis I followed three steps what I learned from the previous coding experience of the data. First, I identified the subjects, tools, objects, rules, communities, and divisions of labor in each synchronous course design. According to the definition of each component, I checked the coding results and re-classified each again. I also matched specific components with design constraints which had been identified through the constant comparative analysis.

Second, I identified tensions that affected each instructor's design activities. Tensions are found in interactions among the six components, and I identified the relationships between the components and how those relationships created tensions. I also identified how instructors make design decisions to handle tensions because tensions ultimately force participants to adapt the nature of an activity to overcome the tensions (Yamagata-Lynch, 2010). Based on the results of steps 1 and 2, I drew participant design activities following the activity systems models as seen in figure 7. Appendix C is an example of activity system analysis results about Chloe's design case that include activity components and its specific items, activity system model, and identified tensions.

Third, I identified findings from the activity systems models I drew for each case and represented those findings in a narrative form. Based on activity systems analysis results, I wrote each participant's synchronous course design story consisting of design situations, problems, and decisions which is a design case. To present participants' voice in a design story, particularly their design decisions, I needed to include descriptions of the participant' perspective and past experiences, design situations, and design problems that explain their design decisions.

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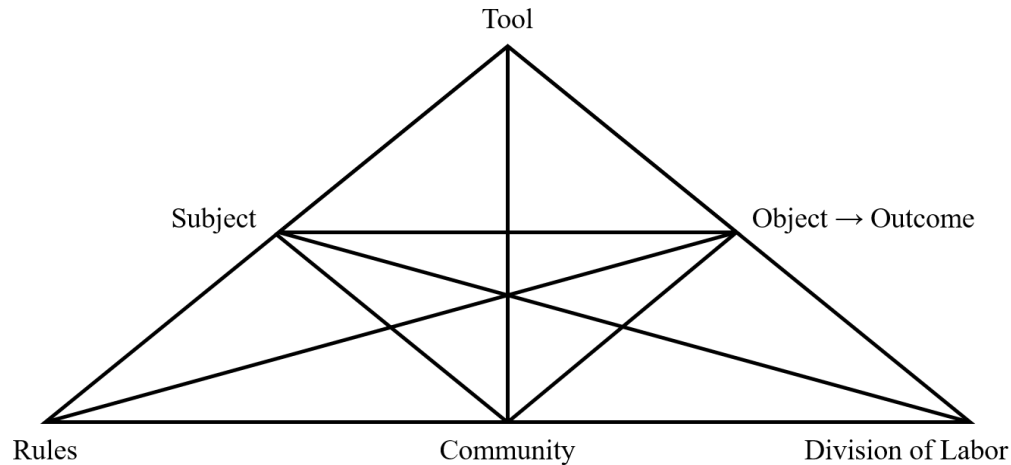
Figure 7. Activity Systems Model

Efforts to Maintain Trustworthiness

To establish trustworthiness for this study, I used several strategies. I established credibility and

dependability based on Lincoln and Guba's research (1985) with the following data analysis

strategies. To establish the credibility of my findings, I first interpreted data from multiple

resources, including interviews with the participants, course documents, and web resources

related to design environments. This all allowed me to investigate more deeply into synchronous

course design experiences from multiple sources. Findings based on multiple resources show

readers an in-depth view of investigated phenomenon.

Second, I used a peer-debriefing strategy (Erlandson et al., 1993). I shared identified

codes and categories with two professionals who had experience with synchronous course

design. One was a doctoral student who had investigated online course design and had taken

seven synchronous courses. The other was an instructional designer in charge of supporting

instructors' synchronous courses design and delivery. These peers provided accountability for

the conducted research and its results (Cornish, Gillespie & Zittoun, 2013). They reviewed codes and categories and asked questions about the contents as they reviewed my results, and we reached inter-coder agreement on the whole. These peers, with their experience with synchronous courses, helped validate my results. And third, I reported my findings with direct quotations from the instructors I interviewed. Those quotations acted as accurate accounts of the interviews and will promote confidence in my findings.

As for dependability, first I used ATLAS.ti 8.0, a qualitative data analysis tool. It allowed me to code the data under identical coding environments and with specific rules and allowed me to write analytical memos and process notes. Second, I used two data analysis methods: the constant comparative method and activity systems analysis. I followed each analysis method's procedure as suggested by other researchers. I followed Strauss's suggestion for constant comparative analysis (1987) as well as Yamagata-Lynch's suggestion for activity system analysis (2010). These procedures allowed me to analyze the collected data systematically.

I promote trustworthiness in this study by establishing its authenticity (Morrow, 2005). I investigated the context and culture of the investigated phenomena. I used the social constructivism approach as a lens for understanding human activity. According to this approach, individuals construct, learn, and interpret meanings within their social interactions (Blumer, 1973). To understand a participant's constructions of meaning, researchers need to investigate the context and culture of their investigated phenomena (Morrow, 2005). I explored the cultural, organizational, and environmental factors of the instructors' design situations and analyzed them to identify how those factors affected the instructors' design decisions. Each design case includes

sufficient information about the culture and context of the design situations, and in this way I improve the authenticity of this study.

In this study, I am a researcher co-constructing the understanding of a phenomena together with participants, and I am also an interpreter who investigates the participants' experiences through my own related experiences, having also worked as an instructional designer. Thus, I stated my view of understanding human activities, my theoretical framework for understanding online learning, and my role as a researcher in this study. These statements show how my understanding and experiences have affected the interpretation of my findings and established the trustworthiness of this study (Patton, 2005).

In this chapter I discussed the methodology of this study and the various methods I have used to complete my research. I explained why I chose a case study, how data was collected and the sources used, concluding with explaining how the data was analyzed. The next chapter will describe the results of the study. As a result of this study, I identified design constraints in synchronous course design and wrote five design cases of instructors' synchronous course design experiences.

CHAPTER FOUR

RESULT

The purpose of this study is to understand synchronous course design activities in order to support instructor's effort to develop their own synchronous courses. To achieve this purpose, I investigated instructors' synchronous course design activities with two goals: first, to identify a wide variety of design constraints that emerged the during design process for synchronous courses. and second, to write design cases that captured the design experience and knowledge embodied in the synchronous course design activities of the experienced instructors.

This chapter consists of sections addressing three topics: design cases in synchronous online courses, design constraints in synchronous online courses, and design considerations. In regard to presenting my findings, I have decided to present the design cases first despite writing them as the last step of my data analysis. I am presenting design cases first because this will allow readers to form a better understanding of the design constraints. Reading each design case can provide readers with a full understanding of each instructor's synchronous course design activities, including what constraints emerged during instructors' design processes and how they affected each instructor's design decisions. With this solid basis of understanding of each design activity, readers can be more familiar with design contexts and better understand the inherent design constraints within this context.

With this rationale, in this chapter, I present five synchronous online course design cases at first. I wrote design cases based on the results of activity system analyses. I introduce each synchronous course design case with information about its designer, the design situation, and related design strategies, design tensions I conceptualized, and identified solutions to specific

tensions. Specifically, I describe how the design constraints interact with one another and how interactions lead to further design tensions, and instructors' solutions to those tensions.

Second, I list design constraints and explain them with direct quotations from instructors. Design constraint refers design limitations that affect instructor's design decisions. Based on the results of constant comparative analysis, I identified design constraints that emerged during the design process of synchronous online courses and categorized those into eight categories. I introduce the general characteristics of a category at first, and then explain specific each design constraints direct quotations.

Finally, I present a list of design considerations. By identifying design constraints, I also found factors that affected instructors' design decisions on synchronous course. I called those factors as design considerations. Design considerations are not limitations unlike design constraints but things which simply added a design task for the instructor or factors that created design tensions by interacting with other design constraints and considerations. I wrote a section about design considerations that I found by analyzing each design case.

Design Cases of Each Synchronous Online Course Design Activity

I wrote five design cases from the five instructors' synchronous online course designs, all based on the results of activity system analysis using the findings related to design constraints. A design case is a description of a real artifact or experience that has been intentionally designed (Boling, 2010, p.2). Particular design knowledge is embedded in design cases, and that type of design knowledge is called design precedent. Design precedent is a representation of knowledge from past designs that can be reused in new or similar situations (Flemming & Aygen, 2001).

Thus, I wrote design cases focusing on design precedent. Readers can improve the understanding on investigated synchronous online course design activities and use design precedent in their own decision-making processes by reading and analyzing design cases.

Each design case takes the form of a narrative that include description of the descriptions of designers (perspectives and relevant past experiences), situations (related people, cultures, organizations, and environments), design features corresponding to the design constraints, design tensions (that I identified as an investigator) and its solutions. I have included relevant information that affected participant design decisions, and each section was written based on an instructor's experiences and reflections on course design. By analyzing data I collected, I found two types of design problems in each design case. First was a simple design problem which was generated by a design constraint. This design problem could be solved with a single solution. In writing precedent, I described these solutions as design features. The other was a design tension which was created by the interaction of some different and contradictory design constraints. Design tension was an ill-defined and complex design problem that I identified through activity system analysis. I described how design constraints in each participant situation interacted with one another, how those interactions introduced added design tensions, and how the instructors solved their design tensions in the section entitled "Design Tension and Solutions". Particularly, I drew illustrations that described each tension, and included those after explaining tensions. Table 7 shows the detailed sections and specific items of each section of each design case.

Table 7. The Sections and Items of Design Case

Section	Description	Specific Items
Designer	The instructor's information as a designer.	• Online course teaching experience in both asynchronous and synchronous courses • Teaching philosophy • Views of synchronous online courses • Design approaches and principles to synchronous courses • Particular previous experiences that affected their course design
Design Object	The course information as a design object.	• Titles of course (pseudonym) and subject area • Course objectives • Main assignments
Design Situation	The instructor's design situation, including students' characteristics, organizational culture, rules, and teaching tools.	• Student characteristics: majors, populations, locations, jobs, numbers, etc. • Technology: information about video conferencing tools and LMS • University or department rules • University or department culture • Support for synchronous course design • Other teaching environments: affiliations, course dates, etc.
Design Outcome	The course structure and elements and design features of the synchronous course designed.	• Course structure and elements • Design features: design decisions for handling design constraints or to improve course design
Design Tensions and Solutions	Interacting design constraints and resulting design tensions. I have identified design tensions and the instructor's solutions, if any.	• Design tensions that a researcher identified • Illustrations about each design tension • Solutions to design tensions that a researcher identified, if any

All design cases have the same five-section structure: Designer, Design Object, Design Situation, Design Outcome, and Design Tensions and Solutions. However, depending on the responses from each instructor, there are differences in the specific items of each section for each design case. I tried to write each case with as much detail as possible, using direct quotations from the interviewees when appropriate.

Case 1: Chloe's Instructional System Design Course

Designer: Instructor Information

Chloe taught an instructional system design course with a synchronous course format at T University. She started teaching the course in a face-to-face setting in 2008, but at the same time she was involved in helping her department design an online version. In 2010 she started teaching the course with a synchronous course format and continued to do so until 2014 when she went back to working full-time. In 2017, however, she started teaching the course again.

Chloe was a full-time staff employee of the course support team at the university and an adjunct assistant professor in the instructional technology program. These aspects of her life as a full-time staff member affected her course design. Because she was a full-time employee and most of her students were as well, she understood that it was sometimes hard for students to meet deadlines, so she tried to be as flexible as possible. However, everyone was often busy, so it got to the point where Chloe said, "As long as I get it in the day before class, I'll try to get it graded or look at it." This method of accepting submissions until just before the next class was taxing on her as she overextended herself to get the work graded and provide appropriate feedback while dealing with her own full-time work. Fortunately, as a member of the course support team, she had easy access to help from technology experts.

Teaching Philosophy. Chloe designed her synchronous course to reflect her teaching philosophy. To her, authentic learning was an important value in her course. She wanted to provide authentic, relevant, real-world tasks that were relevant to students' future careers. She said:

> *The guiding principle is to make it as an authentic experience to what they're*
>
> *going [to be doing] so that the transfer is better when they go to design*
>
> *themselves [at their work].*

Chloe designed learning activities and teaching strategies to create a course that provided authentic learning experiences for her students. In her filed, when students get a job, their primary task is designing educational programs that meet client's needs as an instructional design team member. Chole wanted to provide similar experiences to students. Chloe explained:

> *It is a very intense course because the students are the team and the instructor is*
>
> *the project manager. Students are doing a project for an actual client. So I have*
>
> *to play the role of making sure the students are not overworked for a semester's*
>
> *worth of work and the client still gets the product they need.*

In her course, she acted as a project leader, and tried to provide enough feedback regarding her students' progress on their projects.

Design approach to synchronous online course. Chloe also had her own views regarding what makes a successful synchronous online course. She believed that the most attractive benefits of synchronous online courses is having the chance to interact with an instructor who is an expert in their field and also a facilitator for a course. She said:

I was saying it [a successful synchronous online course] takes advantage of the

time with the students to provide that access to the expert that they need and

because, frankly, any type of lecture or content they can get some other way and

so this this time where you are there for them. They need to be able to ask you if

they've got a question or if they don't understand something they need to be able

to interact with their instructor and with their peers.

Chloe tried to design a course that provided this benefit to students. She designed many learning activities in which she could interact with students and minimize the lecture portion during synchronous meetings to free up more time for sharing her experiences and assisting students' learning. She believed these interactions in synchronous sessions allowed her students to practice in a sandbox type of environment where it was alright to make mistakes. She also thought that it promoted interaction among students, a key element of synchronous course design, and allowed everyone to share their experiences, particularly students who had prior experience with design. They were able to reinforce what they knew and feel good about their knowledge base by sharing it with their classmates.

Chloe felt there were limited recourses for synchronous online course design because most of the principles of online course design focused on the asynchronous course format. When sharing her ideas about this limitation, she said that she needed to optimize her time in much the same way a person who conducts a flipped classroom wants to optimize their time with their students.

Chloe had experience with several asynchronous and synchronous tools for online courses such as Sentra, Blackboard Collaborate, and WebEx. In the past, she explained, the tools instructors had for designing an online class had been far less sophisticated, so they would try to

make things as simple as possible. But with recent tools, Chloe said that she was able to design online courses as she wanted. She designed her course that used various functions of tools without worrying about technological errors.

Design Object: Course Information

The goal of instructional system design course is for students to develop a working knowledge of the systematic, systemic, and iterative instructional design (ID) processes as well as an understanding of how to use learning theory as a foundation for the design of instruction. For her course, Chloe stated five learning outcomes in the syllabus, one of which was "The course participant will analyze existing instructional materials to identify the foundational assumptions about learning and to differentiate between types of instructional designs."

Chloe provided students with a semester project which involved creating an instructional design plan, and they were asked to design a learning program as well. This project consisted of three tasks: writing a project proposal, writing the final instructional design plan, and presenting the instructional prototype. Chloe designed several activities to support her students' projects. In synchronous sessions, students were able to build their design plans and receive feedback from both their peers and their instructor.

Design Situation

Students. This course was for online graduate students in an instructional technology program. Chloe said that most of the students, in fact, were full-time employees with varying background knowledge about several topics because they worked in different areas. She said:

You can't assume that everybody's coming in with the same level of prior

knowledge.

In Chloe's courses there were students who were familiar with course topics as well as students who lacked basic understanding of them. Given these different levels of background knowledge, she needed to design a course structure that would consider them all. In addition, she said that many of her students had difficulty meeting deadlines for assignments and reading instructor feedback because they were often so busy with their regular work.

She also reported that she had students who had connection issues. She explained:

I do have students every semester have connection issues. Maybe they're trying to

be to connect on a tablet or their phone. I had a student who was in the Air Force

who frequently had issues with connection.

Technology. Chloe's university was using Zoom as its video conferencing tool and Canvas as its LMS. The university had switched from Blackboard to Canvas, and since she had previous experience with Canvas, the transition was not too bad. As for Zoom, the university had switched from Collaborate. About this change, Chloe said:

Zoom was totally new to me, but I love it and it's so much better than anything

else I've ever used.

Support. Chloe's university had a department responsible for supporting online course design and delivery, and this department provided support to instructors. There were several services available related to design and delivering synchronous online courses as well as immediate tech support for online instructors and online students, one-on-one consultation for

instructors' course designs, resources for using Zoom and Canvas, and various face-to-face training opportunities related to using video conferencing tools and LMS in online courses.

Affiliation. Chloe was working as part of this support department as a full-time instructional designer, thus she was able to access the aforementioned services more easily. In particular, she was able to contact experts with Zoom and Canvas as well as online course design. In the semester I engaged in this study, this support department focused on accessibility and universal design for learning. Their team was designing and delivering a training course regarding the increasing accessibility of learning materials. Also, all team members had participated in accessibility training and were asked to apply that experience to their work. Within this department environment, Chloe redesigned her course materials to increase accessibility.

Teaching material: textbook. For her course, Chloe used a textbook she had written as a tool to compliment the course. She used it for an asynchronous activity in which the students read a chapter and took an ungraded quiz to check their comprehension before class. Such quizzes were set up so the students could take them as often as they wanted, making them a useful review tool. The quizzes also helped distinguish key aspects of the book's chapters and guided students in pinpointing what was need-to-know information.

Chloe also used the textbook for a synchronous activity: She designed synchronous presentations and discussion activities that summarized each chapter or extended them, showing the chapters in a different light. Chloe added that the textbook provided students with good examples that they would have had a hard time finding otherwise.

Design Outcome

Course structure and elements. In Chloe's course, participants met synchronously every week for three hours. The structure of the course varied, Chloe said, depending on the content or topic each week. I have reviewed each week's instructional materials and found that she had various course elements and different structures to that end. Course elements she added to her course included asynchronous discussions before class, quizzes, tests, activity reviews before class, lectures, whole class discussions, group activities, one-one-one meetings, and weekly assignments.

Each week, Chloe had different combinations of course elements depending on the topic, however, asynchronous discussions, quizzes, group activities, and weekly assignments were the main course elements each week. Chloe designed various activities for before class by using the textbook. Each week, students needed to read a chapter of the course text, complete a quiz on the reading, watch a related presentation, and make notes of a QQTP (question, quote, and talking point) from the reading or presentation for class.

Design feature 1: designing an individual project for students' understanding of topics. Chloe included the individual project as a course element to create more opportunities to interact with each student and provide a better understanding of course contents and activities. She felt that combining groups and individual projects might be too much work for some students, but she included an individual project in her course anyway, reasoning:

> *I've tried it [synchronous online courses] as group projects as well as individual*
>
> *projects. Quite honestly, it's a lot to do in one set semester and students are just*
>
> *some are just overwhelmed. Thus, I try to be there as much as I can and I tried to*
>
> *scaffold as much as I can. But when I've tried it as a group project, I feel like*

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there are more opportunities for people to miss and not understand certain

elements of the process. And so I feel like it's really important for them to have

their own individual project and work through it all the way.

She was using a benefit of synchronous online course, that being that "instructors can correct students' understanding of a given topic and clarify its meaning" by including the individual project.

Design feature 2: providing detailed guidelines for assignments. Chloe provided students with very detailed guidelines for the individual project and asynchronous discussions. In particular, she divided the steps of the individual project and developed specific handouts for each step, including instructions for how to do the task, worksheets that students could use for the task, previous students' work as examples, and a checklist for the activity. Chloe got permission from students who were in previous semesters to let her share their work as examples. She wrote in one handout:

Below are links to several example design plans from previous semesters. These

students have graciously given their permission to let me share their work so you

can see how some have chosen to organize their instructional design plans.

These guidelines supported students in understanding the individual project and its specific tasks correctly and conducting and completing those tasks more easily as well. Students were able to conduct a task without additional questions to the instructor.

Design feature 3: providing enough feedback for student's individual projects through one-on-one meeting sessions. Feedback was one of the most important teaching strategy that Chloe could provide as an instructor, and that was why she felt it was so important for the students to have their own projects and work through it from start to finish. The final

project that students had to complete was a two-part final capstone project that involved a plan

and a prototype. When they completed their plans, they showed Chloe that they understood what

was going on with the process, and upon completion of their prototypes they showed her the

implementation of their plans.

Chloe also had students include a feedback table at the end of the plan portion. This table

was used to show that the students had taken the feedback provided to them, and they were

required to respond to the feedback by implementing or ignoring it and providing justification for

their actions. She said that students praised the amount of feedback she gave them.

However, Chloe felt insufficient time to provide enough feedback during synchronous

sessions, so she designed strategies to overcome this obstacle. First, she provided written

feedback that was included in a PDF. Second, she designed one-on-one meeting sessions. Chloe

explained:

> *I have done one-on-ones with them. I pull of each person out of their group and*
>
> *have my one-on-one with them send them back take another person out of another*
>
> *group and everything.*

Chloe would put the students into their groups and assign them group activities. At that time, she

pulled out individual students for one-on-one time, then put them back into their groups before

picking someone else, and so on. During this time they discussed the objectives, and Chloe also

wanted to make sure they understood what they had turn in and that they were discussing it in

their groups.

If Chloe felt as though students were missing something, she also used this time to let

them know. For this, she encouraged students to read her written feedback to their individual

projects before they met one-on-one to discuss it. In addition, Chloe tried to make herself as

available to her students as she could. She sometimes stayed on Zoom after class and even arranged times to meet her students using Skype.

Design feature 4: providing options for student presentations and preventing technical issues. In Chloe's course, one assignment was a prototype presentation. She thought that both PowerPoint and Storyline were effective applications for this assignment, so she gave students the option of using either. However, she found that Storyline was not entirely compatible with the video conferencing tool. She had to develop a strategy to handle that. Chloe explained:

I have done one-on-ones with them. I pull of each person out of their group and have my one-on-one with them send them back take another person out of another group and everything.

And so, students could present their prototypes in PowerPoint by creating a PowerPoint presentation incorporating screenshots from Storyline.

Design feature 5: preventing technical issues during synchronous sessions. In relation to the prototype presentations mentioned above, Chloe always had students upload their presentation materials the night before class as a back-up option in case they were unable to present their prototypes from their own computers. With the materials uploaded, Chloe could take over and share the presentation with the rest of the class as the student presented it. She tried to have a back-up plan for everything that could go wrong.

In her first class, Chloe spent time introducing how to use a video conferencing tool. Figure 8 shows the second slide of her first-week presentation that explained the main functions of Zoom that she used most frequently. With this information, Chloe also explained how to handle technical issues during the first class. She suggested three ways to do so:

- *If you have technical problems during class, type me a message in the Chat window, at the bottom left of your screen and/or email me.*

- *If your sound or visual goes "flaky," try exiting and re-entering the Zoom meeting.*

- *If you still have problems or can't re-enter the class session, email me or contact university support team (website and phone numbers)*

And Chloe included in her syllabus how to get tech support from her university's support department. She did this because in the past she herself had had an issue with connecting to the internet, and she had also had students with connection issues.
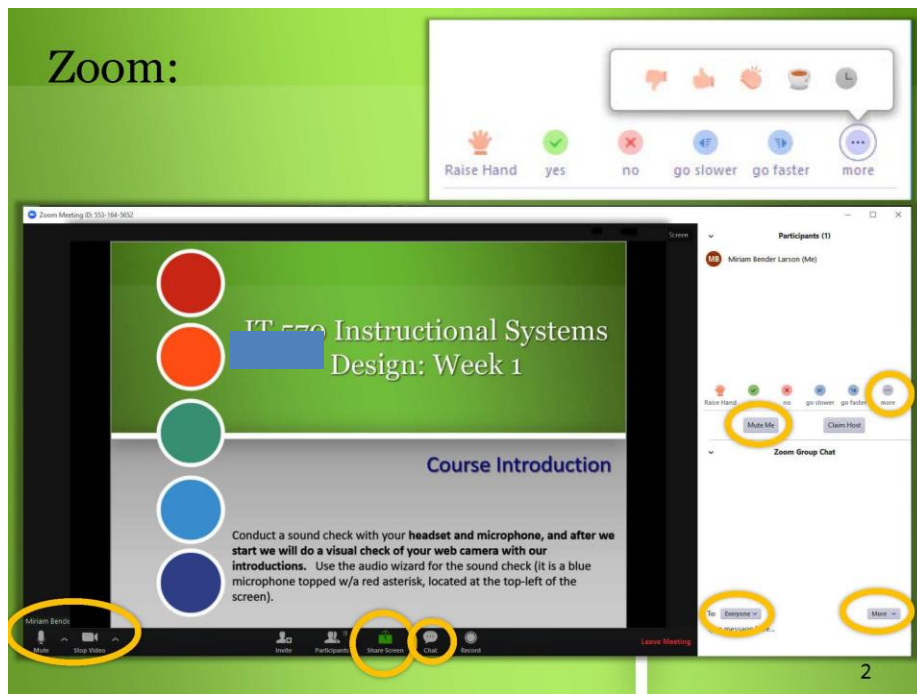
Figure 8. Chloe's Presentation on How to Use Zoom

Design feature 6: asking students to upload their photos to build social presence.

Chloe explained a strategy she implemented as an icebreaker at the beginning of the course:

> *I always do at the beginning of the semester is that I had them do like a personal*
>
> *biography and they can they can upload a photo, but I can't insist that they do*
>
> *that because of University policy.*

She asked the students to upload a photo of themselves or a doppelganger with a brief description of themselves. Uploading photos was part of her teaching strategy, and it was intended to build the social presence of online learners. But she stated that because of a university policy she could not insist that students did this. However, she could ask to get a feel for her students.

Chloe provided an example with her photo and a description of herself so that the students were able to learn about her. She went on to say that she had only had one student who used a doppelganger photo rather than a real one, and that just proved that they still wanted some sort of social presence rather than skipping the icebreaker altogether.

Design feature 7: developing a group assignment strategy based on her teaching philosophy. About a group activity, Chloe explained:

> *I cannot think of any class where they have not had group interactivity.*

A group activity was essential in Chloe's course. For group activities, she developed a strategy for assigning group effectively. Groups were assigned after the first day of class. She grouped the students in two ways, one based on their career environments and the other a mixed group, and those were the groups they were in throughout the semester. When students were put into their breakout rooms it was only with either one of those groups, so there was a consistency within the feedback they received.

Students generally placed themselves in a career environment group, so Chloe gave them the choice of staying in that group or being placed in a career group for where they wanted to be. For example, someone was in the K-12 group because that was their current career goal, but they switched to a higher education group because that was the career they wanted to pursue. Chloe noted that in most learning activities, she had them break into their career groups because they would usually provide more relevant feedback to each other based on their career backgrounds and interests.

Toward the end of the semester she had them switch groups and received feedback from students who were in totally different career environment groups, and that provided interesting feedback that the students' would not have gotten in their original groups. This blending and sharing of feedback helped students overcome blocks they may have experienced with their projects or see things from entirely different perspectives.

Design feature 8: supporting group activities by providing a rule for group work. Chloe had a strategy of facilitating students' group activities. She asked students to pick a facilitator, a recorder, a timekeeper, and a reporter for their group activities. In particular, a reporter recounted what the group discussed or accomplished in their activities. Chloe encouraged this role to go to a different person each time so that everyone could try their hand at that form of participation. She felt that it was important to share roles because design and speaking during synchronous sessions would be part of their careers, therefore students had to be able to summarize and synthesize work. Figure 9 shows a slide she used to explain the different roles in group activities.

Figure 9. Guideline for Group Work: Assigning roles

She went through a trial-and-error period in which she thought these roles were not necessary and tried the course without them before realizing they were necessary after all. She included the roles in the group sessions in order to enrich her students' communication skills.

Design feature 9: explaining the etiquette for synchronous communication. Chloe had to include an etiquette section in her syllabus for students who were unfamiliar with synchronous online course formats. She wrote in her syllabus:

Classroom Etiquette

Your efforts to minimize distractions during synchronous class meetings reflect

respect for your course peers and instructor. Silence your cell phone, and take

measures to remain engaged so that you can participate when called on for

comments or to answer questions. Due to the current limits of technology,

synchronous environments do not provide all the visual cues required by

instructors to effectively orchestrate a meaningful discussion. The cooperation of

all session participants can improve the quality of these sessions, so do your best

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to respond to questions posed for discussion, asking for clarification when

necessary. In addition, be aware that you may occasionally be asked to monitor

the chat window or facilitate a small group discussion. When you contribute

verbally, you will be expected to have your microphone and webcam on so the

class can see and hear you. When not speaking it's a good idea to mute your

microphone. You are also expected to abide by the University's Civility Statement

in your interactions with your course peers and the instructor

This statement included the characteristics of synchronous communication and how to communicate with others in synchronous learning environments.

Design feature 10: redesigning course materials to increase accessibility. With assistance from her instructional support unit, Chloe worked on increasing the accessibility of course materials, including redesigning them. Still, she faced several issues in doing so:

With the push that we had in the department here, I have started trying to go

through my materials slowly and surely and see. I found several issues on my

existing materials. I'm gonna have to do something about it. So I started to go

through and adjust that. I haven't gotten through all of them yet. Okay, it's time

consuming.

She said that redesigning course materials was time-consuming. For example, Chloe redesigned a course syllabus to make it work well with screen readers. For online students who would read materials on a webpage such as LMS, she tried to increase web accessibility, and for that work she changed all the table formats and title styles.

In addition, the screen reader software Chloe used was inconvenient. She needed to restart her computer every 40 minutes when using it. The design task was tedious and complex.

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But the department culture regarding accessibility forced her to redesign her course materials, necessitating additional complex design tasks.

Design feature 11: listening to students' opinions about course for future design. Chloe tended to make changes to her course every semester, thus in addition to regular course evaluations, she did a course reflection at the end of each semester that basically asked students "What are your five big takeaways from this class?" as well as detailed questions like "How important did you feel that the peer interaction was for you in this course?" Based on their responses, she adjusted her course design.

Design Tensions and Solutions

Tension 1: internet connection issues were unpredictable. In a synchronous course, if individuals encounter connection issues, they will not be able to access their synchronous classroom or participate in any activities. Therefore, internet connection is crucial to synchronous learning. Chloe experienced losing her internet connection and was unable to access her synchronous classroom, making it impossible for her to manage her course. She explained:

> *I always led the course from home. And one time my internet went out totally went*
>
> *out ten minutes before class started. I panicked. I called another faculty member*
>
> *and I said my internet went out. I can't get connected and I ran over to Starbucks*
>
> *and that connection was kind of iffy. It was going on and off and everything. It's*
>
> *just terrible.*

The instructor's internet connection is vital in synchronous online courses because all participants join the online course simultaneously, and the instructor is responsible for managing the course. Furthermore, in Zoom only instructors can use moderator functions such as recording

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class and creating breakout rooms. After this experience, Chloe was worried about unexpected internet connection errors. Considering her experience, she began to think that if students had similar problems, she would not be able to help them. She said:

> *I do have students every semester have connection issues.*

Chloe had students who tried to attend synchronous sessions using a tablet or smartphone, and those students usually had connection issues. In addition, a student in the U.S. Air Force frequently had problems. Reflecting on past experiences, Chloe realized that the connection issue was out of her control. Internet connection issues were unpredictable, so handing such issues was far too difficult for her. Figure 10 describes this tension.
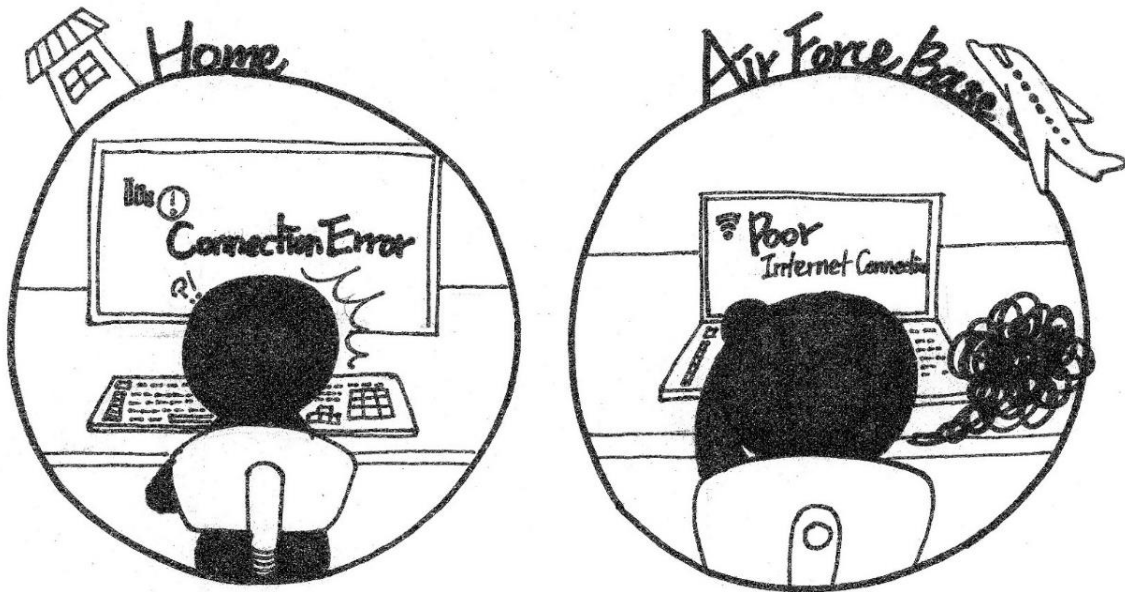
Figure 10. Tension: Internet Connection Issues Were Unpredictable

Chloe tried to solve this tension by preventing internet connection issues before they happened. First, she taught the course from her office in the university where she could be assured of a stable internet connection. Even she preferred to teach at her home, she decided to teach synchronous courses at her office after experiencing connection issues at her home. Second, she included in her syllabus the contact information for the university support team which could help when students had connection issues. She also made sure in the syllabus to stated that students connect to the class with a personal computer or laptop with a high-speed internet connection. Chloe also explained in her first class how to react to internet issues. And third, she asked students to upload their materials the night before each presentation just in case they had connection problems the next day. These were Chloe's practical back-up plans for handling connection issues.

Tension 2: there are differences between previous and current tools. Chloe's university switched its LMS from Blackboard to Canvas and its video conferencing tool from Blackboard Collaborate to Zoom. The tools had broadly similar functions, but Chloe had issues with certain functions due to key differences between them. In relation to the LMS change, she said that the transition from Blackboard to Canvas was not as smooth as she thought it was going to be despite her previous experience with Canvas. Chloe explained:

> *The grading function worked a little bit differently, and the discussion boards worked a little differently. ... In addition, there is a difference between instructor view and student view. Thus, I was not able to check whether I all set up correctly or not. Whatever it was that I did so that process was not quite as smooth as I wanted it to be.*

She also did not like that there were differences between the instructor's view and the students' view of the course on the LMS.

Chloe also experienced difficulties when transitioning from one video conference tool to another. She was accustomed to using a hand-raising function in her course. She explained:

> *At the first night of class, I'm going through and I said, "now you're it is let's all try raising our hand" and nothing happened and I said "you all see where that raising hand is he's right down here you know." Then, one student said that "Uh…Dr. Chloe we don't see that. I'm like you're kidding." I asked them to share their screen and show me what you're seeing in sure enough. It wasn't showing up on their screen.*

Chloe tried to use the same teaching strategies that depended on specific functions of her previous video conferencing tool, but the new tool just did not work as well. She also had thought that her students could see what she was seeing until one student shared their screen with her and she found out that they did not have access to the function she was explaining. This tension shows that even though there are similar functions, the instructor had trouble applying those functions due to the tool differences. The university's tool change created difficulties with designing the course Chloe wanted, so she needed more time and effort to use the new tools effectively. Figure 11 describes this tension.
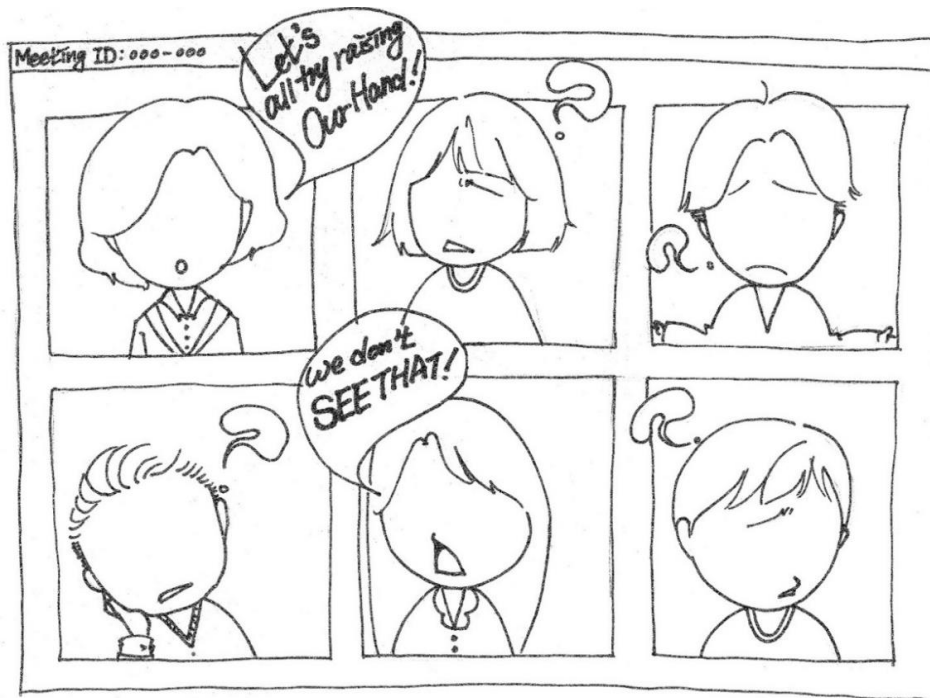
Figure 11. Tension: There Are Differences between Previous and Current Tools

Chloe's approach to solving this tension was taking time to learn about and adapt to the new tools. About the LMS difference, she said, "I felt like I was catching up to all [the differences] throughout the semester," and added, "I hate that feeling because I really like for the students to be able to see what's there at the very beginning. This semester they were not able to see everything all at once." As for the hand-raising function in Zoom, Chloe investigated the tool by herself and contacted a technology expert in the university support department to solve the issue. Finally, she found out how to add the hand-raising function to her video conferencing tool settings and quickly changed that setting. The university had selected the tools for synchronous courses, whether the instructors liked it or not, they had to use what the university had selected. Instructors had no choice but to adjust themselves to the tools.

Tension 3: lack of time to cover all the activities that the instructor wants to do.

Chloe felt a lack of time to cover all the course activities that she wanted to deliver to achieve the course objectives. The students were learning the basics of design in one semester, and that was a big undertaking for only one semester. Chloe had designed various course elements, such as lectures, group projects, and individual projects, to help students achieve the course objectives but felt as though the contents were so vast that students could easily become overwhelmed.

About a certain course element, she had specific reasons to include it. First, she wanted to have more time to share with her students her field experience. Chloe believed that the most attractive benefits of synchronous online courses is to get a chance to interact with an instructor who is an expert in their field. She tried to design a course that provided this benefit to her students.

Second, Chloe felt it was necessary to lecture due to her students' diverse background knowledge and levels. She said that she had students with varying background knowledge on the topics because they had worked in different areas, explaining, "You can't assume that everybody's coming in with the same level of prior knowledge." Due to these differences, there were students who were already familiar with specific course topics and other students who had little knowledge in that regard. Thus, Chloe needed to find a way to deliver the basic contents of specific topics to students who were not familiar enough with them.

Third, she wanted to include an individual project as well as a group project in her course. Chloe thought that in synchronous online courses there was the possibility that students misunderstood or did not understand important course topics. She thought that it was hard to have one-on-one interactions with individual students. Thus, she tried to include the individual project as a course element to create more opportunities to interact with each student and provide

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a better understanding of course contents and activities. Nonetheless, felt that it was difficult to include all these activities in her three-hour synchronous course.

In addition to this design issue, Chloe had another issue that made her feel a lack of time. In the semester, she taught her course on Thursday nights. However, Thursdays in that semester were frequently days off for events and holidays like Thanksgiving. Chloe said:

We lost a Thursday to fall break and to thanksgiving and it was bad so really. We

really suffered from losing two Thursday nights.

She had originally designed her course based on a fifteen-week schedule, but due to missing classes on two Thursdays, she had trouble accommodating all the topics and had to revise her original design. Figure 12 describes this tension.
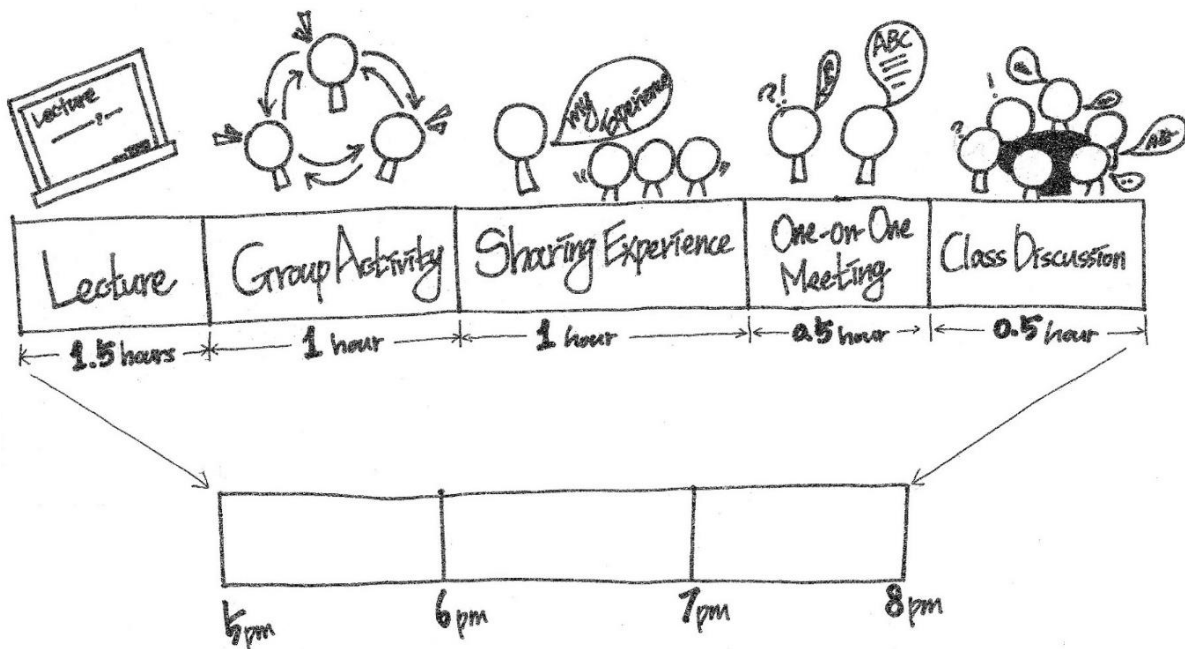
Figure 12. Tension: Lack of Time to Cover All the Activities that the Instructor Wants to Do

To handle that tension, Chloe designed more asynchronous presentations that summarized course contents instead of giving lectures. Due to the students' different levels of background knowledge, she needed to design a session that delivered the basic concepts to students who were unfamiliar with them. However, as mentioned, Chloe felt that that she already had insufficient time to deliver essential course elements, so she could not allocate extra time to also delivering the basic course concepts. In the end, she decided to cover the basic concepts through asynchronous sessions:

> *I really would like to be able to package that in a way that they can go through it asynchronously on their own time and take as long as they need. If they if they're already familiar with some of it, they can skip through it. And then synchronous section focused on an application of those concepts and principles.*

Chloe minimized the lecture portion as much as possible with this approach. She was able to have many sessions that shared her experiences with students by reducing the lecture time.

Chloe said that the reason she wanted to include the individual project as a course element was to create more opportunities to interact with each student and provide a better understanding of course contents and activities. She included an individual project in her course, and tried to have time to talk about her students' individual projects one-on-one. She had meeting time during group activities instead of having separate sessions. During group activity sessions, she pulled out individual students for one-on-one time, then put them back into their groups and selected another student. With this strategy, Chloe was able to have one-on-one meetings with all the students in her course and check each student's progress on their individual project. In relation to the course date issue, Chloe said that the constraint of Thursday evenings

was fixed by switching the course meeting day the following semester. She said that she asked a program coordinator to move the course to a more convenient day.

Case 2: Lorie's Digital Tools in Qualitative Research Course

Designer: Instructor Information

Lorie taught a course focusing on digital tools in qualitative research within a synchronous course format. Her program was part of a parallel track system for both the online graduate certificate program and the face-to-face one, and they always had a section for both. She was asked to teach a qualitative research course face-to-face first, and then put it online, hence she taught the same course in face-to-face and synchronous formats.

Lorie started teaching the synchronous online course in 2010, so by the time of our interview she had had eight years of teaching experience in synchronous online courses at two universities. At her previous university, she decided to teach the existing face-to-face course with a synchronous course format. She said the reason being that she could teach her courses synchronously was because there was the practical university support for synchronous courses in her previous university. Regarding her experience, Lorie said, "One reason that I did it there was that the support was phenomenal." She recalled the first week of teaching her first synchronous course and how the university support team sent someone to make sure things ran smoothly, including making sure that students would not be kicked out of the system and that there were no freezing errors during the course. Thus, Lorie considers university support for synchronous online courses to be essential for the success of those courses.

Teaching Philosophy. Lorie said her teaching philosophy involved designing task-oriented courses. She said,

> *My big strategy for both face-to-face and synchronous classes is to really make it*
>
> *very task-oriented and let students actually be doing something.*

Bearing that in mind, she designed group activities and put students in small groups with tasks in which students talk to each other and work on group projects such as creating concept maps or visual representations. Thus, breakout rooms that enabled such activities in synchronous courses were an important function to Lorie. She said, "If there weren't breakout rooms, I don't know if I would use the synchronous tool at all."

Design approach to synchronous online course. Lorie had a lot of experience in teaching synchronous online courses, and from her successes she had developed the pedagogical belief that online courses that have both synchronous and asynchronous components are pedagogically better for online courses. With that in mind, she designed her online courses with synchronous course formats including asynchronous portions. She was the first instructor in her program to design synchronous course formats while incorporating the view that asynchronous course formats could also be accommodated.

Regarding her design principle of synchronous courses, Lorie said,

> *I try to make as little a difference as possible, really. I mean, I think the power of*
>
> *the synchronous tool is to replicate the face-to-face class.*

She tried to design her synchronous courses as similar as possible to how she would design face-to-face ones. She thought that the majority of the things she wanted to do on a face-to-face level could also be done synchronously. However, there was the element of individuals physically being in the same space that could not be completely replicated in synchronous online

classrooms. She thought that a synchronous course is most successful when students feel a sense of engagement and believe that they can interact with other people in class and not feel isolated. Lorie designed learning activities and teaching strategies based on this belief.

Lorie was really satisfied with her previous university's support system for synchronous course design. She said that that university had provided one-on-one consultations and well-designed training, and most importantly she felt that the administration was willing to help. However, her subsequent university did not provide that kind of support, and due to this, particularly in comparison to her previous university, she was not satisfied.

Design Object: Course Information

The purpose of Lorie's "digital tools in qualitative research" course was to give students experience with using a variety of technologies for qualitative research. The course highlighted how new technologies change the essence of what it means to engage in qualitative inquiry and did so with presentations from on-the-ground researchers, exploration of scholarly literature, and skill-building activities. In this course, Lorie designed an assignment that asked students to develop their skills at using new research tools. She asked students to describe the tools they learned and how they learned them, reflect on the tools' affordances and constraints, and discuss what they would do as they continued developing their expertise with these tools.

Lorie thought that there was sufficient appropriate content to teach within an online course format. Nevertheless, she had taught several courses related to qualitative research before and felt it might be difficult to teach the data collection course within an online course format. However, she said that teaching her "digital tools in qualitative research" course with such a format was not difficult and that all things went very well. In the end, she thought that the topic

was appropriate for an online course. She did not encounter any difficulties with designing the synchronous course while adapting the same learning activities from the face-to-face course.

Design Situation

Students. Having taught at her current university for several years, Lorie noticed some common characteristics of the students in her program. Most generally seemed to assume that her course was in an asynchronous format, and when they signed up they anticipated the "anytime, anywhere" style they were used to. This is because the most common format of online courses in her program were asynchronous. She said:

> *I'll say that the culture here in my department is mostly that it [online course]*
> *should be completely asynchronous and so students sign up assuming that it's*
> *anytime anywhere.*

Due to her students' expectations, Lorie had to be very clear and up-front months in advance, making sure everyone knew that there would be synchronous sessions and that a Doodle poll would be held to figure out which night would work best for everyone. She also thought that her students had the characteristics of online learners; she thought such students in synchronous online courses may feel isolated due to the distance between themselves and other participants. Thus, she tried to design courses that would make students feel connected to a learning community.

Technology. Lorie's university used Blackboard Ultra as a video conferencing tool and Desire2Learn (D2L) as the LMS for online courses. Unfortunately, she did not like either of them. Regarding D2L, she said simply, "For whatever reason, I did not want to mess with

Desire2Learn." And so, instead of using an LMS, she used various external tools. For file exchange she used Dropbox, and for asynchronous discussion she chose the Discourse and Sandbox web-based programs.

Lorie also preferred Adobe Connect, but the university changed their default video conferencing tool to Blackboard Ultra. She was displeased and explained:

> *We changed platforms. The University supports Blackboard Ultra. But they have*
>
> *no support for it. And it's very glitchy. There's a lot of bugs in it.*

With this negative view of the tools available, Lorie decided to forego synchronous sessions that semester and planned to use another tool to fulfill her needs in regard to video conferencing, paying for the service herself.

Department and university rules. Lorie's department offered both online and face-to-face courses. It had a parallel track for its online graduate certificate program as well as a face-to-face one, and so there was always a section of both. Lorie's department also had its own view of online course formatting, of which she mentioned:

> *There's a lot of misunderstandings around what online courses [are] and what*
>
> *distance education is. I'll say that the culture here in my department is mostly that*
>
> *it should be completely asynchronous.*

Her colleagues also had certain assumptions about online courses:

> *My colleagues insisted that it was impossible to do a class for longer than an*
>
> *hour in a virtual classroom.*

The university also had little understanding of online courses, so if instructors designed an online course it had be in an asynchronous course format. There were simply no regulations

related to synchronous online courses at that point. And so, Lorie always had to make attending synchronous sessions optional, saying, "Technically, I can't require that students come." Due to this limitation, she needed to develop a strategy to deliver course content to students who could not or would not attend the synchronous sessions.

In addition, the university did not provide an appropriate system for synchronous online courses because its views on online courses favored asynchronous ones. In fact, the course registration system was designed to accommodate asynchronous courses, and on the course registration page there was no space in each online course section for instructors to include date and time information. Seeing no data or time information in the registration system, students assumed that Lorie's course was an asynchronous one, and Lorie said that due to this it was tough to catch all the students on the front end of the course and ensure that they understood that it had a synchronous format.

Department culture. Lorie's department had pedagogy meetings where they talked about teaching strategies. The meetings were around an hour long each and were held monthly, covering topics such as textbooks, assignments, online teaching tools, course design strategies, and how to handle different things in their courses. She appreciated this, saying, "That's been really nice because I get good ideas from them." Her colleagues' experiences and support affected her synchronous course design positively.

Specifically, there were two colleagues who had started putting face-to-face courses into online formats. They had taken a lot of training workshops, learned about the process, and did their best to put the courses online. Lorie said they had very different philosophies of teaching online than her but communicated with her to help in converting existing face-to-face courses into online ones. She said she got productive, encouraging support from them. For example, they

had developed a template for using the learning management system which consisted of an introduction area, a content area, and an activities area. And so, when Lorie redesigned a face-to-face course into a synchronous online one, she just imported the master class and then tailored it according to what she wanted. In addition, Lorie herself was later the inspiration for a colleague's choice to change an online course format from an asynchronous course to a synchronous one.

Support. According to Lorie, her university had three different university-level institutions that were responsible for supporting online course delivery and the use of technology: the information technology office, the center for teaching and learning, and the office of online learning. However, she was not satisfied with any of them, as each operated differently and did not adequately provide practical support to instructors. She explained:

None of them do professional development or support for online instructors. So, I think faculty feel really unsupported when it goes like trying to teach online even asynchronously. Let alone try to figure out a synchronous classroom.

Due to this lack of support, Lorie became overwhelmed when adapting to new tools, and this led to a limited use of LMS and video conferencing tools. Ultimately, it affected her decision to not offer any synchronous courses in one particular semester. She felt that one reason why she did not get practical support was because of the school size. That university was bigger than her previous one, and it seemed much less personal.

Lorie's department had a departmental graduate assistant (GA) whose role was to support technology use in the department. This GA had a basic knowledge of LMS, video conferencing tools, and other tools for teaching and learning, and Lorie felt they could be helpful for some faculty members who were inexperienced in course design. However, Lorie herself was not sure

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that the departmental GA would be helpful or not when it came to her own course design. The problem was that the GA only handled basic technological problems, and the individuals in the GA's role changed often, so there was no consistency or depth on which the faculty could rely. Also, Lorie thought that she had more knowledge than any of those people because she had already had a lot of experience in LMS and video conferencing tools by teaching synchronous online courses for more than seven years. Nevertheless, she provided her students with contact information for the GA in case they needed technical support.

Design Outcome

Course structure and elements. Lorie actually uses the full three hours of her course. She breaks the course down into sections, the first being a twenty-minute check-in and introductory remarks, sometimes extending to thirty minutes to get through a preliminary. The students are then put into breakout rooms for group discussion, usually lasting around an hour. The reason for the hour, she explains, is that these breakout rooms tend to take longer than face-to-face lessons focusing on the same task. There is a break, then the last section of the class is used as a debriefing session about the students' group discussions along with explanations of what to do next. She says it does not always take up the full three hours, nor has she ever had any complaints about sessions being too long.

Lorie also included asynchronous discussions as a learning activity based on her teaching philosophy that the best online courses have both synchronous and asynchronous elements. She asked students to post their reflections on the assigned readings to the course website before synchronous meetings, with each student posting once before she responded. She would use the posts to run the synchronous sessions. However, Lorie said that including

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asynchronous sessions created more tasks for her because reading and responding posts requires considerable time. She said:

> *If I was going to respond to every single student every work it would take me five*
>
> *and a half to six hours a week.*

Thus, she thought that including asynchronous discussion activities in the synchronous course essentially created twice as much work as a face-to-face class.

Design feature 1: using external tools instead of university LMS. According to Lorie, investigating and adapting new tools requires instructors' time and effort. This additional effort limited her use of tools in synchronous courses. In particular, she worried about using eLC, her university's LMS, because it was new to her. She did not want to use it in her course, and in the end she chose to use external tools instead, including Google's array of tools as well as Dropbox. In her syllabus, she mentioned:

> *Please note that we will not be using the eLC this semester. Instead, our course*
>
> *will take place in three locations.*

However, there was an issue in using those tools because they were not university-based systems. Her university did not encourage the use of outside tools; in fact, it restricted their use, limiting Lorie to only university-based tools and systems.

Design feature 2: providing suggestions for better communication. For student engagement, Lorie recommended that students have a video stream available to turn on when they were speaking or when they were in their breakout rooms, but not all students did. It was intended to be a requirement for the course, but still some did not use it, and Lorie could not force them to. In addition, she asked students to use headsets, a combination of a microphone

and headphones, instead of using those things separately, to ensure the quality of the class's audio communication.

Design feature 3: preventing technological issues in synchronous sessions. Lorie had her own experience with technological issues and had difficulty in managing them. In light of this, she started including in her syllabus information about handling technological issues. She provided a five-step guideline for solving technical issues related to Adobe Connect during synchronous sessions, and at the end of that guideline she wrote:

> *The key thing is to stay calm and not panic. Technical problems do occur for*
>
> *reasons beyond our control. Department GA and I are happy to work with you to*
>
> *fix the problem. It may not be possible to do this during a class session though, so*
>
> *be patient and we will find a time to get the technical support you need.*

Lorie tried to support students in her synchronous sessions by designing her syllabus as a supportive, detailed document.

Design feature 4: facilitating group works. Lorie said that breakout rooms appear to have limitless possibilities. She explained it can be a time to address a discussion question or an actual task. She said she used breakout rooms in various ways: creating a visual representation of something on a whiteboard, brainstorming a list of ideas, creating a concept map, or collaborating on a group project. To provide extra time for such projects, Lorie assigned the same teams for each group discussion. Students could keep talking about their real projects after their group discussions. She also tried to give them time to meet in breakout rooms for their main group projects.

Design feature 5: providing guidelines about taking a synchronous course successfully. Lorie also created "Being Successful in a Fully Online Class", a three-page section of her syllabus which included information about synchronous online courses such as technological requirements, technological competencies, expectations about attendance and participation, participating in synchronous meetings via Adobe Connect, and emergency plans for Adobe Connect. For example, she stated in syllabus:

> *Come to every synchronous Adobe Connect meeting [as you are able] on time and be fully engaged, with headset and webcam fully functioning, and the backdrop appropriate. Be sure you are familiar with the netiquette and expected behavior in online meetings explained above. [...]*
>
> *Here is a learning site that has lots of short videos that will be helpful for you: http://tv.adobe.com/show/learn-adobe-connect/ In particular, look at "Using VOIP audio". If you are not sure how to navigate any elements of the synchronous learning.*

This section explained the expected behavior in synchronous sessions as well as appropriate preparation for using video conferencing tools.

Design feature 6: designing an orientation session to check students' readiness for synchronous sessions. Lorie designed and implemented an orientation section titled "Open House" to expose students to synchronous courses and allow them to test their learning environment. Students were able to experience how synchronous sessions would appear and test their connections, video settings, and headsets. She said that this session was effective, and she realized that this simple testing period vastly reduced the number of technical problems on the

first night of class. She said, however, that she needed to spend an extra hour of her time for that session alone.

Design Tensions and Solutions

Tension 1: online course as an asynchronous online course? Lorie had her own views on online courses. As an instructor who had been designing synchronous online courses for eight years, she had a lot of success with teaching synchronous online courses, and based on those experiences she believed that using a synchronous classroom with both synchronous and asynchronous activities is pedagogically better. Thus, she designed her online courses with synchronous course formats incorporating asynchronous portions.

However, her department and university had different views regarding the format of online courses. She thought that there were many misunderstandings about what online courses and distance learning actually are. She said that the thinking in her department was mostly that online course should be completely asynchronous. And along these lines, her colleagues also thought that it would be impossible to conduct a class in a virtual classroom for longer than an hour at a time.

The university also had little understanding of online courses and did not provide an appropriate system for synchronous online courses. The course registration system was designed only for the asynchronous online course format, so on the course registration page there was no information regarding the date or time of online classes. Therefore, when students registered for Lorie's classes, they assumed the class would have an asynchronous format.

Lorie elaborated that it is not the norm for online classes to have an actual meeting time at her university. And due to this differing view of online courses, she faced two complex issues

in designing and delivering synchronous online courses. First, as mentioned, students assumed that her course was an asynchronous one. The majority of students had only had asynchronous course experiences, plus they were not provided relevant information during registration. So overall, an asynchronous course format was what most students expected, not entirely unreasonably. Lorie was the first instructor in her program to design online courses with synchronous course formats, so it was difficult to ensure that all her students understood at the beginning the nature of the course format.

Second, she could not require her students to attend synchronous sessions. Adapting the synchronous course format was her personal choice based on the teaching philosophy, but her university and department felt that online courses should be asynchronous, thus there were simply no regulations related to synchronous online courses. A synchronous online session was not an essential requirement. Lorie always had to make attending synchronous sessions optional. However, the main learning activities occurred during synchronous sessions because she had designed her course that way. Students who did not participate in synchronous sessions, then, could neither participate in the learning activities nor achieve certain course goals. Lorie needed to solve these issues by designing a new synchronous format. Figure 13 describes this tension.

Lorie developed several design strategies to facilitate her students' understanding of her synchronous course, particularly overcoming the assumption that her course was asynchronous and accounting for students who were unfamiliar with synchronous courses. First, her department made students get permission from instructors before registering for classes. Lorie took that opportunity to explain what her course looked like and what taking synchronous courses meant to students.
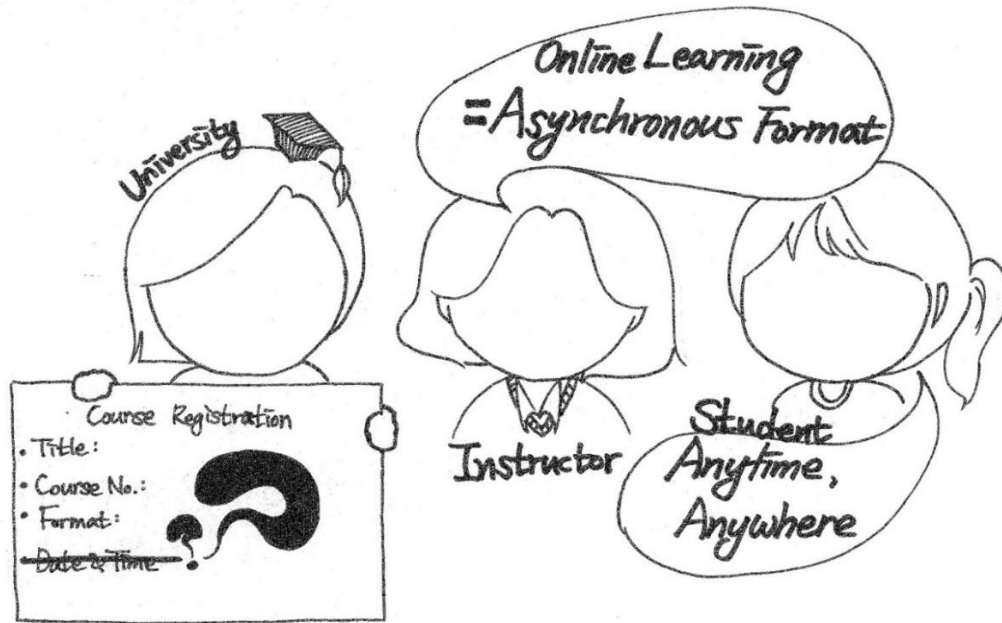
Figure 13. Tension: Online Course as an Asynchronous Online Course?

Second, Lorie provided the information about taking synchronous online courses such as technological requirements, technological competencies, expectations about attendance and participation, participating in synchronous meetings, and emergency plans for video conferencing tool in her syllabus. In addition, she provided the following statement at the beginning of the weekly schedule section:

> *There are many types of online courses. This course is place-independent, but not time-independent. You can participate in the class from anywhere, but you must log-in at regular times to interact with others in the course. Below is our weekly schedule. If you are going to be away from Internet access for more than a few days, this is probably not a good course to take.*

Through this statement, she explained the main difference of synchronous online course with asynchronous online course which is not anytime, and emphasized the participation of synchronous session. Third, Lorie also designed and implemented an orientation section to expose students to synchronous courses and allow them to test their learning environment.

Lorie always had to make attending synchronous sessions optional. Due to this limitation, she designed a learning activity for students who could not or would not attend the synchronous sessions. After the Wednesday synchronous meeting, students who were unable to attend (or who attended but whose headsets or webcams were not working) needed to participate in an asynchronous discussion on the Discourse site at some point between Thursday and Sunday. Students had to participate in the discussion by either writing or sharing a link to a video response they had created.

According to Lorie, even though attending the synchronous sessions were optional, students usually wanted to come, and they were often persuaded by being convinced that doing so was worth their while. She said that she often got comments from students who really appreciated the synchronous sessions, and only a few students ever said they resented the idea.

Tension 2: scheduling would be a real nightmare! For synchronous online courses, instructors must set a date and time for the class. This entails the first design tension: students' expectation that online courses are anytime and anywhere. In this regard, Lorie felt some difficulty in scheduling synchronous sessions. Along with her efforts to improve her students' understanding of synchronous courses, she tried to make students understand that they must all attend sessions at the same time. However, scheduling was a complex problem that could not be solved easily. Lorie explained:

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The scheduling is the biggest constraint. If the time and day is not established

before students register a course, it's going be really hard to find a time when

everybody can meet. So scheduling has been the hardest part because it's just not

the norm for our online classes to have an actual meeting time in our department.

Specific design conditions made finding a specific date and time for synchronous meetings exceedingly problematic. First, Lorie had only five options for the course date and time. Many students were full-time employees who were able to attend sessions only after work. This meant that the available course times could only realistically fall between 5pm and 8pm each day. Lorie had few options when it came to time. Second, in that semester the department had assigned her to teach two online courses, and there were many students in each course. Thus, she and all her students needed to find two nights a week for synchronous sessions. About this dilemma, Lorie said:

I knew scheduling would be a real nightmare because there's a lot of students in

both of those courses so to find a night that both of them…to find two nights a

week to teach in the new system and then trying to find which night it was going

to be.

To figure out which night was available to all students, Lorie conducted a Doodle poll a month in advance. But even with this strategy, scheduling was the hardest design task, and ultimately she was unable to work out an ideal solution for herself or many of her students. Figure 14 describes this tension.

Figure 14. Tension: Scheduling Would be a Real Nightmare!

Tension 3: adapting a new tool without support. Lorie's university was using

Blackboard Ultra as a video conferencing tool and Desire2Learn as an LMS for online courses.

However, she didn't want to use those tools, and for several reasons. First, she did not like them.

She had used Adobe Connect for her synchronous courses before. However, since it was the

university's decision to use Blackboard Ultra as its default video conferencing tool, she needed

to use it. Still, Lorie was more comfortable with Adobe Connect. She explained:

> *We used Adobe Connect and that was great. It was very stable and it always*
>
> *worked well so once. I was comfortable with it.*

Considering her preference for her standard tool, Lorie didn't like the new one. Referring to

Blackboard Ultra, she said, "It's very glitchy. There's a lot of bugs in it."

Second, Lorie did not have the time or energy to learn how to use new tools, though new tools require an abundance of both when being integrated into existing course designs. Lorie explained:

> *I just haven't had time to [learn about new tool]. I just get tired of always having to learn the new tools. I haven't had any downtime to really test out the tool to be sure. […] I've just kind of dreaded having to go through trial and error again.*

She was discouraged from learning about new tools. So for these two reasons, Lorie decided to use external tools instead of the new LMS, choosing Google Sites as well as Dropbox. However, this decision also created issues because she was not using university-based systems. Her university did not approve of using outside tools, opting to restrict their use and insisting that Lorie use only university-based tools and systems.

And one final reason why Lorie did not want to use the tools that her university provided was lack of support in using new tools. She was not satisfied by the support the university provided. She said:

> *[In this university] one unit runs the technical background of the system like they run the management system, Desire-to-learn. Another unit runs Blackboard Collaborate. However, none of them talk with the people who do professional development or support. So I think the faculty feel really unsupported when it goes like trying to teach online. Let alone try to figure out you know a synchronous classroom.*

In particular, she pointed out that there was limited support when tools changed:

> *We changed platforms. The University supports Blackboard Ultra. But they have*
>
> *no support for it.*

There was another reason why Lorie was not satisfied with their support system. She was satisfied with her previous university's support system for synchronous course design. She said that her university provided one-on-one consultations and well-designed training, and most importantly she felt that the administration was willing to help. However, her subsequent university did not provide that kind of support, and due to the different levels and quality of support, Lorie was simply displeased overall. She needed more support in using new video conferencing tools, but there was no satisfactory support available. She said:

> *I mean I think that if I felt better support with going back to the Blackboard*
>
> *Collaborate, I would have been a little more encouraged to use it this semester.*

For teaching synchronous online courses, video conferencing tools and LMS are essential. However, Lorie had issues in using both tools due to personal and environmental constraints. She needed to find a solution to using these tools in her synchronous courses. However, this problem was too complex to solve because various factors, such as personal preferences and willingness, university rules and decisions, and a lack of support were intertwined and conflicting. Figure 15 explains this tension.

Figure 15. Tension: Adapting a New Tool without Support

Solution to Tension 2 and 3. Lorie's solution to handling scheduling and adapting to new tools related issues was designing an online course without synchronous sessions. Though she believed that designing online courses with both synchronous and asynchronous sessions was pedagogically better, she decided to forego including synchronous sessions in her courses, and so in the semester during which she was interviewed Lorie was teaching online courses with an asynchronous online course format rather than a synchronous one.

To handle tension 2 (scheduling) and tension 3 (tool change with lack of support), Lorie developed and applied some strategies including conducting a survey to determine class dates and times long before each semester started. Also, she used external tools instead of the problematic tools her university had provided. However, those were not the ultimate solutions to either issue. Her solutions at this point, then, involved designing an online course without a synchronous session. About this decision, she said:

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> *I'm gonna just experiment with not doing any synchronous sessions because it's*
>
> *been a long time since I haven't, and see how it goes.*

Lorie felt that that would help her see what she was missing and what her students missed about the synchronous aspects of the courses.

Because she had stopped holding synchronous meetings, Lorie developed an alternative way of using the benefits of synchronous online courses, namely increasing students' engagement and building social and teaching presences for online students. She recorded a video with Camtasia each week to provide a kind of weekly summary and introduce the next week so students could feel like there was some real interaction going on and not just text-based content. She also required students to create their own video posts. Of this, Lorie said:

> *I can pretty much assume that students know how to do a video post. It's like I*
>
> *don't even have to teach them how to do that because that's just like a thing now.*

Lorie thought that students' video posts created a type of presence in the course and helped everyone engage more. She believed that these activities reduced the need for synchronous discussions.

And even though she decided to not include synchronous sessions in her course that semester, Lorie was really satisfied with her synchronous online course teaching experiences overall:

> *I'm always in a really good mood after I teach synchronously. I don't feel like that*
>
> *when I teach face to face actually. I actually don't get that same sort of*
>
> *satisfaction.*

She thought that everyone was sitting at their computers, all over the world or wherever they were, having engaging learning experiences with a sense of togetherness that was completely different from face-to-face interactions. Lorie concluded, "I don't think I can get away with not having any synchronous sessions." She even thought about just paying for Zoom herself for future synchronous courses because it seemed more stable than Collaborate.

Case 3: April's Online Learning Environments Course

Designer: Instructor Information

April taught a course focusing on online learning environments within synchronous course formats. She had started to teach online courses at her previous university, but those were either asynchronous in nature or hybrid (50% on campus and 50% online). She also participated in designing fully online programs, that started in 2010. And furthermore, at that same university she taught a fully asynchronous online course in 2010 that included two synchronous meetings. She said that from those developmental and teaching experiences she realized what went well and what didn't, and she got ideas about how to better design synchronous online learning.

April started teaching fully synchronous courses in 2011 at her current university and had taught multiple online courses since then. Her academic background was instructional design and her research area was online course design, so she was a researcher who actively investigated synchronous online course design. During our interview, I felt that April was confident in designing and teaching synchronous online courses and had rich experiences and knowledge about the subject.

Design approach to synchronous course design. April said, "I really thought about how not to make it a waste of time, and I think it's successful when students are looking forward to the next meeting." This statement became her teaching philosophy in synchronous online courses. This philosophy also came from her previous experiences. She said that in her previous position she had mainly taught asynchronous courses, with just a session or two of synchronous meetings, and she had had students that would say, "Well… That [online meeting] was a waste of time."

In addition to this experience, when April started to teach synchronous courses at her current university, she was unable to find literature that said synchronous courses would be meaningful, and she met people who also thought that they were unproductive. With all this in mind, she wanted to make sure that her synchronous sessions were meaningful and a very good investment of students' time. Thus, to have a course that was interesting enough to spark students' desire to return for more was April's chosen criteria for a successful online course.

In addition to that overall approach to synchronous courses, April had a specific design principle: She tried to create synchronous courses that would keep students engaged. She said:

> *I really don't want the synchronous sessions to be like a lecture style where I just talk the whole time in order to keep students engaged and this is true with asynchronous and synchronous. I tried and make conversations- and activity-oriented so they have to do something and then report back.*

April included lectures in her course, but she tried to avoid designing a strictly lecture-based course. Instead, she wanted a course that would promote student participation and interaction. To engage students this way, she designed a synchronous course that was more activity-oriented. April explained:

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I wanted to do is to have the discussion that can take place asynchronously first

and then makes the synchronous session more activity oriented do the things you

cannot do asynchronously on the same topic!

This design principle came from her understanding of the advantages of synchronous courses. She continued:

[In a synchronous online course] I think that synchronous classes compared to

asynchronous classes, synchronous classes students can engage in group

discussion and group activity on the spot work and create something together. I

try to bring those in either through class activities or by assigning team projects.

April also had a simple design principle:

Design three weeks in advance! It doesn't always work that way, but I always try.

Personal characteristics. At her previous university, April had the chance to explore a course about the *Second Life* virtual world for research purposes. *Second Life* is an online place that provides synchronous learning experiences because participants communicate in real time via chat and audio. From the observations she gained from that experience, April and her colleagues found that there was a lot turn-taking issues in participant live conversations, and they had some difficulty in designing interactions. About that experience, she said:

There was a lot of chaos and but I learned a lot from that just about what kind of

structure is really necessary in a synchronous environment which is much more

fluid and open.

This experience also affected April's design approach to synchronous online courses. She believed that the structure of synchronous courses was very important. During our interview, she

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kept mentioning that she was a "very structured" person, and this personal characteristic affected her preference of video conferencing tools and the structure of her synchronous online courses. And so, in regard to April's university changing its video conferencing tool from Blackboard Collaborate to Zoom, April said:

> *I like that [Blackboard Collaborate] structure. I am a very structured person and maybe others are just fine with zoom how it's much more fluid. I do feel like because zoom was not a classroom platform.*

With her personal characteristics, she simply preferred the previous tool instead of the new one.

Design Object: Course Information

The topic of the course April was teaching at the time of our interview was online learning environments. She explained her course:

> *This fully online course will examine theory, research and practice of designing, developing, and evaluating online learning environments including distance education and blended learning approaches.*

She had five learning objectives. One of them is that "course participants will be able to identify, analyze, share, and demonstrate effective online teaching and learning activities." She said she felt really lucky because the subject of the course is related to online learning environments. She explained:

> *I'm very lucky that what I teach is directly related to the environment. I want students to become comfortable and be more engaged. Because they're reading about how to be a good learner or a teacher in an online environment, I feel like*

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students become more willing to take risks and be more bold or and being

receptive and open in an interactive environment.

The subject characteristics affected her approach to course design. She said, "With this class, I was very conscientious of trying to demonstrate what students read about because it's about designing online classes." She tried to filter out good practices from the readings related to online courses, then she slotted in topics and tried to figure out assignments that could tie everything together.

Design Situation

Students. April's students were mainly individuals who worked full-time. She described that demographic as "pretty all over the place", with the inclusion of K-12 teachers, military or ex-military members, corporate employees, and people involved in higher education. People were taking the course, she explained, because they had jobs as instructional designers but had never had relevant training or had an unrelated job and wanted to make a career move. Along with the students in her program, there were several students from other departments, namely the health sciences department.

By having taught synchronous courses for several years, April could detect some common characteristics among the students who registered for her courses. First, most of the students had online course experiences with asynchronous courses. When she first taught a synchronous course in 2011, she assumed that most students would not have had any online course experience. Thus, she used to have a "How prepared are you for online classes?" questionnaire and outlined some basic expectations. But she stopped doing that because students seemed to have more online course experience as time went by. Second, her students had had

negative experiences with online courses and had told her so. April tried to design synchronous

online courses that would be more meaningful for these students. And third, students had had

little experience with the synchronous course format. Most of their previous online course

experiences were with asynchronous courses. Thus, April took the time to talk to new students

before they applied and told them that her course was very different from what they might

expect.

Technology. April's university was using Zoom as its video conferencing tool and

Canvas as its LMS. The university had switched from Blackboard to Canvas. As for Zoom, the

university had switched from Blackboard Collaborate.

Program. April's program was an online master's program in the field of instructional

technology. This program was fully online and delivered all the courses in synchronous online

course formats. Students in this program were responsible for participating in synchronous

sessions each week. According to April, because they were part of a distance education program,

the program could get some tuition money back. These additional funds went toward securing

the resources they would need. In April's case it included up-to-date hardware for online courses,

particularly desktops, webcams, and headsets.

Support. April's university had a department responsible for supporting online course

design and delivery, and this department provided support to instructors. There were several

services available related to design and delivering synchronous online courses. First, they

provided immediate support to online instructors. They provided contact information (online and

by phone) where instructors could get immediate support with using video conferencing tools,

and so instructors could also get support with issues during synchronous sessions. These services

were described on the website as "Contact the LiveOnline (Zoom) team during your class by

calling 111-111-1111 or 222-222-2222 (toll free)." This immediate service was also available after 8pm and on weekends.

Second, they provided one-on-one consultation for instructors' course designs. If an instructor had issues or specific needs in course design (both face-to-face and online courses), they could request one-on-one consulting from the department. Instructional designers supported instructors by considering their needs, skills, and environments. About this service, they said:

> *Instructional Support Unit partners with faculty and instructors to help with the design of your course. […] Whether you need help learning how to use an online teaching tool or advice on converting your face-to-face course to online, we're here to help.*

Third, they provided rich resources related to Zoom and Canvas. Webpages were available to provide various resources related to using either tool. For example, on the Zoom page there were the following services: Zoom Getting Started (Instructors), Zoom Leader/Instructor Guide, Zoom Participant Guide, Best Practices for Instructors and Meeting Leaders, Resources for Instructors and Meeting Leaders, and Students – Best Practices for Participants.

Figure 16 displays the Best Practices for Instructors and Meeting Leaders. They also developed a Knowledge Base to share the latest troubleshooting tips with instructors.

Figure 16. Zoom Support: Best Practices for Instructors and Meeting Leaders

And finally, this department also provided various face-to-face training opportunities related to using video conferencing tools and LMS in online courses. Below is a list of some of the training sessions they provided:

- Canvas Analytics for Student Success

- Canvas Assignments/Assessments/Grades

- Canvas LEAD (Learn, Explore, and Design)

- Canvas Foundations: Getting Started

- Canvas Tips & Tricks

- Open Consultations for Transition to Canvas

- Introduction to LiveOnLine (Zoom)

- What's New in LiveOnline (Zoom)?

Figure 17 shows training information about Canvas LEAD. The training session was six hours in a single day, the entire time devoted to using Canvas for a course. As shown, if there were no scheduled times for the workshops listed, instructors could request specific training from the department, and training would be provided.

April shared her experiences with this support. She said that during her first class using Blackboard Collaborate she requested help from the department and that she also attended a Zoom training session. But she did not often get help from the department. Instead, April served as a faculty fellow in the department and shared her experiences with using instructional technology in courses, with topics including online course design, and helped improve the quality of the services being provided.

Figure 17. Canvas LEAD Training Information

Design Outcome

      Course structure and elements. April had observed that synchronous online courses could create a lot of chaos. And she also found that synchronous online courses were much more fluid and open. In addition, she was emphatic about how she was a very structured person. With her views of synchronous online courses and her personal characteristics, she thought that structure was very important in synchronous online courses. April tried to support her students' synchronous learning by providing a consistent structure:

      It was important for me that when they're in the synchronous session to not feel

      chaotic. It's kind of boring over time but there are very basic structures that they

      can always anticipate to be the same.
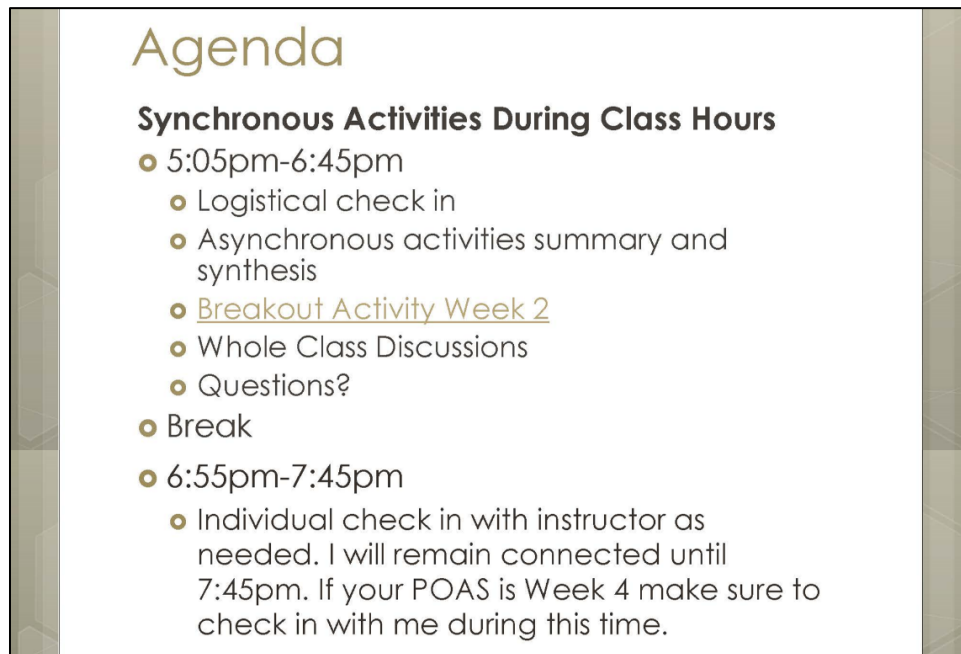
      In relation to course structure, April stuck to the agenda she had set: A logistical check-in, a summary of asynchronous activities, then a lecture or activity before students went to their

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breakout sessions for discussion, then finally individual check-ins. Figure 18 is an example of the agenda from April's presentation materials.

   To make synchronous sessions more meaningful to students, April usually implemented an asynchronous activity beforehand. Each week, she provided discussion topics or questions to students along with detailed instructions including requirements for each student's post and for each student's comments to other participants. About the asynchronous discussions, April said:

> *I use an asynchronous discussion like a formative assessment of how to enhance*
>
> *what they were talking about during the synchronous session. It's very procedural*
>
> *in a way.*

During the synchronous time they could revisit the points they had made asynchronously, seeking a deeper and more meaningful conversation in real-time with their peers.

Figure 18. April's Synchronous Session Agenda

Design feature 1: designing individual check in sessions. April provided individual check-in sessions from 6:55 to 7:45, after course activities every week, meaning that that was time built into the schedule. At that time, there were no course activities, but April kept synchronous sessions open and remained connected, conducting individual and group check-ins with her students. She arranged the sessions that way to also provide students time for group projects. April said:

> *I also tell them it's built in if there's any group activity in class that's time for them*
> *to work in their groups. So I know that it's not enough for most group projects but*
> *it's to ensure that they can have a synchronous meeting with their groups and they*
> *can't tell me later that they didn't have time.*

In April's syllabus the required office hours were stated, though she said that no one took advantage of the opportunity. And no one did so, she said, because there was already a timeslot within each session for students to ask their questions.

Design feature 2: using accessible external tools. April used Google Drive or Microsoft OneDrive to share the readings and videos she recorded. She had typically used Google Drive, which was supported by her university, to share course materials. However, she had several students from other programs who were unable to access Google Drive. She explained:

> *I was using Google Drive just to share the readings. And then I record the videos*
> *and post it on, again, Google Drive. I learned that when you have students that*
> *are in our system but from the health sciences group there is an issue because*
> *they did not subscribe to Google Drive. So they don't have access to it. This*
> *semester I had to switch to OneDrive.*

With students who had limited access to that specific tool, April chose another that all students could access.

Design feature 3: setting requirements for successful synchronous communication. April developed several strategies to support students' successful synchronous communication. First, she asked students to turn on their video streams when they spoke. When she first began teaching synchronously, she made video functions optional because she thought people would possibly not have a webcam. It soon became a requirement, however, about which she said:

> *In student evaluations, it's consistently came up that between people who had the camera and didn't and how connected they felt or how disconnected they felt. So the following semester I made it just a requirement. I ask student must turn your video on when you are talking to the class.*

Second, April asked students to use a USB headset which combined a microphone and headphones, instead of using those things separately, to ensure the quality of the class's audio communication. She explained:

> *Sometimes if they just have earbuds and a microphone it seems like there is a terrible feedback loop and so it's a problem I say it really changes the quality for everybody's participation. So please make sure and have it.*

This was another requirement in her course. But even though she required a USB headset, she could not force her students to use one.

And third, she developed "Classroom Etiquette", a section in her syllabus, and asked her students to review it carefully. Here is a part of that section:

During synchronous sessions, while your instructor, your peer, or guest lecturer is

conducting a presentation you are expected to pay complete attention to what they

are presenting. … Make sure that your cell phone and any other devices that sends

you notifications are turned off or set on manner mode.

Design feature 4: preventing technology issues. April tried to make sure that students

understood that when there was a computer-related problem, they needed to contact the

university technology team. She put this information in her syllabus:

If you have technical issues or need help troubleshooting, please contact 000 at

remedy.000.edu/contact/ or call the helpdesk at 000-000-0000.

She said she used to keep a website so that if the LMS was down her students would still have

something else to go to. But she thought that such an idea was quickly becoming outdated. April

could instead use the new LMS system as a course website, and then she would not have to

bother with any upkeep herself. She also provided her students with a PDF of the syllabus so that

they could access it more easily and in more places.

Design feature 5: supporting group activities with various strategies. A group

discussion that used a breakout room was a main learning activity in her synchronous course.

She developed strategies to support student group work. First, she designed an activity in which

students developed ground rules for the course. In week 1, she posted an initial set of ground

rules based on past best practices and posted it on the asynchronous discussion board, then asked

her students to review them and provide comments and suggestions for additions, changes,

and/or enhancements. By synthesizing their comments, she created a document containing

course ground rules, then shared it on the course LMS.

Second, April provided a guideline for group activities. Regarding each group activity, she designed a detailed handout and provided it to her students. It included the following information: group members, a discussion topic, specific topics that needed to be discussed, activity procedures, the time limit, and roles. Specifically, April asked students to assign various roles in their group discussions. For example, in one particular handout, she wrote:

> *Be efficient and use your time wisely. It may be a good idea to set the agenda*
>
> *first and decide on a designated note taker, timekeeper, and summary reporter.*

About the reporter role, April explained:

> *I say when you get into your group, you're going to pick the reporter. I want to*
>
> *hear each time you all report, I want somebody different. If it's the same person,*
>
> *it's not working. We need to all take turns on this.*

Third, April assigned each group member group activities before each semester. In particular, she designed five rotations within group assignments, and with this rotation students were able to interact with different peers in each group activity.

And last, April developed a strategy to monitor students' group activities by using a specific function of Zoom. In synchronous online learning environments, instructors should be able to stop by each group and monitor their progress. However, she found that when she entered a group room to monitor their activity, the students became quiet. For this reason, April stopped dropping into the groups. She instead asked the students to use the "ask for help" function to call her if they had any questions, then she would join the conversation.

Design feature 6: constructing stable teaching environments. According to April, one of the benefits of synchronous courses is that all of the participants, including the instructor, participate in class by logging in from a comfortable location. However, April decided to teach her course at her office at the university instead:

> *I always do my synchronous sessions from work. […] I teach from my office. I can rely on a steady connection. I have a reasonably powerful computer. So, I know that I'm taking advantage of that.*

By teaching a course at her office, she could develop a stable teaching environment by relying on a steady connection and a reasonably powerful computer.

Design feature 7: handling various communication channels. There are various communication channels in synchronous learning environments. April developed a management strategy to handle these channels effectively. She recommended that students use the chat board freely to promote their participation, and she could catch up on those chats later instead of during lectures or other teaching activities. She said:

> *I just tell students that they can use the chat board freely, and then I will go through it when I have time. But for the most part, I can't pay attention to it. If something very important comes up on the chat screen when I ask for are there any questions, I asked students to volunteer to let me know. I think in a regular class it's easier to have a longer pause for when you ask for questions and just wait. But I feel like it's harder in a synchronous video context. So I will tell them that I'm gonna go through the chat to see if there is anything that needs to be addressed. For the most part, I know I try to ignore the chat and then go back to it later.*

Design feature 8: handling various communication channels. April's teaching

philosophy in synchronous online courses was making sure the sessions were meaningful and not

a waste of time. She tried to design activity-oriented courses that students could engage in

through group discussion and group activities by creating something together. Aligning with this

design approach, she developed a type of group activity called Participatory Online Activities

Showcase and Analysis (POAS) activities. This kind of activity was student-led and pushed

students to think about what they had been learning about online learning, design asynchronous

and synchronous activities, and demonstrate designed activities to peers in class.

Before she started teaching online, April was involved in K-12 teacher professional

development, and through that she had learned that adult professionals learn from each other

very well and, since her students were working adults, it was important to acknowledge that they

often brought their own expertise from their experiences. With this rationale, she designed a

POAS activity in which students designed online course activities by themselves and

implemented them later on. In the course syllabus, she wrote that students could get the

following experiences:

- Finding a topic relevant to the course readings as the content of your activity;

- Finding, designing, or customizing an existing online learning activity for the content a
  good starting point are the examples in your textbooks;

- Demonstrating and engaging course participants in the activity; and

- Providing a theoretical analysis on what went well and what did not go well when you
  implemented the activity

That semester she had assigned 40 minutes for this activity, but she found this to be too

short, so she considered changing it to 60 or 90 minutes instead. By implementing this activity,

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April stressed the importance of students not stressing about whether or not they would fail. She wanted to use her course as a safe space for future designers to try new ideas. It was a place where it was okay to fail, as this was valuable preparation for their future endeavors.

Design feature 9: using asynchronous course design strategies for synchronous course designs. April said that before coming to her university, she probably would not have taught synchronously and had only began to do so because her colleagues said they only taught synchronously. She recognized that most of the design resources on online courses were based on asynchronous online course formats and that there were limited resources for synchronous online course design. About the limited design resources for synchronous online courses, April used strategies for asynchronous online courses by transferring those strategies to synchronous course design. She explained:

> *[For my course design] I read a lot about online courses in general and a lot of*
> *the principles are specific to asynchronous courses. But then I really thought*
> *about how that would look like in a synchronous and I kind of just translated.*

April explained an example of this translation process in which she read that in asynchronous courses, ground rules needed to be established. She said:

> *That is something about straight from online course design books about*
> *asynchronous courses, that you need ground rules.*

So in her synchronous class students designed learning activities in which students developed ground rules about taking a synchronous online course.

Design Tensions and Solutions

From April's interview, it was hard to find design tensions in synchronous course design. She was confident with her synchronous course design as well as her seven years of design experiences, her academic background, and her research interests in online course design. With these experiences and knowledge, she had her own strategies and concrete views of synchronous course design. In addition, she shared her recent experiences with synchronous online course design that had reached a stable, productive stage.

Tension: Adapting new tools for synchronous courses. April's university changed its video conferencing tool and LMS at the same time. The decision was made by university, but the instructors were the ones forced to adapt. I have observed a lot of complaints about course tool changes from instructors by working on a university support team.

Tool changes brought several issues to April. Frist, there were features that she liked from Blackboard Collaborate that were missing, for example, the "raise your hand" feature or emoticons that allowed her to get a feel for how her students were doing. Second, she did not like the structure of the new video conferencing tool. She thought that Zoom was not a classroom platform like Blackboard Collaborate. She added that the chat function in Zoom was somehow more intrusive than it was in Collaborate. As a very structured person, April did not like Zoom as much as Collaborate. And third, designing a course with a new tool required more time and effort. She explained:

> *It was also the first time to teach an online class on Canvas. There was just a lot*
>
> *of prepping that was more than I would expect.*

April needed to spend more time to redesign her course due to the tool change. And in addition to her personal reaction to the tool change, there were other issues. Her university had changed

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both tools (the video conferencing tool and the LMS) at the same time, so instructors had to learn about both tools simultaneous, adding to the strain on their time and effort. Figure 19 describes this tension.

To this tension, there was no specific or prominent solution she could have made. Actually, those tool changes brought up several more issues in regard to designing synchronous courses. April adapted to the new tools and used them well in her course. She explained:

> *There's not a whole lot of trouble to get into Zoom. […] I went to one Zoom*
> *Training when I was really worried a little worried about it. But it wasn't a big*
> *deal. It was like that with Canvas too. So Blackboard to Canvas, I just usually*
> *need time to get used to.*

April just accepted the new tools and learned about them by attending training and practicing as she went along.
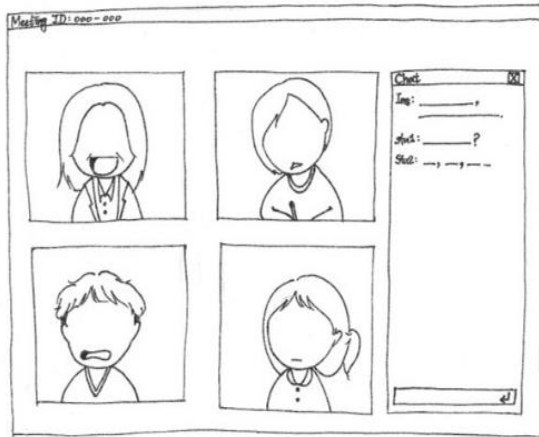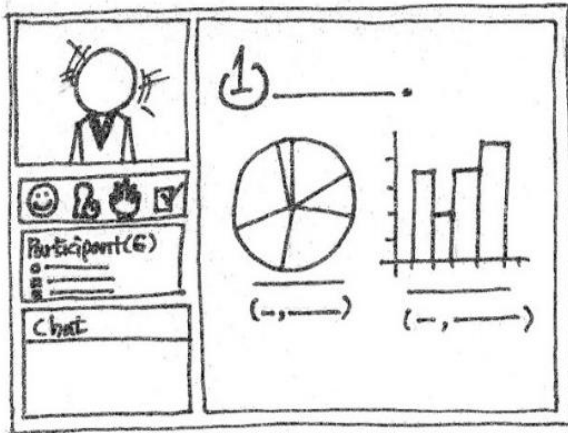
Figure 19. Tension: Adapting New Tools for a Synchronous Course

Case 4: Kailee's Learning Technology Course

Designer: Instructor Information

Kailee was a professor teaching learning technology in a synchronous online course during the fall of 2017 at U University. She had been working at U since 2013 and had been teaching synchronous online courses. She had four years of experience with that synchronous online course at U, but her total online class experience had been more than 10 years. During her PhD course, she gained experience by supporting the design and management of synchronous online classes as a graduate teaching assistant because the graduate school required her to lecture the course.

After graduation, Kailee taught at G University as an assistant professor for the first time. G University provided online classes with a 100% asynchronous format. She wanted to try synchronous online courses by utilizing her GTA experience but could not teach with that format due to university policies. Alternatively, she added a synchronous meeting as an optional session for group project meetings or Q&A sessions. And so, Kailee had had 10 years of experience teaching online, including seven years as a professor plus her time as a GTA.

Teaching philosophy. Kailee said that her teaching philosophy was authentic learning. She said, "I tried to design a course based on the authentic learning theory. The nature of my course is focused on applications in real life. Thus, I tried to design authentic learning activities including a client-based activity and a case study." She applied teaching strategies to her course design from various literature sources related to authentic learning. She also emphasizes the instructor modeling, explaining:

> Instructor modeling is my teaching approach as well. For example, I believe
> that prompt response is basic etiquette in online communication. When a

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student asks a question, I try to respond within a few hours. The reason why I

give an answer to the question as soon as possible is to show a basic

expectation of online communication to students.

These philosophies acted as overall design principles in Kailee's synchronous course design.

Design approach to synchronous online course. What Kailee valued most in a synchronous online course design was provoking student engagement. She said that educators should promote student engagement by taking advantage of the efficiency of communication and real-time interaction and that this design principle reflects online learners' characteristics. She explained that online students must be considered in a different manner than existing face-to-face course students.

According to Kailee, online students may feel bored because they cannot see their classmates' faces or because of the distance between them. Moreover, they are easily disturbed or distracted from focusing on their class. Regarding these drawbacks, she highlighted that it is very important to encourage active engagement in online classes. She designs small group activities to stimulate interaction and provides feedback about class activities to individuals, groups, and whole classes in real time. Kailee said that students appreciate this in synchronous online classes and that she feels closer to them personally this way. In this sense, synchronous online courses seem to build the learners' social presence, as previous research has stated. Kailee contended that synchronous online courses are necessary because of their advantages in regard to social presence construction and real-time interaction which can be cultivated in team activities and online discussions. And though she believes that online courses that are not held in real time are easier to develop and manage, considering that they have fewer materials to prepare, the class

contents and objectives may be inappropriate, hence the synchronous format should be used to best achieve class objectives.

Design Object: Course Information

The class Kailee designed and offered with the synchronous online class format was about learning technology. Its course objectives were:

- Identify suitable learning technology applications for problem-solving tasks.

- Design learning technology solutions based on the Cognitive Load Theory and related multimedia learning design models.

- Justify the selection of learning technologies based on sound theoretical frameworks and practical applications to solve organizational problems.

This course provided an overview of current learning technology applications across organizational and operational functions.

The course was intended to be designed with a synchronous online course format between two representative online course formats. Kailee argued that with the learning technology class it was important to see whether or not students could acquire the expertise for specific skills. Particularly, it was key to confirm that they understood each skill in order to advance to other skills because all of them were linked. Thus, she had check student comprehension in real time and provide feedback to each individual or team in various ways, meaning that her lectures would be best presented as part of a synchronous online course. Kailee had taught a similar course at a previous school but with an asynchronous format, and she said that it was difficult to design and manage in that manner.

Students. In her course, the number of students was always variable. There were many students pursuing master's degrees. At the same time, the rate of doctoral students was relatively high, and undergraduate students could also take the course if they wanted to. Half of the students were from the same major, and half of them were from others. The number of students differed each semester, though usually there were between 30 and 50.

Kailee was teaching this course in both face-to-face and synchronous online course formats. She found a pattern within the student registration after teaching the subject for several years. Once the course was made available online, more students registered for that than did for the face-to-face course. In addition, online courses at Kailee's university were open to both online and on-campus students, leading even more students to register for online courses than face-to-face ones.

Furthermore, the student characteristics were different. Kailee said that online classes had more students from other departments, higher age ranges, and higher rates of career employment compared to students in face-to-face classes. These diversities had a big impact on Kailee's class design. For instance, she had students share their work experience (e.g., field stories) related to the topics in class.

Technology. U University used different video conferencing tools and learning management systems (LMS) for each of its colleges. The Education College to which Kailee belonged utilized Moodle as its LMS and Blackboard Ultra as its video conferencing tool. It had used Blackboard Collaborate until 2017, then adopted Ultra in the summer with an upgraded version of Blackboard Collaborate. In terms of the change, Kailee mentioned that there were pros

and cons that came with it. In particular, some functions she had relied upon were unavailable in Ultra:

> There are several missing functions in Ultra. In Collaborate, I was able to set up student breakout rooms and send PowerPoint slides to each. But Ultra doesn't have these functions, so I needed to give materials for group activities separately or enter each breakout room and upload them. And Ultra doesn't have a timer function. Due to these missing functions, it is really inconvenient.

Along with those missing functions, there were many changes to the program's interface and navigation. Kailee tested new tool functions but was not sure she had checked all of the changes. She told her students, "Because this is my first time to use this tool, there will be some mistakes. Please don't be surprised."

U University allowed colleges to choose their LMS based on the characteristics of their study areas and the nature of their learning contents. The Education College selected Moodle which, along with Ultra, is most generally used for online courses.

University rules. Kailee's university had specific rules for online courses. It offered two formats for each course: online and face-to-face. The decision regarding which format would be selected was made by the university, not the instructors, and changes of this nature were made each semester. Kailee explained:

> The decision to have online courses or not varies from semester to semester. Depending on the needs at that time, the course is delivered online or face-to-face. There are a number of online courses that we must provide each semester for online students. To allow those students to

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complete their programs, we need to provide online courses each semester.

Besides, once a course has been available only online for several semesters,

it needs to be delivered as a face-to-face course the next semester.

Another university policy stated that online courses were to take place across eight weeks, unlike face-to-face courses which were sixteen weeks. And so, Kailee had to condense the contents of her sixteen-week course, cutting what she could and squeezing the rest into a course half its size. She removed and modified several course elements that she had designed for the face-to-face course, explaining:

Due to time limitations, I removed a guest speaker session that I had used

in the face-to-face course. It was easy to invite a guest speaker, but it is

hard to provide enough time for them.

Even there was a difference in course time between the two formats, Kailee tried to provide the same general course level.

Kailee's university provided GTAs for online courses, however there were regulations regarding their use. For example, to have a GTA's assistance, a course had to have at least 25 online students (students who were in an online program). If there were only 24 online students but also eight on-campus students in her online course, Kailee could not have a GTA despite having more than 30 students overall.

Kailee said she was usually unable to have a GTA due to this particular regulation. Still, in her class there were typically more students than in other classes, so whereas the other instructors I interviewed had between 10 and 20 students, Kailee had an average of 30 and

sometimes as many as 50. She had been using the chat function as her main communication tool, but there were too many open chats for her to check on her own. She needed a GTA.

College. In terms of the design for online courses, synchronous sessions can be optional or necessary depending on each college. In Kailee's Education College, weekly two-hour synchronous sessions were required.

Support. Kailee's university has a department, the Center for Innovation in Teaching & Learning (CITL), to support instructors with class development and management. CITL provides course counseling in addition to personalized support for instructors who want to create, revise, or blend courses. As for online courses, once instructors submit a request for help, the online strategy coordinators offer their services in person, but CITL also has materials related to online course design on its website. There are various resources including best practices about general strategies related to design and delivery based on published research. However, those resources focus on asynchronous online courses. The center provides only a single page of information on synchronous online sessions as a sub-topic of a "Teaching Online" section. They have best practices sorted by platform, and that includes the best practices for Zoom and Blackboard Collaborate. When instructors click on the link, they can see information from each platform's website, not just information developed by the school. The school developed only one resource, a 40-minute video about how to use synchronous tools. Recently updated materials for Blackboard Ultra have not been provided. Figure 20 shows the synchronous session resources CITL provides.

Figure 20. Synchronous Sessions Resources Available from CITL

Even though Kailee was aware of her university's support, she did not make use of it. She did do so because of her prior expertise in online course design and technology. She explained, "Because I am a researcher who investigates online learning, I do not feel that it is necessary to seek support from others in designing online course and learning new tools."

Design Outcome

Course structure and elements. Kailee's learning technology course had a two-hour synchronous session every week. During those two hours, Kailee would summarize asynchronous discussions, deliver lectures, ask students what happened in their group discussions, and conduct whole-class discussions including debriefing group activities. In addition to those two hours, Kailee opened each synchronous session 30 minutes before class and kept it open 30 minutes afterward. She used that time to prepare and answer students' individual and group questions. Students could also use that time for their group projects. In total, then, the synchronous online session was three hours each week.

Students had two assignments before each synchronous session. They had to read materials assigned each week and participate in asynchronous discussions based on the readings on the LMS discussion board. In both her face-to-face and online courses, Kailee designed discussion activities as essential learning activities, however, the synchronous online courses were limited in terms of discussion time, so she asked her students to discuss topics on the discussion board outside of class. She provided an asynchronous discussion forum to students, and in each discussion she provided one or two discussion questions, and her students could then should post at least one response in addition to replying to another student's response at least once.

When students had entered the classroom, Kailee started with feedback and a summary of their latest asynchronous discussion. If there were specific topics or questions mentioned frequently, she addressed them in the session. Each session also included an explanation of upcoming assignments, and after each session, Kailee talked a little bit about the following week's topic.

For Kailee, lectures were an essential course element. In each week's class, she included a lecture in the synchronous session. She thought that even though she had asked students to do course readings before class, she thought they might not understand all of the concepts in the readings. She provided many readings, thus she felt it was necessary to lecture and deliver the key concepts of readings.

Lectures were also an opportunity to introduce cases and examples related to course topics. However, lecturing in synchronous learning environments can be boring to students, and it can be hard to check students' attention levels because one cannot see faces, an obvious contrast to face-to-face courses. Thus, during lectures Kailee often asked questions to students to attract and retain their attention.

Group discussions were also one of Kailee's essential course elements. She said that synchronous online courses promote students' real-time interaction, so to use that benefit she tried to include group discussions in synchronous online courses. After each lecture, she asked students to participate in group discussions by creating breakout rooms for each team. She also led group discussions (between one and three) during each class. Discussion topics varied depending on the course topic each week and were provided to the group by Kailee.

Design feature 1: increasing student participation during lectures. During lectures, Kailee encouraged students to ask questions via the chat function because chatting was a more efficient method. Having students ask questions directly through voice chat often made it more difficult for students who were reluctant to speak in class, plus it interrupted Kailee's lectures. Additionally, since they could feel free to express their opinions and ideas, Kailee encouraged

the use of the chat function. However, she mentioned that when the class size was large it was difficult to keep up with the volume of questions and comments coming in.

Design feature 2: promoting group discussions with various strategies. Group discussions were a core learning activity that reflected Kailee's teaching philosophy. From previous experience, she had developed several strategies for promoting student group discussions. First, she assigned groups before each semester started because she had learned that assigning groups was heavily time-consuming. Second, she had those groups make ground rules for smooth group activities. She said that she did not check the ground rules but helped students sort out how to make their rules. And third, she acted as a facilitator to support her students' debriefing activities from group discussions. Each group assigned one speaker, and that speaker reported the results of their group's activities. At that time, Kailee gave her students a blank table and let them type their activities onto a screen for summarization, though often she did it herself. In our interview, Kailee highlighted that instructors should give students an exact presentation time and set up a timer to account for any lack of time during group reporting.

Design feature 3: asking about students' field experiences. Kailee's teaching philosophy was authentic learning. She provided materials and class activities from workplaces in which students would work in order to enhance the authenticity of class. Specifically, she asked her students about their work experiences because most of them were employed. She said that this strategy helped eliminate moments of silence. Kailee asked students for their experiences and shared them with other classmates based on each student's characteristics whenever there was silence during class.

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Design feature 4: providing detailed instructions about assignments. Kailee

mentioned that when she gives assignment, she offers specific guidelines in detail. She explained

in detail about one assignment guide with at least one to two pages. She said that the reason why

she gave detailed guidelines for assignment is because online students are not able to get answers

to questions about assignment immediately like face-to-face course. She reported that she did not

receive lots of inquiry email about assignment after providing detailed guidelines for assignment.

She said this strategy from her teaching asynchronous course experiences.

Design feature 5: providing guideline for online communication. Kailee believed that

prompt responses were essential etiquette in online communication. She said:

> *In online learning environments, students will be frustrated if they don't get a*
>
> *response to their questions from their instructor within 24 hours. Thus, I tried*
>
> *to answer students' questions as soon as possible.*

When Kailee got a question from a student, she tried to respond within a few hours. This strategy

was related to instructor modeling, part of her teaching philosophy. She said that she responded

to questions as quickly as she could because it upheld a basic expectation from online students of

timely communication.

Design feature 6: providing formative feedback. With her belief in the importance of

formative feedback, Kailee tried to provide sufficient feedback regarding students' projects four

times each semester. She provided students with individual assignments to be completed during

the semester. Interim checks were necessary for effective assignments because a project could

take a long time. She had students submit sub-tasks such as design and development tasks for the

learning module project. She did not grade the project, instead giving formative feedback.

Students received formative feedback twice per assignment, for a total of four times. Kailee talked about the difficulty of this feedback, saying it was okay to give feedback a week after a student had submitted the assignment, but for the online course she had to start grading immediately and give feedback only two days later to allow them time to resubmit a revised version. The time assigned for the online course was half that of a face-to-face course because students had to finish their projects within eight weeks, Kailee had to provide them with feedback as soon as possible. This put a lot of pressure on her.

Design feature 7: increasing students' participation in synchronous sessions. Kailee highlighted the importance of participation in synchronous online courses, as seen in the syllabus excerpt below. The sentences in red emphasized the significance of participation in synchronous online courses, saying that each student's participation would be reflected in their grades.

Participation in Online Synchronous Sessions (30% of your participation grade)

You are expected to attend all synchronous sessions and contribute to discussions and activities during all synchronous sessions. **If you miss more than two sessions, you will lose 50% of the online synchronous session participation grade; if you miss more than four sessions, you will lose 100% of the online synchronous session participation grade.**

Figure 21. Grading Criteria for Student Participation in Synchronous Sessions

Design feature 8: increasing students' participation of synchronous sessions. Because Kailee felt that class time would not be enough to cover all of the course activities, she decided to not spend synchronous session time on group projects. Instead, as mentioned earlier, students had time to gather and do group projects for 30 minutes before and after each class. Each group

had an individual breakout room where they could conduct additional group meetings about their projects outside of regular class time.

Design Tensions and Solutions

Tension 1: the communications were too numerous and too varied to handle. In synchronous online courses, instructors and students can communicate via chat, audio, and video as well as by sharing their screens. However, Kailee faced an issue in using those various communication channels. She said:

> *When I teach, I need to check my PowerPoint slides, chatting, and video together.*
> *Checking all these forms of communication distract me when I teach.*

Among the many communication channels available, the chat function was the primary one in Kailee's synchronous course, but she was having difficulty using it:

> *To me, chatting is the most useful but also the most difficult communication type.*
> *In class, I asked students to use chatting for classroom communication. However,*
> *it is hard to follow up on students' messages because there are too many people*
> *chatting. It is difficult to read and react to all their messages alone.*

For students' active participation on synchronous session, Kailee encouraged her students to feel free to express their opinions through chat. However, she found that there were too many open chats. She said she usually had at least 30 students in a course, and open chats from that many students were simply too much to check on her own. She felt that she needed a GTA who could monitor and handle chats for her. However, due to university regulations, Kailee was unable to have a GTA even though she had more than 30 students.

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She faced issues with managing various communication channels because there was too much communication input and no GTA to assist her sort it all out. Figure 22 describes this tension.

She said that she was not able to find an ideal solution to this dilemma, but she developed a strategy: She decided to turn off her video during class to better manage various communication channels, adding:

I decided to turn off my video after welcoming students at the beginning of the class. […] To concentrate on specific communications, I decided to turn off my video because I thought that it is less important to students' learning than other communication channels.

By turning off the video function, Kailee reduced the amount of communication input and was able to focus on her students' chats. She realized that using video could build a teaching presence among online students, but she decided to deliver the course without video anyway. She justified this by saying in part that she had watched a recorded synchronous session after class and noticed that her gaze stayed on PowerPoint. She thought that having her video on the screen did not perform any specific role because she didn't even look at the camera. And so, Kailee decided to give up the video function and focus on her students' chats instead. She pointed out, however, that she turned on her video during another course for which she had a class GTA.
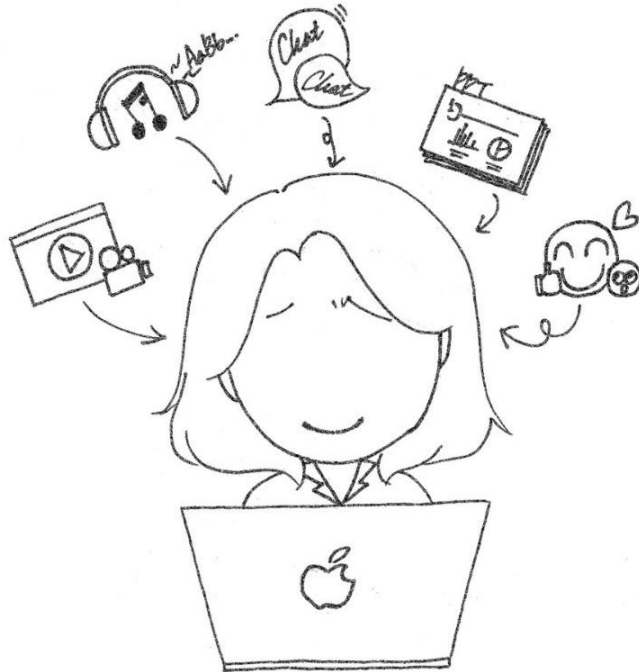
Figure 22. Tension: The Communications Were Too Numerous and Too Varied to Handle

Tension 2: condensing a 16-week face-to-face course into an eight-week synchronous course. Kailee's program offered two formats for each course: online and face-to-face. The decision regarding which format would be available was made by Kailee's university, not the instructors, and change to this extent were made every semester. Once a class was approved, though, an instructor needed to redesign their face-to-face course according to university regulations. The university's policy for online courses was that they must consist of eight weeks of lessons, unlike face-to-face courses which were to be delivered across sixteen weeks. Thus, Kailee had to condense a sixteen-week course's contents into eight weeks, literally cutting everything in half. Yet despite such a drastic difference in the course time between the two formats, Kailee had to provide the same course quality. That is, the design condition necessitated

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a very difficult task: designing an online course that provided a similar learning experience and achievements as its face-to-face course but in only half the time.

And Kailee had yet another issue that contributed to the difficulty of synchronous online course design. By teaching this course in both face-to-face and synchronous online formats for several years, she had noted a pattern among student registration. When the course was open as a synchronous online course, more students registered than they did for the face-to-face course. One reason was that online courses were open to both online and on-campus students, so naturally more students were available for the online courses than for the face-to-face one.

Kailee said that having so many students in an online course created several tensions. For example, assigning groups for group activities took more time than during the face-to-face course. And so, because there were too many groups, there was an issue with providing each group with enough time for their group project presentation and reporting their group discussions. Figure 23 illustrates this tension.

2016 Fall	Title	Course No.	Format	Instructor	Status
	Learning Technology	543	On Campus 16 weeks	Kailee	20/50

2017 Fall	Title	Course No.	Format	Instructor	Status
	Learning Technology	543	Online 8 weeks	Kailee	50/50

Figure 23. Tension: Condensing a Sixteen-week Course into Eight Weeks

To handle this tension, Kailee removed and modified several course elements and teaching strategies that she had designed for the face-to-face course. For example, she said:

> *Due to time limitations, I removed the guest speaker session that I used in face-to-face courses. It is easy to invite a guest speaker, but it is hard to provide enough time to a guest speaker.*

She also added asynchronous discussion activities every week. In both her face-to-face course and online course, she designed a discussion activity as an essential learning activity. However, synchronous online courses have limited time for discussion, so she asked her students to use the discussion board outside of class time.

Kailee asked her students to read materials assigned each week and participate in LMS-based asynchronous discussions related to those readings. She provided one or two discussion questions, and then students posted their responses about each question at least once while also replying to other students' posts at least once as well. Figure 24 shows the guidelines for these asynchronous discussions, as written in Kailee's syllabus. Later, when students entered the classroom, she started class with a summary of and feedback on their most recent asynchronous discussion.

In addition, Kailee decided to use two hours of synchronous sessions for only classroom activities. She did not spend synchronous session time on group projects. Instead, she opened her synchronous course 30 minutes before class and kept it open 30 minutes afterward to provide group work time to the student groups. This session also allowed her to answer students' questions just as she did in face-to-face courses without including additional Q&A time during synchronous sessions. Even with these strategies, Kailee said that she felt a bit of difficulty with providing the same learning experience to online students as she did in her face-to-face course.

Participation and Online Discussion (ongoing)

Online Discussion (70% of your participation/online discussion grade)

Between synchronous class meetings, we will continue our conversation in Learning Technology discussion forum.

1. You need to demonstrate your efforts in
   a. Accessing the online discussion forum by responding to the discussion question at least once per question and,
   b. Responding to at least one of your peers' postings per question.
   c. In other words, you need to post at least 2 times per discussion question
2. A good online discussion posting should consist of:
   a. A clear initial statement indicating the thesis/viewpoint/stance of your posting (e.g., I agree with the…, I disagree with the…, I consider this a …issue)
   b. A comprehensive explanation supporting your statement. If possible you should cite relevant reading assignments to support your explanation.
   c. When appropriate, you need to state and explain actions or solutions you plan to implement to resolve the presented evaluation issues.
3. You will be evaluated on whether you engaged in meaningful asynchronous dialogues throughout the term.

Figure 24. Guidelines for Asynchronous Discussions

A group discussion during a synchronous session was Kailee's essential course element. However, she noticed that assigning groups during synchronous sessions was too time-consuming, unlike during a face-to-face course. To save time, Kailee assigned groups before class started. She said that she checked the registered students' information, such as their programs (majors), whether they were online or on-campus students, their degree levels (master's or PhD), and the semesters they were in (first or third semester).

Kailee then assigned a group by considering those factors. In addition, when she assigned group members she also assigned each group's presentation topic for their group project. She said it was an inevitable decision in response to a design condition, that being the limited course time. Kailee explained that there were too many things she needed to prepare for the synchronous online course before the semester started because she needed to adjust existing

course management strategies based on the number and characteristics of her students. Kailee said:

> *I hardly had time to breathe even two hours before the first class of the online*
>
> *course.*

Case 5: Jane's Instructional Design Course

Designer: Instructor Information

Jane had taught a class on instructional design within a synchronous course format at H University since 2013. The course was the first synchronous online class for her, but she had had five years of synchronous online class experiences when I interviewed her. The course had been available with both a synchronous online class format and a face-to-face format since before she started teaching. During the time of my interview, the course was being taught in an online format as well as in a face-to-face class led by another instructor.

Teaching philosophy. In all her course designs, both face-to-face and online, Jane had tried to design activity-oriented courses. In each of her courses, she always tried to include group discussions and hands-on activities that asked students to participate instead of simply receiving instructor-led lectures. Aligning with her teaching philosophy, her design approach to synchronous course was encouraging students' real-time interactions. Jane said synchronous online courses should allow participants to teach and learn from activities which are available to face-to-face courses and not possible in asynchronous courses. She said:

> *To me, an ideal synchronous online course is one in which students can*
>
> *interact with each other and participate in group activities as they can in*
>
> *face-to-face courses.*

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In particular, the course Jane was teaching was being delivered in a face-to-face course as well, thus she wanted to design a course that provided the same learning experiences in terms of real-time interaction and group activities. She designed many real-time group discussions and group activities using breakout rooms.

Based on this design principle, Jane designed a course by adapting a flipped classroom approach, an instructional strategy that moves most information transmission teaching, such as lectures, out of class and uses class time for learning activities that are active and social and require students to complete pre- and/or post-class activities to fully benefit from in-class work (Abeysekera & Dawson, 2015, p.3).

Previous online course experiences. In teaching the synchronous online course, Jane had one concern with promoting students' participation due to the characteristics of synchronous communication. She said that in a synchronous online course, it is hard to engage students who are uncomfortable with attention in classroom communication. In face-to-face classes, she had relied on making eye contact with students to induce them to discuss the subject. This eye contact allowed her to speak directly to students and encourage them contribute. Jane said it was a good strategy for bringing reluctant students into the discussion.

However, in synchronous courses Jane could not check the face of each student, so she could not involve those who avoided attention. In synchronous online courses, when someone talks, the spotlight is directly on them, and the other students can only watch or hear that student because only that student's microphone or video stream is active. Due to this, Jane thought that shy and hesitant students avoided participating in conversations.

Jane was teaching an asynchronous online course as well as a synchronous course in the same semester. She felt more comfortable teaching the asynchronous online course between, but

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in that course it was difficult to achieve the course objectives. According to Jane, some classes that required group projects were difficult to teach with an asynchronous course format. She said that she was then providing one group project in the class but that students were having a hard time with it. She believed that her instructional design course should be taught with a synchronous course format.

Design Object: Course Information

The instructional design course that Jane taught was one of core courses in the program. Her program offered four required courses that first-year graduate students should take. Among them, two were provided with a synchronous online class format. Jane's instructional design course was one of them and was linked to another instructional design class the following semester.

This was a foundational course preparing students to become instructional design professionals. The course covered foundational processes for analyzing systems and their learners. There were twelve learning objectives including "Students will be able to write a funding proposal for a grant or business plan based on the front-end analysis results that include a purpose, project plan components, and budget."

Jane designed two group projects: 1) analyzing a workplace that conducts front-end analysis and 2) an instructional design project that creates a technology-based lesson. Seventy percent of each student's grade was made up of these group projects.

Design Situation

Students. This class was a required course in the department and available only to students in the online master's program. This program provided online courses in both

asynchronous and synchronous course formats, thus students who had taken an asynchronous course in Jane's department had the expectation that her course would also be asynchronous. Jane reported that many of her students had their own expectation that online courses would indeed be anytime and anywhere. She said:

> *Students have their own reasons for registering for online courses. Because they cannot attend a face-to-face class at a specific place and time, they registered for an online course. Thus, they don't like taking the class at the specific time and communicating with others in real-time. They are reluctant to participate in real-time activities.*

Many of Jane's students were full-time employees, including K-12 teachers and university staff members. She said that one reason for their entering the online master's program was career development. She found that many graduate students in her courses tended to do only the bare minimum for each assignment because their goal was to graduate as soon as possible. In that regard, Jane had difficulty increasing those students' participation in course activities. She designed several strategies to turn that around, but none worked well enough.

Jane said that there were several students living in remote, inconvenient areas, and as a result they had poor internet infrastructure. She needed to design a course that considered these students.

Technology. Jane used Zoom and Canvas for her synchronous course. Jane's university had changed its video conferencing tool from Blackboard Collaborate to Zoom, and this change had brought both advantages and disadvantages. Because the university changed the tool during a semester, Jane didn't have enough time to understand the new one, so ultimately she was unable to use the video conferencing tool effectively. She said:

I hadn't had a chance to use Zoom yet, so I couldn't figure out its specific

functions. I am not able to use all functions in my course now.

Jane also noted that she was missing a survey function from the previous tool. Overall, tool change limited her use of video conferencing functions.

On the other hand, tool change had also brought a convenience. In Jane's case, she created presentation materials with Google Slides. It was her preferred and main presentation application. She uploaded Google Slides files to the LMS to share presentation materials with her students. However, there was a conflict when using Google Slides in Blackboard Collaborate because that application's share screen function did not support Google Slides.

Thus, Jane created two types of presentation materials for each topic: one with Google Slides and the other with PowerPoint. Still, when there was a change to either program, Jane needed to update the materials separately according to each software. She said it was difficult, time-consuming work, and she expressed that she did not know how many versions of presentation files she had as a result.

Department culture. Jane was a professor in the department of instructional technology, a field which investigates the use of technology in learning, including in online course and classroom technology. The department decided to take an active approach with this new tool. They decided to use a new tool for their courses just after the switch even the university still allowed to use existing video conferencing tool. the switch. Since this was a departmental decision, Jane needed to alter a synchronous course delivery tool during the semester. She needed to learn about the new tool quickly in order to use it properly in her course, and she made several changes to her existing course design and teaching strategies in response to the characteristics of the new tool.

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Jane's department provided students in its master's program with both online and on-campus tracks. H University constructed a system associated with several satellite colleges. The online master's program was for students who attended colleges not on the main campus, meaning that to register for the online master's program, students had to live in another area. But the registration rule had recently been weakened so that those who had classes at the main campus but had difficulty commuting to the school could take online courses. Still, according to Jane, two-thirds of her students were from another campus.

Jane's department provided on-campus and online programs, so there was another professor who taught the same course as Jane but with a face-to-face format. Because this was a core course in each program, the learning objectives and content had already been assigned. Jane and the other instructor needed to design the course together in order to provide the same level of academic achievement to both online and face-to-face students. They decided to adopt the same main contents and learning activities but modify minor things based on their different learning environments. They tried to align the courses' designs as much as possible.

Support. Jane's university had a Technology Distance Program, a technology support team from its College of Education. The team was in charge of all technology support and purchased video conferencing tools for the college. The director of the support team had a deep understanding of the use of technology in class and was also a professor in the instructional technology department.

Jane explained that the team offered fast and diverse support for the purchase of online class equipment and the needs of professors. For instance, the team gave instructors permission to choose their own LMS from among Sakai, Laulima, Canvas, and Google Sites. In Jane's department, each faculty member was using a different LMS depending on their teaching style,

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preferences, and tool characteristics. Jane was using Canvas. Also, another professor in her department had built their own class website with support from the team.

Jane said that when she first taught a synchronous online course, the support team offered to assist her and stayed in her office during her first synchronous session in order to guide her through any difficulties that might have occurred. However, she did not utilize the support because she already had basic understanding of online classes.

Jane's department also provided support for online classes with the support of a single college size. Her department had a three-day face-to-face orientation for all students in their first semester. The orientation explained the expectations of online students, the features of online classes, and how to register for classes. It was mandatory for all students to attend, so those who did not were not allowed to take classes that semester. In other words, though they had been admitted, they would have to wait until the following semester if they did not attend the orientation.

Design Outcome

Course structure and elements. Each synchronous session lasted for two hours. Before class, students needed to complete watching the course videos, finishing the course readings, and writing reflections on the contents. After a synchronous session began, students were asked if they had questions about the activities before class or if there was something that they did not understand. Jane said that most of the students had no questions during the sessions. Students were then gathered with their group members and started the weekly group activity. After they completed their group activity, they had time to share what they did together by gathering again as a full class.

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Design feature 1: adapting a flipped classroom approach. Jane designed her online course as a flipped classroom. In her syllabus, in the "Instructional Procedures" section, she wrote:

> *This course will use a "flipped classroom" methodology where much of the content is delivered online in video lectures and course readings for your use outside of class. In-class activities will allow you to practice the new content and processes and allow you to begin to apply it to your course project. Your ongoing conversations with your team about the project will be where much of your learning occurs.*

Jane adapted this approach to make her synchronous course more activity-oriented. She adapted a flipped classroom approach because she didn't want to lecture in a synchronous online course. She said:

> *When I taught this course for the first time in 2013, I did a lecture in my synchronous courses. However, I felt that lecturing in a synchronous course is one-way communication because I cannot observe students and how they are taking my lecture.*

From this experience, she found that there was no difference between reading the instructor's presentation materials and taking the time to lecture on the course contents. And so, Jane removed all the lecture sections from the course and decided to focus instead on discussion group activities by adapting a flipped classroom approach.

Design feature 2: designing a reflection activity. With a flipped classroom approach, Jane designed a reflection activity to facilitate and check student comprehension outside of class activities. Students needed to complete writing weekly reflections after watching the course

videos and finishing the course readings. She wrote that this activity could aid in the analysis, understanding, recall, and use of reading materials as well as provide a means of clarifying important concepts that were unclear or difficult to grasp. She provided specific guidelines for this activity in her syllabus:

- Synthesize two or three of the assigned videos & readings for the week;

- Explain how the main ideas covered by the videos & readings may be applicable to you;

- Generate one question based on the videos & readings; and

- Respond to at least two of your classmates' questions

This activity accounted for 15 percent of each student's grade.

Design feature 3: removing whole classroom discussions from the beginning of classes. Jane had had a whole class discussion section for 30 minutes at the beginning of each class. However, she removed this activity based on her previous experience:

In my synchronous course, I had designed a whole classroom discussion activity that overviewed students' asynchronous discussions. I asked students to share their opinions on the previous asynchronous discussion topics. I used several strategies to facilitate that activity. However, it didn't work well. For example, I brought specific sentences that students posted, and then asked the student who wrote the specific sentence to elaborate on it. However, students didn't like that activity. They questioned why I asked them about their sentences again even though they already posted about the topic. With this issue, the whole classroom discussion activity was really quiet and hard to manage with the lack of participation.

According to Jane, students participated in the activity passively. They shared only two or three sentences, then insisted that that was the extent of their perspective. Thus, Jane felt a difficulty in managing that activity and decided to remove the activity from her class.

Design feature 4: assigning groups in various ways. In Jane's case, she assigned groups depending on projects. Usually, she had two projects in each semester. She had attempted various ways to assign groups; she assigned them randomly but also sometimes asked students to assemble their own groups. Synchronous online courses require meeting at specific times, so when she asked students to assign themselves into groups she suggested they do so according to their personal schedules and topics of interest. However, she said that assigning groups was always problematic.

> *I tried many ways to assign groups. However, there are always different types of*
> *complaints from students. I am thinking about the ideal way to assign groups, but*
> *it is still difficult find the solution.*

Design feature 5: providing a place for group projects after class. Jane felt a lack of time to do essential course activities, so she was unable to provide group work time during her synchronous course. As an alternative, she provided a virtual classroom to students which they could access at any time in order to communicate with one another. All the same, that virtual classroom was limited in that if the instructor was not in the virtual classroom, the students could not access moderator functions such as recording and content sharing.

With these limitations in mind, Jane suggested that students use Google Hangouts for group work instead. She found that students were good at using Google Hangouts, so she didn't need to worry about finding a resource for them; the students had provided their own.

Design feature 6: facilitating in-class group activities. In Jane's course, group projects were the main course activity. To facilitate students' group work, Jane developed several strategies. First, she asked them to write team contracts for their group projects. Those contracts included when they would present, who would do what, and what penalty would occur if someone did not perform their role. Second, she asked students to assign roles (project manager, subject matter expert, etc.) among themselves when they conducted group project meetings. With these roles, all group members could contribute to their project. Jane also set the minimum amount that each individual should perform. And third, she provided weekly milestones related to group projects. Two group projects in her course were one-semester projects. By specifying what they had to do each week, Jane could ensure the completion of the project on time. And yet, she said that in spite of these efforts, students always expressed difficulty with group activities.

Design Tensions and Solutions

Tension 1: co-design a synchronous course with a face-to-face instructor. In designing her course, Jane faced several limitations due to the course's characteristics. First, the department had a certain expectation of this course because it was a core course of master's program. The learning objectives and main topics had been assigned by the department. Jane said:

> *The topics of this course are really important and essential to our field. And this*
> *course is the only one that covers these topics, so it is clear what the instructors*
> *must teach in this course.*

Jane was worried that the students did not meet the achievement level required by the department due to her changes to the course objectives and topics. Also, her department provided two tracks

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for the same master's program (on-campus and online), so another professor taught the same course in a face-to-face format. Jane and the other instructor needed to provide the same level of academic achievement to both online and face-to-face students. To that end, they had to design the course together.

However, the decision to design the course together brought design issues. First, they had to consider both learning environments. They tried to align the courses' designs as much as possible. Specifically, the synchronous online course format had different communication types, teaching and learning environments, and design constraints than the face-to-face course format, and due to these differences, it was a complex and hard task to design a course that met the needs and conditions of both formats. For example, Jane had difficulty incorporating lectures in her synchronous course, though doing so in the face-to-face course was no problem. And so, she didn't want to include lectures in her synchronous course, but she needed to consider the face-to-face course in that regard.

Second, the face-to-face instructor had her own concrete views of that course because she had been teaching it for nearly 25 years. Even though the face-to-face instructor did not force her to use the existing activities and materials, Jane still felt pressure to use that instructor's materials and adapted her existing approach to course design as a matter of deferring to the other instructor's experience. In addition, because they had decided to design the courses to be as similar as possible, Jane needed to explain, negotiate with, and persuade the face-to-face instructor regarding her own design ideas. Figure 25 describes this tension.
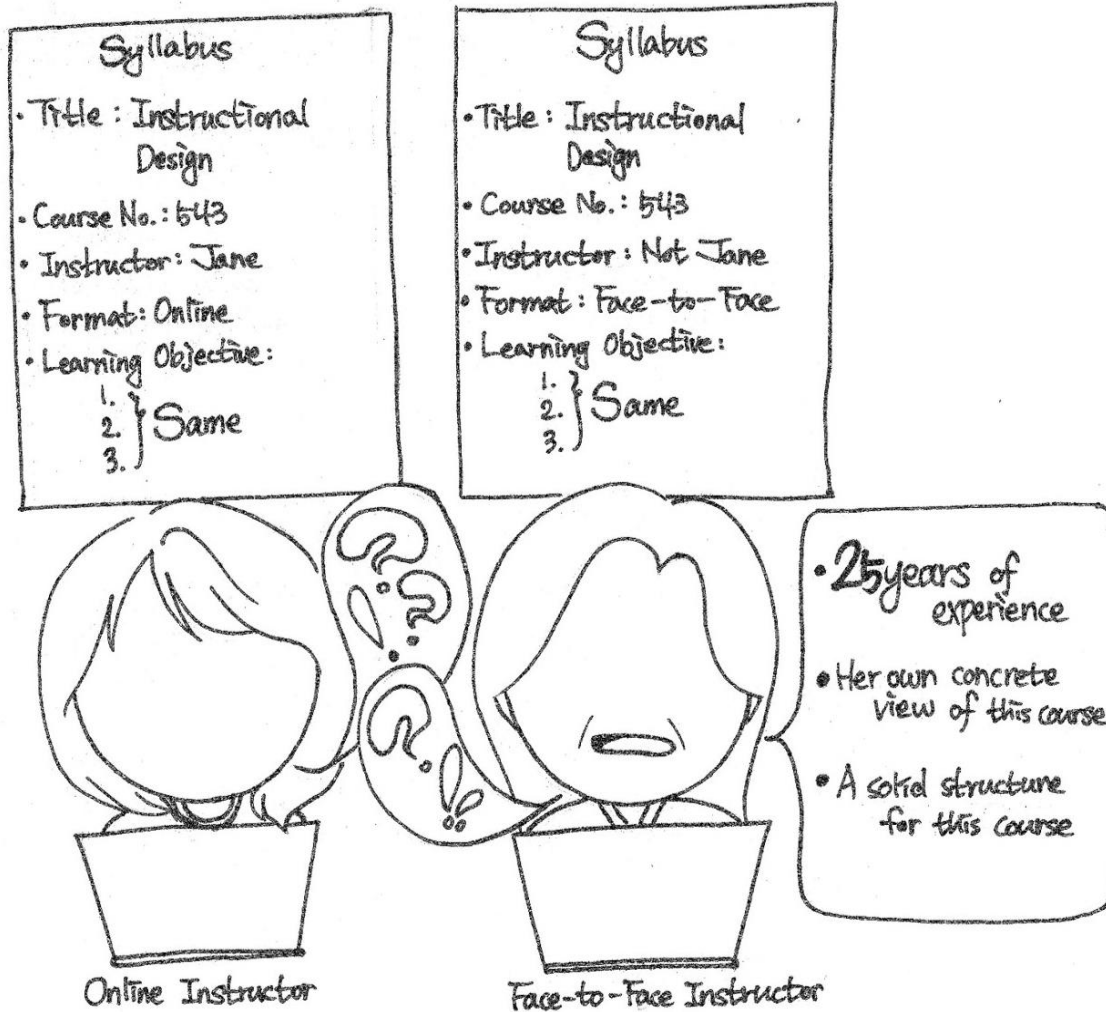
Figure 25. Tension: Co-design a Synchronous Course with a Face-to-Face Instructor

To handle these design limitations, generally, Jane and her colleague decided to use the same main contents and learning activities in both courses, but they changed the structures of the courses by adapting a flipped classroom approach to the course design. Jane said that even though the face-to-face instructor had no intention of resigning the course as a flipped classroom, Jane suggested designing the course by adapting a flipped classroom approach because delivering a lecture during a synchronous session was the hardest thing for Jane to do. She thought that, in her experience, giving a lecture in a synchronous session was an inappropriate teaching strategy. Luckily, her department and the face-to-face instructor accepted her suggestion.

In designing a flipped classroom, the two shared roles. The face-to-face instructor created lecture videos with her rich experiences in teaching this course and uploaded them to YouTube. Jane, meanwhile, developed all the weekly presentation materials that were to be used in both courses. All students were asked to watch the video lectures and review the course readings before each class to prepare suitably for participating in the class activities.

Jane and her colleague designed the basic course together and incorporated the same course contents, elements, and learning activities in both their courses, then they changed and modified several things based on their different learning environments. In particular, Jane modified the course structure by reflecting her synchronous online learning environment. For example, after delivering the course for one semester, she found that one entire classroom activity would not be suitable in the synchronous online course. She explained:

> *In my colleague's face-to-face course, there is a whole classroom activity. That*
> *activity is about applying what they learned in their real life. Students have a*
> *chance to apply what they learned in general practice. This is a short individual*

practice before a group activity. I tried to use this activity in my synchronous

courses, however, it was hard to manage each student's activity. In addition, this

activity took too much time. Thus, students did not have enough time for their

group activity because they had spent too much time on the whole classroom

activity even though the group activity is more important activity.

Jane thought there was not enough time to include a whole classroom activity in a given two-hour synchronous session, so she decided to remove it from her course and instead provided materials for whole classroom activities from the face-to-face course to students before each synchronous session. With those materials, students could practice the activities by themselves in their own time.

Tension 2: there were students with limited bandwidth. In synchronous courses, instructors can use various communication channels such as video, audio, and chat. Jane particularly wanted to use a video function. She wanted to show her face to students by turning on the camera function and retain her students' attention while providing a teaching presence. However, she had an issue in using the video function due to the characteristics of some students. Jane said, "In my course, there are several students who are living in a rural or otherwise inconvenient location. She said that they have poor internet infrastructure, including limited bandwidth." She continued:

When I taught synchronous online courses by turning on my video, they said that

with their internet connection in particular, video streaming was slowing down

after 30 minutes.

Due to those students who were having bandwidth issues, Jane was unable to use the video function properly. Figure 26 illustrates this tension.

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As a solution to this issue, Jane decided to not turn on video during class. She said that she only turned on her video stream at the beginning of the semester to say hello and at the end of the semester to conclude the course. However, this solution brought yet another issue. By delivering the course without video input, Jane felt that students were often confused because they could not see their instructor's face. In class, there were moments when she did not say anything while she adjusted her screen, operated various functions, or read students' messages. At those times, students did not know what was happening and were confused.

For this issue, Jane developed another strategy:

I keep talking while preparing or reading something in class. For example, 'Please wait a moment, I am doing something,' or, 'Someone asked a question via chat. Did you read it?

Jane did not stop talking during class. She left no moment unfilled or silent, instead talking constantly in order to prevent students' confusion. In addition, when she gave answers to questions via chat, she read the students' questions before answering them. She did this because there was a chance that students did not see the chat, so if she only answered a question, some students would be lost because they didn't know where they were. Jane had to develop various strategies to solve problems caused by the lack of video presence in her course.
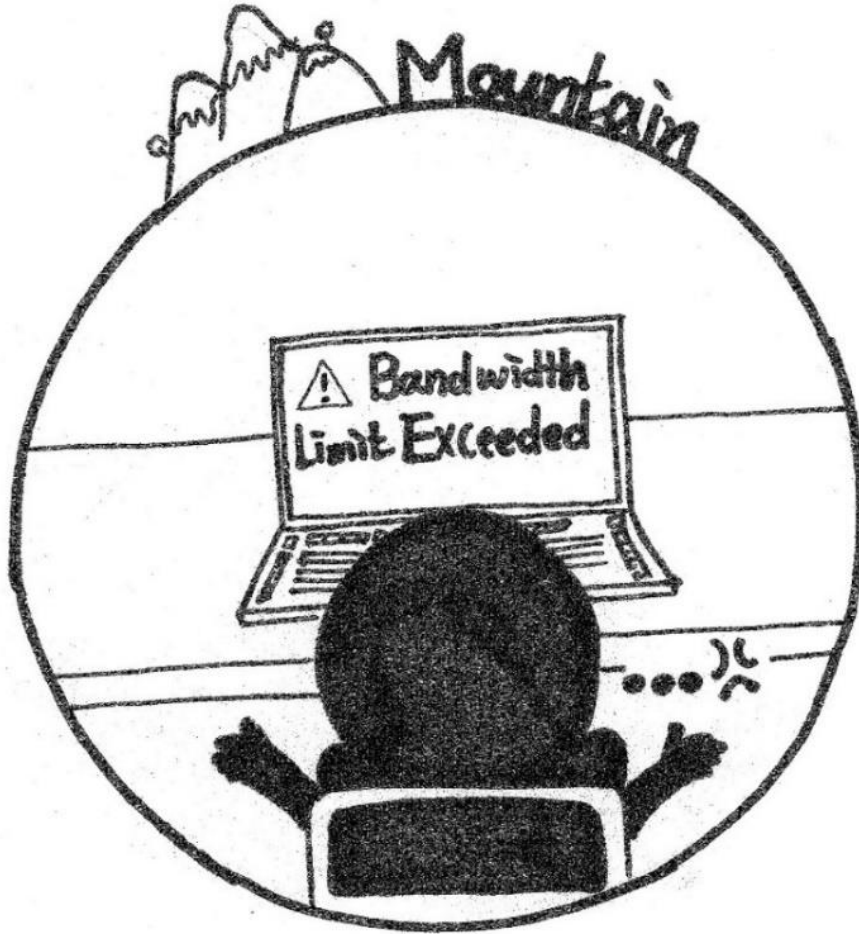
Figure 26. Tension: There Were Students with Limited Bandwidth

Tension 3: managing group activities as she did in face-to-face courses. Jane's design principle of synchronous online course was providing the same level of experiences in group activities as in face-to-face courses. With this approach, she designed group activities in her synchronous courses each week and tried managing group activities as she did in face-to-face courses. But she faced several difficulties in doing so due to the limitations of the video conferencing tool.

Jane managed group activities in face-to-face courses by observing the students' group activities. In face-to-face courses, she was able to gather everyone in one place, and when she found something that needed to be shared with the rest of the class, she simply paused the group activities, talked about the issue, and then let them resume. However, in synchronous online courses, students were located in different group rooms in which only they could see or hear their group members. In this situation, the instructor could observe only enter one room and observe one group at a time. She was unable to check all the groups' activities at once. In addition, even Jane though had found that some topics needed to be presented to all of her students, but she could not share such information immediately because it was time-consuming and difficult to bring all the students to the main classroom and then release them again into their group rooms.

She had another issue with managing group activities. She stopped by each group room every 10 minutes or so to monitor their group activities. She found that when she entered a group room, the students became quiet. She said that she had to leave the meeting room before students would resume talking. Figure 27 describes this tension. About these difficulties, Jane said:

I have not yet developed a solution for the issues related to monitoring group
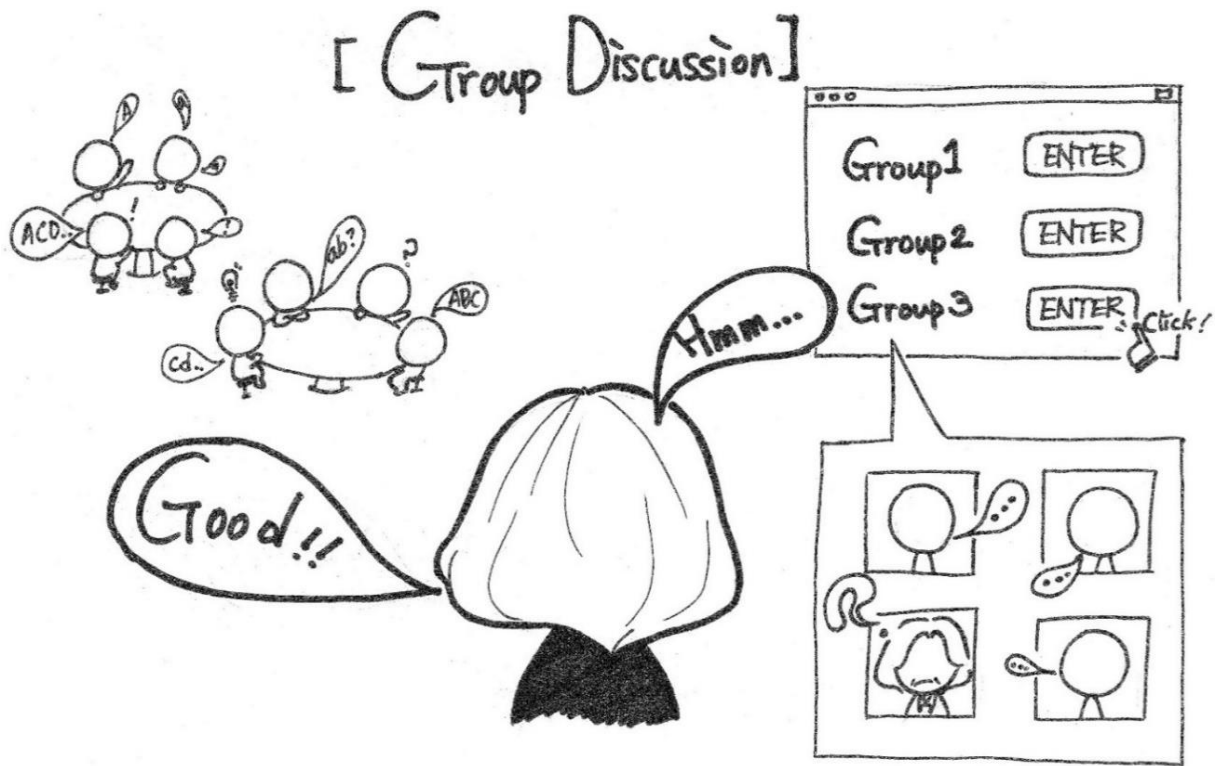
activities.

Figure 27. Tension: Managing Group Activities as She Did in Face-to-Face Courses

Design Constraints in Synchronous Online Courses

Through constant comparative analysis, I have identified design constraints that instructors have often faced in synchronous online course design. The term *design constraint* refers to formal and informal constraints including rules, requirements, conventions, and principles that affect an instructor's design decisions in regard to synchronous course design, and it can also refer to limitations that affect design decisions. (Gross, 1986)

This study is the first effort to understand design constraints regarding synchronous online courses design, and so instead of focusing on the frequency of design constraints (or identifying which are the most powerful design constraints), I focused on listing all the possible design constraints regarding synchronous online courses I uncovered in each design case. Table 8 shows list of categories and associated design constraints in synchronous course design.

Table 8. Design Constraints

Category		Design Constraints
Adaptation of Synchronous Course Formats	Inherent characteristics	• Not anytime, same time • Technology barrier in communication • Various communication channels • Hardware requirements
	Unpopularity	• Unfamiliar format to students • Limited understanding on online course • Limited design resources
	Course elements	• Lectures • Asynchronous sessions • Reviewing session for asynchronous discussions • Individual projects
	Pedagogical affordances	• Group activities • One-on-one meeting
Converting Existing F2F Courses		• Deciding course elements • Modifying teaching strategies • Assuring the same quality
Instructor (designers) Characteristics		• Past design experiences • Learning style of new technology • Technology skills • Personal characteristics
Learner Characteristics		• Preview online course experience • Expectation on online course • Full-time workers • Diversity in major, goals, and background knowledge
Technology		• Additional effort for adapting new tool • Missing functions • Tool difference • Tool preference • Technology issues • Accessibility of external tool • Interactivity with video-conferencing tool

Table 8. Continued

Category	Design Constraints
Organizational Rules	• Decision on online course • Course time • Graduate teaching assistant (GTA) regulation • No regulation on synchronous online courses • Uploading students' photos
Environmental and Cultural Factors	• University culture: Lack of university support • University culture: University size • University culture: No outside tools • Department culture: Accessibility of learning materials • Department culture: Different view on online courses • Department culture: Active approach to new tool • Department culture: Departmental GA • Teaching environment: Students' registration pattern • Teaching environment: Course date • Design environment: Designing with another instructor
Physical Learning Environments	• Bandwidth limitation • Teaching place

Jonassen (2008) suggested seven types of design constraints in instructional design, though he did not explain them in detail; he only introduced the concept of design constraints. As a reader, it was difficult to understand each design constraint mentioned without having examples or explanations to support their listing. With this in mind, I instead have explained each design constraint using direct quotations in addition to my own interpretations.

I have identified categories of the design constraints, generating eight total categories that explain the different types: adaptation of synchronous course formats; converting existing face-to-face courses; instructor (designer) characteristics; learner characteristics; technology; organizational rules; environmental and cultural factors; and physical learning environments. I used deductive and inductive approaches to identify categories, then started coding the scripts from my results. In explaining each category and its design constraints, I introduce the general characteristics of a category at first, and then explain specific each design constraints direct quotations.

Adaptation of Synchronous Course Formats

The synchronous online format has its own characteristics, awareness, affordances, and course elements distinct from existing, better-known course formats like the face-to-face and asynchronous course formats (Earnshaw, 2017; Lowenthal, Dunlap & Snelson, 2017; Romero-Hall & Vicentini, 2017). Instructors need to consider these qualities when they design synchronous online courses. By analyzing participants interviews, I found that these qualities such as worked as design constraints and contributed to design tensions. For example, instructors faced scheduling issue due to the inherent characteristic of synchronous online course which is real-time communication. This category has the most varied design constraints among all the

identified categories. I identified 13 types of design constraints in this category. So I have identified sub-categories in order to classify the design constraints more clearly. Identified sub-categories are inherent characteristics, unpopularity, course elements, and pedagogical affordances.

Sub-category: Inherent characteristics

From the interviews, I found that synchronous online courses have its inherent characteristics that are distinguished from asynchronous online courses such as real-time communication, and various communication channels. I found that the unique characteristics of synchronous online courses acted as design constraints in synchronous online course design, leading to issues when designing a course. "Inherent characteristics" sub-category includes following design constraints: same time, technology barrier in communication, various communication channels, and hardware requirements.

Not anytime, same time. Instructors must set a date and time for the class for their synchronous online courses. One of participants, Lorie expressed the difficulty in setting a date and time. According to Lorie:

> *I knew scheduling would be a real nightmare because there's a lot of students in both of those courses. So to find a night that both of them…to find two nights a week to teach in the new system and then trying to find which night it was going to be. (Lorie's interview, January 19, 2018)*

In addition, when this design constraint conflicts with student and department expectations of online courses – which is "anytime" – it becomes increasingly complex to handle. Lorie added:

The scheduling is the biggest constraint. If the time and day is not established

before students register a course, it's going be really hard to find a time when

everybody can meet. So scheduling has been the hardest part because it's just not

the norm for our online classes to have an actual meeting time in our department.

(Lorie's interview, January 19, 2018)

This particular design constraint asks for additional preparation in that the instructor must consider what time and which day of the week their course is to meet synchronously. Lorie stressed the need for clarity, saying, "I've had to be very clear and upfront months in advance that we will have synchronous sessions and do a Doodle poll and figure out which night is available to all students," meaning that she had to consider everyone before making a decision regarding synchronous course time. In synchronous online courses, participants interact in real-time, meaning that instructors and their students must be online at the same time (Branon & Essex, 2001). This characteristic contradicts the promise of "anytime, anywhere" learning that online courses have traditionally promoted (Skylar, 2009), and it creates a constraint in synchronous course design.

Technology barrier in communication. Participated instructors reported that there is a barrier regarding the technology in communication. Jane said that in a synchronous online course, it is hard to engage students who are uncomfortable with attention in classroom communication. In face-to-face classes, she has relied on making eye contact with students to induce them to discuss the subject. This eye contact has allowed her to speak directly to students and encourage them contribute to the class. Jane said it was a good strategy for bringing shy students into the discussion.

However, in synchronous courses Jane cannot check to see all participants' faces, so she cannot involve those who avoid attention. In synchronous online courses, when someone talks, the spotlight is directly on them, and other students can only watch or hear that student because only their microphone or video stream is active. Due to this, shy students and hesitant students avoid participating in conversations. Considering this characteristic flaw of synchronous communication, Jane needed to design a specific teaching strategy for those students.

Lorie also experienced this barrier. She asked students to do peer reviews within their groups, but they sometimes logged out of the platform, conducted a peer review, and then sent it by email instead of sharing their peer review in an active conversation. She included a peer review in her face-to-face and synchronous online courses and noted that students talked a great deal in the face-to-face course but not much at all in the synchronous online course. She thought that the reason for this was how avoidance was being enabled by the technology, observing:

> *I wonder if the barrier of the technology makes them feel more reluctant to*
>
> *engage in peer review honestly. But when they're face to face together it's fine. I*
>
> *never really thought about that before but I did notice that. (Lorie's interview,*
>
> *January 19, 2018)*

Various communication channels. The instructors were having issues with using and managing various communication channels, and each made their own decisions regarding the use of these channels. A chat box was the primary communication channel in Kailee's synchronous course, though she was having difficulty using that function. She explained:

> *To me, chatting is the most useful but also the most difficult communication type.*
>
> *In class, I asked students to use chatting for classroom communication. However,*
>
> *it is hard to follow up on students' messages because there are too many people*

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chatting. It is difficult to read and react to all their messages alone. (Kailee's

interview, December 20, 2017)

With this issue, she decided to turn off her video during class to better manage various

communication channels, adding:

So I decided to turn off my video after welcoming students at the beginning of the

class. When I teach, I need to check my PowerPoint slides, chatting and video

together. Checking all these communications disperse my spirit. To concentrate a

specific communication, I decided to turn off my video because I thought that my

video is less important information to students' learning than other

communication channels. (Kailee's interview, December 20, 2017)

Unlike Kailee, April focused more on video communication than chatting. To her, video

input is important in her synchronous course, so she asked students to turn on their video stream

when they spoke. April developed this into a course rule:

The very first time I taught synchronously, I made videos optional. I was really

thinking optional because I thought some people may not have a camera in 2011,

and not every computer had a camera. So I thought maybe that's asking for too

much. But in student evaluations, it's consistently came up that between people

who had the camera and didn't and how connected they felt or how disconnected

they felt so the following semester I made it just a requirement. I ask student must

turn your video on when you are talking to the class. (April's interview,

December 11, 2017)

And so April took a different approach to chatting than Kailee, though she also checks students'
chats. However, she catches up on those chats later instead of during presentation time. She said:

> *I just tell students that they can use the chat board freely, and then I will go*
> *through it when I have time. But for the most part, I can't pay attention to it. If*
> *something very important comes up on the chat screen when I ask for are there*
> *any questions, I asked students to volunteer to let me know. I think in a regular*
> *class it's easier to have a longer pause for when you ask for questions and just*
> *wait. But I feel like it's harder in a synchronous video context. So I will tell them*
> *that I'm gonna go through the chat to see if there is anything that needs to be*
> *addressed. For the most part, I know I try to ignore the chat and then go back to it*
> *later. (April's interview, December 11, 2017)*

Synchronous online courses provide real-time communication to participants in several ways.
Both instructors and students in synchronous courses can communicate via chat, audio, and
video as well as by sharing their screens. These various communication channels act as design
constraints, and instructors must make design decisions about what types of communication they
will use, how to use each communication channel, and how to manage the various channels.

Hardware requirements. In Lorie's syllabus, she wrote that "Headset (combination
microphone and headphones – not separate microphone and earbuds) and web cam (highly
recommended) for use during synchronous online class sessions." in technology requirements
section. As she did, synchronous online courses require particular devices unlike other course
formats. To participate in learning activities in synchronous courses, students must typically have
at least a webcam (or camera-enabled laptop) and a headset. However, instructors were having
issues with asking students to have those devices since they cannot technically require any

particular preferred hardware devices. Instructors often dealt with students who joined classes without the devices preferred by the instructor and had some difficulties including feedback issues. One instructor said:

> *I put it as a requirement to have USB headset in my class not everybody has it. If they just have earbuds and a microphone sometimes, it seems like there's a terrible feedback loop and so if it is a problem. I say it really changed the quality for everybody's participation. So please make sure and have it but I can't force it either so. (April's interview, December 11, 2017)*

Sub-category: Unpopularity

All participants faced design issues due to the unpopularity of synchronous course format. The most common form of online courses is the asynchronous online course format, and synchronous online courses have received less attention in comparison to asynchronous courses (Butz & Stupnisky, 2016). However, online course instructors have shown an interest in using synchronous elements in their classes. Nevertheless, this interest has not been enough to persuade them to adapt their courses to become fully synchronous. In relation to this unpopularity of synchronous online courses, I found three design constraints: unfamiliar format to students, limited understanding on online course, and limited design resources.

Unfamiliar format to students. Each instructor assumed that synchronous online courses are not a common format, expecting that students would be unfamiliar with them. This assumption entailed the design task of supporting students' basic understanding of synchronous online courses. In Chloe's case, she included the etiquette of a synchronous online course in her

syllabus. She explained that she included such a section because students did not understand synchronous courses well, given how uncommon such courses are.

Lorie also created a section called "Being Successful in a Fully Online Class", taking up three pages of her syllabus. This section included information about synchronous online courses such as technological requirements, technological competencies, participating in synchronous meetings via Adobe Connect, and emergency plans for Adobe Connect. She also designed and implemented an orientation section titled "Open House" to expose students to synchronous courses and test their learning environment. Students were able to experience how synchronous sessions will appear and test their connection, video settings, and headsets.

Limited understanding on online course. The instructors' universities had a limited understanding on synchronous course format. At Lorie's university, a synchronous online course was not an essential requirement. Her case shows that the university did not provide an appropriate system for synchronous online courses because its views on online courses favored asynchronous course formats. Also, the course registration system was designed based on the asynchronous online course format:

> *It's just not the norm for our online classes to have an actual meeting time in fact. It's not even on the schedule like when they open the schedule on the system. When students are looking at the course banner to register, they can check it's an online course. But there's nothing after that. There's no time and place listed so they just assume that it's asynchronous. (Lorie's interview, January 19, 2018)*

With no date or time information in the registration system, students assumed her course was an asynchronous one, and due to this issue, she said it was tough to catch all the students on the front end and be sure they understood that it was, in fact, a synchronous class.

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Limited design resources. Through a literature review, I found that most studies of online learning have been focused on asynchronous online courses. There was little research on how to design synchronous online courses. The instructors also recognized the limited resources for synchronous online course design. With this in mind, they used strategies for asynchronous online courses by adjusting them or transferring their existing design experiences with face-to-face and asynchronous courses to synchronous course design through trial and error. According to April:

> *[For my course design] I read a lot about online courses in general and a lot of the principles are specific to asynchronous courses. But then I really thought about how what would that look like in a synchronous and I kind of just translated. (April's interview, December 11, 2017)*

This approach required a great deal of time for instructors to take their previous formats and adapt them to the newer format.

Sub-category: Course elements

In every course, the instructors made design decisions about course elements such as which elements to include and how to design selected course elements. Synchronous online courses are a different format from asynchronous online and face-to-face courses, however, so adapting a synchronous course format requires a different approach in course elements and structure. Reflecting on instructor interviews, I found that they were using various course elements including asynchronous discussion, lectures, classroom discussion, group discussion, group activities, and one-on-on meetings. Each instructor employed similar course elements but

expressed difficulties and concerns with using specific ones. In this way, alignment with a particular instructor's teaching strategies and design environments, the use of specific course elements acts as a design constraint in the course design process.

Lectures. Participated instructors made design decisions regarding whether to include lectures in their synchronous online courses. Instructors had different views and approaches to the use of lectures in their courses. Five instructors were using lectures differently, though they were using them as essential, optional, or unnecessary course elements in their synchronous sessions. Each decision to use lectures was made by reflecting the characteristics of synchronous learning environments. For Kailee lectures are an essential course element. She said:

> *In each week's class, I include a lecture in synchronous session. Even though I*
> *asked students to read course reading before class, I don't think that they*
> *understand all of the concepts in the readings. I provide many readings, thus I felt*
> *the necessity of lecture to deliver the key concepts of readings. In addition, to*
> *introduce cases and examples related to course topic, I include a lecture in my*
> *course. However, lecturing in synchronous learning environments can be boring*
> *to students, I also hard to check students' attention level because I cannot see*
> *their face unlike face-to-face courses. Thus, during a lecture, I ask various types*
> *of questions to students. (Kailee's interview, December 20, 2017)*

In her case, using lectures required her to develop specific teaching strategies that could reflect synchronous online learning environments and allow the effective use of lectures.

Jane also experienced similar difficulties with using lectures in synchronous courses. She explained:

> *When I taught this course for the first time in 2013, I did a lecture in my*
>
> *synchronous courses. However, I felt that lecturing in a synchronous course is*
>
> *one-way communication because I cannot observe students and how they are*
>
> *taking my lecture. (Jane's interview, December 12, 2017)*

From this experience, she found that there was no difference between reading the instructor's presentation materials and taking the time to lecture on the course contents. And so she removed all lecture sections from the course and decided to focus on discussion group activities instead. By collaborating with another professor, she was able to provide an alternative way to present lectures to her students. She asked them to watch lectures which had been created and uploaded to YouTube by another professor before the synchronous class began.

April also included lectures in her course, but she tried to avoid designing a lecture-based course:

> *I really don't want the synchronous sessions to be like a lecture style where I just*
>
> *talk the whole time in order to keep students engaged. And this is true with*
>
> *asynchronous and synchronous. I tried and make conversations- and activity-*
>
> *oriented so they have to do something and then report back. (April's interview,*
>
> *December 11, 2017)*

Using lectures in synchronous online format demands several design decisions from instructors. The instructors' decision on using lectures was made by reflecting their design situation, teaching strategy, and past teaching experiences.

Asynchronous sessions. Similar to the use of lectures, an asynchronous session also created a design constraint. All interviewees used asynchronous sessions in their synchronous

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courses, and they used asynchronous discussions as essential course elements. They recognized the usefulness of asynchronous discussions and used them in a similar way. They developed two or three asynchronous discussions related to weekly topics and asked students to post their opinions on those questions and respond to peers' posts before synchronous meetings later on. The instructors were using asynchronous discussions as pre-class activities. Regarding this, Lorie said:

> *I think that using the synchronous classroom is pedagogically better like to have both synchronous and asynchronous. (Lorie's interview, January 19, 2018)*

Likewise, April said:

> *I use an asynchronous discussion like a formative assessment of how to enhance what they were talking about during the synchronous session. It's very procedural in a way. (April's interview, December 11, 2017)*

However, the use of asynchronous discussions created a tension in synchronous online courses. In Lorie's case, she said that including asynchronous sessions created more tasks for her, explaining:

> *I think that using the synchronous classroom is pedagogically better like to have both synchronous and asynchronous. But it's also kind of twice as much work as a face to face class because when you think about a face to face class, you meet three hours a week but you aren't doing discussion forums all week long so to do discussion forums all week long and to meet synchronously and to grade on top of that. (Lorie's interview, January 19, 2018)*

The use of asynchronous discussions affects instructor decisions on course time management. In April's case, her actual synchronous session time was two hours. She said:

I did that because by the time with the amount of work they put it asynchronously I realized they don't have to meet all three hours synchronously. (April's interview, December 11, 2017)

Reviewing sessions for asynchronous discussions. The instructors felt the necessity of designing sessions for reviewing students' asynchronous activities. Kailee explained:

When student enter the classroom, I start a class with the summary and feedback on their asynchronous discussion. If there are specific topics and questions that were mentioned in asynchronous discussion repeatably, I address that in that session. After that session, I start to talk about that week's course topic. (Kailee's interview, December 20, 2017)

All five interviewees had used this reviewing section before the main learning activities of the day. However, Jane expressed difficulty in managing reviewing sessions:

At the beginning of class, I had had a whole class discussion section with students for 30 minutes. In this section, I asked students to share their questions related to asynchronous discussion and their extended explanation about their post on asynchronous discussion. However, students participated in that activity passively. They just shared two or three sentences, and they said that's it. It was very difficult to attract participations from students. (Jane's interview, December 12, 2017)

With this experience, she decided to omit an entire class discussion section. Using asynchronous discussions created another design task which was designing a reviewing session for asynchronous discussions for the instructors.

Individual projects. Even though Chloe felt that combining groups and individual projects could be too much work for her students, she included an individual project in her course:

I've tried it [synchronous online courses] as group projects as well as individual projects. Quite honestly, it's a lot to do in one set semester and students are just some are just overwhelmed. Thus, I try to be there as much as I can, and I tried to scaffold as much as I can. But when I've tried it as a group project, I feel like there are more opportunities for people to miss and not understand certain elements of the process. And so I feel like it's really important for them to have their own individual project and work through it all the way. (Chloe's interview, December 19, 2017)

She included the individual project as a course element to create more opportunities to interact with each student and provide a better understanding of course contents and activities. She was using a benefit of synchronous online course, that being that "instructors can correct students' understanding of a given topic and clarify its meaning" by including the individual project. However, this element created issues such as a lack of time for giving individual feedback and holding individual meetings during class.

Sub-category: Pedagogical affordances

The instructors had some insights into the perceived uses of synchronous online courses. According to Norman (1988), affordances are the perceived and actual properties of a thing, primarily those fundamental properties that determine just how the thing could possibly be used (p. 9). In other words, an affordance is an object's possible uses by a user to achieve an objective. As mentioned, this includes not only actual properties but also perceived properties. By analyzing interview results, I found that synchronous course instructors had both actual and perceived uses of synchronous online courses based on their knowledge and experiences. In this study, I determined that synchronous online courses have two types of affordance: pedagogical affordance, which is related to perceived uses, and tool affordances, which are related to actual uses. I will talk about tool affordance in the "Design Consideration" section.

With their views on a successful synchronous online course, they have ideas of how to use this course format pedagogically. Those uses were related to the application of the advantages of synchronous online courses. They recognized the advantages of synchronous online courses in comparison to other formats and tried to use those for their classes. April said:

> *[In a synchronous online course] I think that synchronous classes compared to asynchronous classes, synchronous classes students can engage in group discussion and group activity on the spot work and create something together. I try to bring those in either through class activities or by assigning team projects. (April's interview, December 11, 2017)*

Kailee said:

Synchronous online courses promote students' real-time interactions. To use that

benefit, I tried to include group work and group discussion into synchronous

online course. (Kailee's interview, December 20, 2017)

According to their responses, a group activity in a synchronous online course can 1) enhance

students' engagement, 2) improve students' interactions, and 3) build a learning community.

These three features are advantages of synchronous courses identified by researchers. Group

activities were regarded as using advantages as well as implementing perceived uses of

synchronous online courses.

From the interviews, I found two pedagogical affordances of synchronous online courses

that the instructors had applied, those being a group activity and a one-on-one meeting with the

course instructor. The instructors participating in this study integrated the affordances into their

courses to best use the synchronous online course format more effectively. However, these

affordances also created several design constraints in the process.

Group activities. All participants regarded group activities as an essential course

element. They said that one of the most attractive features of synchronous learning environments

is that it allows students to interact and collaborate in real-time in online learning environments.

For such an activity, the instructor designs a group discussion and a group project by using the

breakout room function of a video-conferencing platform, allowing students to communicate

using video, audio, text, and whiteboard applications in real-time. However, designing and

delivering a group activity has various design constraints. Lorie explained:

I will say that I don't do a lot of group projects for my online students because

that is tough. (Lorie's interview, January 19, 2018)

And I myself found four types of design constraints inherent to designing group activities for synchronous courses.

First, instructors had difficulty with assigning groups for the activity. They each had different strategies and approaches to doing so. In Lorie's case, to provide extra time on team projects, she assigned the same team for each group discussion:

> *If they do have team projects during that same course I will try to sometimes, group them with those same team members so that they finish early they can keep talking about their real project. But I know it's usually like a task or a discussion question related to that week not necessarily their bigger team project. But like I said I do try to give them sometime to work together on that. (Lorie's interview, January 19, 2018)*

However, instructors were struggling with assigning groups. Kailee expressed that assigning groups for group projects is one of the hardest design tasks for her. She assigned groups before the semester because she has learned that assigning groups is heavily time-consuming. She explained:

> *In my course, I assigned groups before the semester, and kept those groups for a semester. In face-to-face course, I asked to students assign groups by themselves by sharing their interests each other. Before the semester, I checked students' majors, programs, degree levers, semester, on-campus or online, and time zone. By considering those factors, I assigned groups and also assigned group project topics to each group in advance. The reason why I assigned groups and topics before semester is that assigning groups during synchronous session is wasting*

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time. This is an inevitable choice due to time limit of synchronous courses.

(Kailee's interview, December 20, 2017)

She further added:

I am so busy due to a lot of preparations including group assignments, even to the
two hours before the start of the first class of the semester. (Kailee's interview,
December 20, 2017)

In Jane's case, she assigned groups depending on projects. Usually, she had two projects in each semester. She said that assigning groups was always problematic. She had attempted various ways to assign groups; she assigned groups randomly and also asked students to build their own groups. Synchronous online courses require meeting at specific times, so when she asked students to assign themselves into groups she suggested they do so according to their personal schedules and topics of interest:

I tried many ways to assign groups. However, there are always different types of
complaints from students. I am thinking about the ideal way to assign groups, but
it is still difficult find the solution. (Jane's interview, December 12, 2017)

The instructors expressed the difficulty of group assignments and put great effort into attempting to find the best way to do so.

Second, instructors had trouble providing group work time to students. One group activity was a project that students complete together during the semester. The instructors in synchronous online courses expressed that there were several limitations in this regard, including limited time and certain student characteristics and other design constraints that I will go over in greater detail later. But essentially, in regard to limited time, the instructors felt there was a lack

of time with the synchronous sessions. This could apply to the characteristics of students as well, as some were full-time employees who had scheduling issues.

Four instructors were providing group projects to their students, and they all tried to provide time and space for their students to work together on these group projects. But because most of the students were full-time employees, it was difficult for them to set a specific time for meeting after class, and so the instructors provided each team some project time during their synchronous sessions.

April provided 50 minutes after course activities every week, meaning that that was time built into the schedule. At that time, there were no course activities, but April kept open synchronous sessions and remained connected, conducting individual checks with her students. She arranged the sessions that way to also provide student time for group projects. April said:

> *I also tell them it's built in if there's any group activity in class that's time for them*
> *to work in their groups. So I know that it's not enough for most group projects.*
> *But it's to ensure that they can have a synchronous meeting with their groups and*
> *they can't tell me later that they didn't have time. (April's interview, December 11,*
> *2017)*

Kailee opened her synchronous course 30 minutes before class, and kept it open for 30 minutes afterward, allowing students time for their group projects. Jane felt a lack of time only for doing essential course activities, so she was unable to provide group work time during her synchronous course. As an alternative, she provided a virtual classroom to students which they could access at any time and communicate with each other. All the same, that virtual classroom was limited in that if the instructor was not in the virtual classroom, the students could not access moderator functions such as recording and content sharing. With these limitations in mind, she suggested

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that students use Google Hangouts for group work instead. I found in my analysis that providing group work time was regarded as an essential design element, yet it was hard to provide that time in regard to the characteristics of synchronous online courses.

Third, instructors have had issues with monitoring group activity. With current technology, instructors should be able to stop by each group and monitor their progress. However, instructors found that when they entered a group room to monitor the activity, the students became quiet. For this reason, April stopped dropping into the groups. She instead designed another strategy for monitoring students' activity: She asked the students to call her if they had any questions by using the "ask for help" function, at which point she would join the conversation.

Jane also experienced a similar barrier in monitoring student group activities. She said she stopped by each group room every 10 minutes or so during group time but was also met with silence each time. She said that she had to leave the meeting room before students would resume talking. In her case, however, Jane said that she had not yet developed a strategy for monitoring student group activities effectively.

And the fourth and last design constraint related to designing group activities is managing group work. By using group activities in their synchronous courses, the instructors found several issues in managing students' behaviors in those activities. In both group discussions and group projects, students had some trouble deciding each member's role. Also, there were always students who were unwilling to participate. For example, Kailee said, "When each group debriefs their group activity, the same person always reports their work. There is a person who is always quiet."

To handle these issues, the instructors felt it was necessary to develop strategies to support student group work. Most instructors set ground rules, for example asking their students to create their own group rules regarding what they will do throughout the semester. In April's case, she had her own strategy for managing groups:

I talk about the roles and then I say when you get into your group, you're going to pick the reporter. I want to hear each time you all report, I want somebody different. If it's the same person, it's not working. We need to all take turns on this. (April's interview, December 11, 2017)

And as for why she took this approach, she added:

I do so when I first taught, it wasn't that detail and it didn't have those roles in there. But what I learned after the first or second class is that a lot of students that get into the room and they go uhhhhhh… It just seemed like students we're wasting a lot of time deciding who's gonna do what. So I thought I'll just do that and they can go straight to what they're supposed to do. (April's interview, December 11, 2017)

Jane developed a similar strategy. She asked her students to write team contracts. Those contracts included when they would present, who would do what, and what penalty they would receive if someone did not perform their role. In addition, she asked students to assign roles (project manager, subject matter expert, etc.) amongst themselves when they conducted group project meetings.

One-on-one meeting. The instructors also provided one-on-one meeting time to students. Among the five instructors, three explained specifically how they provided students with such an opportunity. Chloe said:

> *I have done one-on-ones with them I have them go and do an activity or group feedback in their groups. So and then I pull of each person out of their group and have my one-on-one with them, send them back, and take another person out of another group and everything. (Chloe's interview, December 19, 2017)*

She also set aside one week for one-on-one meetings instead of a synchronous session. As I already mentioned, April and Kailee set specific times to communicate with students. Kailee opened synchronous sessions thirty minutes before class and used that time to answer students' individual questions. April had individual check-in times after learning activities each week, and during that time students could do their group projects together in the breakout rooms and still ask questions. Figure 28 is a slide that explains the one-on-one meeting sessions from April's presentation materials.

These instructors provided students a chance to ask questions to instructors and immediate responses to their learning activities through one-on-one meeting time. Existing studies have identified that one of the limitations of asynchronous courses is that there is limited interaction between instructors and students. One-on-one meeting was a solution to handle this limitation to instructors.
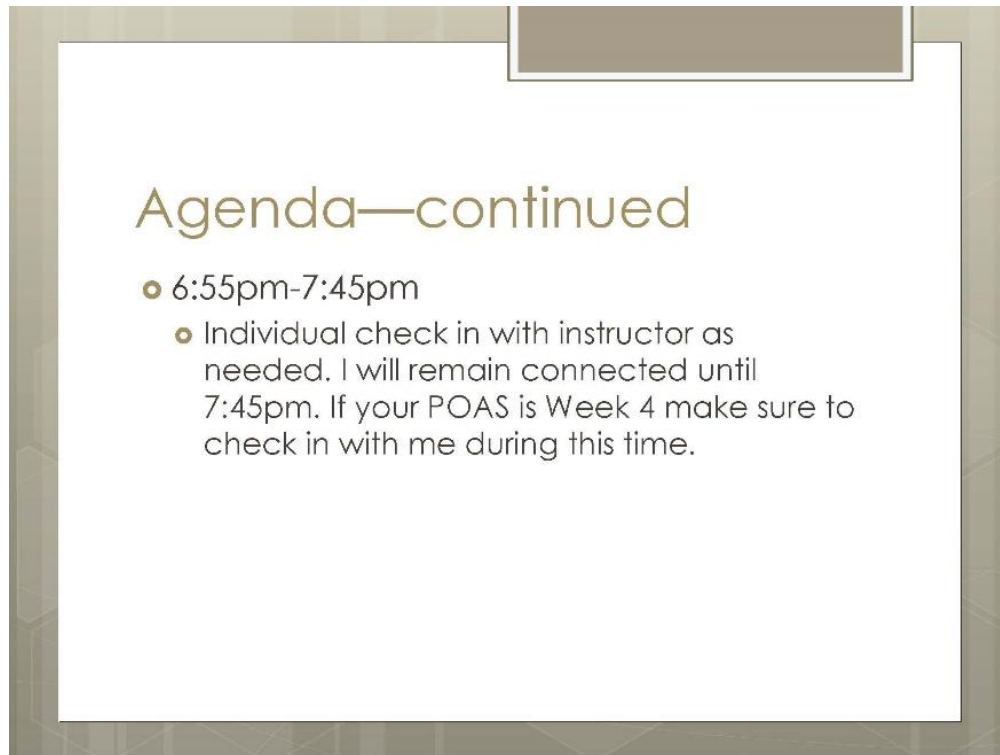
Figure 28. One-on-one Meeting Session Explanation

These affordances are strongly related to the benefits of synchronous courses that existing

studies have identified. Providing group activities is related to building a social and cognitive

presence, while providing one-on-one meetings is related to building teaching presence and

providing immediate feedback. In addition, those two course elements also have a positive effect

on increasing engagement. According to coding results, the adaptation of synchronous online

courses includes most codes. However, this category is not included in the list of design

constraints that Jonassen identified. One possible reason is that Jonassen's design constraints are

about general instructional design, so he did not specify a design area. This study of specifying a

design area as a synchronous online course design found various design constraints based on the

characteristics of a design area.

Converting Existing F2F Courses

Converting existing F2F courses is the second category in my findings. Among the five synchronous online course design cases, four instructors designed their courses based on existing face-to-face courses. Participants said:

> *We offer both online and face to face at here. So we have a parallel track about*
>
> *we have an online graduate certificate program and a face to face one. And so we*
>
> *always have a section of both and I had did they wanted me to teach all of the*
>
> *qualitative research courses face to face first and then put them online. (Lorie's*
>
> *interview, January 19, 2018)*

In particular, two instructors were teaching both a face-to-face course and a synchronous course. The first category ("the adaptation of synchronous online courses"), explained the characteristics of synchronous online courses in design which are distinct from face-to-face and asynchronous courses. Specifically, the synchronous online course format has different communication types, teaching and learning environments, and design constraints as compared to the face-to-face course format (Bower et al., 2013; Chen et al., 2015; Piskurich, 2004). And even though these differences exist, instructors are asked to convert existing face-to-face courses into synchronous online courses all the same. This converting task is unique to synchronous online design cases, so naturally in the process of converting existing courses, design constraints emerge. This category includes three design constraints: deciding course elements, modifying teaching strategies and assuring the same quality.

Deciding course elements. The instructors need to remove existing course elements such as a lecture or add new ones such as asynchronous discussions based on the characteristics of synchronous courses and their design conditions. Kailee had a unique design condition.

According to her university policy, online courses had to take eight weeks of lessons, unlike face-to-face courses which were sixteen weeks. This meant that she should condense sixteen weeks of course content into eight weeks by redesigning the face-to-face course. Due to this design condition, she removed and modified several course elements that she had designed for the face-to-face course. She explained:

> *Due to time limitations, I removed a guest speaker session that I had used*
> *in the face-to-face course. It was easy to invite a guest speaker, but it is*
> *hard to provide enough time for them. (Kailee's interview, December 20,*
> *2017)*

Lorie also expressed that it was hard to include a guest speaker session into synchronous sessions, unlike face-to-face courses.

In Jane's case, another professor taught the same course with a face-to-face format. That professor had 25 years of experience in teaching that course and had already developed a solid structure for it. And because that course was provided during the same semester, they decided to deliver the same contents to students. In addition, because the other professor had had a lot of experience with the course, Jane tried to design her course based on that professor's face-to-face course. After delivering the course for one semester, she found that a whole classroom activity would not be suitable for the synchronous online course. She said:

> *In the other professor's face-to-face course, there is whole classroom activity.*
> *That activity is about application of what they learned into their real life. Students*
> *can get a chance to apply what they learned into general practice. This is short*
> *individual practice before group activity. I tried to use this activity in my*
> *synchronous courses. However, it was time consuming, and hard to manage each*

student's activity. In addition, student cannot have enough time for their group

activity because they spent much time for this activity even though a group

activity is the most important activity. (Jane's interview, December 12, 2017)

She decided to remove the whole classroom activity from her course and instead provided

materials for classroom activities used in the face-to-face course. With those materials, students

could practice the activities by themselves on their own time.

Modifying teaching strategies. In most cases, the instructors kept their teaching

strategies and learning activities from face-to-face courses in their synchronous online courses.

Still, they often felt it was necessary to modify existing strategies and activities. Kailee said she

had to change her way of using discussion activities and student presentations. In her course, one

group activity involved investigating a topic and presenting it to the other students. But there is a

difference in communication style between synchronous online courses and face-to-face courses.

For example, in face-to-face courses students can deliver their presentations in various ways,

including using actual materials. However, in synchronous courses, students must share their

work through video-conferencing tools that allow only multimedia files such as PowerPoint

presentations, PDFs, and such. Students must consider the accessibility of their presentation

materials, and the instructor should notify them of that issue. Kailee also modified a discussion

activity from a face-to-face course to a synchronous online course:

In both of my courses, I designed a discussion activity as an essential learning

activity. However, synchronous online courses have limited time for discussion.

Thus, I asked to student discuss on discussion forum before or after class. I

provide asynchronous discussion forum to students. (Kailee's interview,

December 20, 2017)

Jane used group activities in both course formats. She managed group activities in face-to-face courses by observing the students' group activities. When she found something that needed to be shared with the rest of the class, she paused the students' group activities, talked about the issue, and then let them resume. However, in synchronous online courses, students were located in different group rooms in which only they could see their group members. In this situation, the instructor could observe all group activities but only sequentially.

In addition, Jane found that some topics needed to be presented to all of her students, but she could not share such information immediately because it was time-consuming and difficult to bring all the students to the main classroom and then release them into their group rooms again. She instead would make memos about what needed to be addressed and then review them after group work. Teaching strategies which were based on face-to-face courses needed to be modified to reflect synchronous online learning environments. Modifying existing strategies acted as design constraints in synchronous course design.

Assuring the same quality. The last design constraint is providing the same level of course quality to students in synchronous courses as with students in face-to-face courses. Three courses were provided both in synchronous and face-to-face course formats, thus those instructors had to ensure the same quality. Lorie explained her efforts to design a synchronous course similar to a face-to-face course and the inherent difficulty of the task:

> *I try to make it as little as difference as possible really. I mean I think the power*
>
> *of the synchronous tool is to replicate the face to face class but at a distance. So I*
>
> *think some of the same things that I try to accomplish face to face, we can do*
>
> *almost all of that synchronously. So I mean I do think there's something about the*
>
> *embodiment of being physically co-present that you can't completely replicate in*

a synchronous room. I mean there is an energy there and people can talk to you

before and after class and during the breaks. And you know it's much more

engaged that you can't do all of that synchronously. But I really do try to run it

almost exactly the same. (Lorie's interview, January 19, 2018)

Meanwhile, Kailee was in a very difficult design situation due to university regulations. According to university policy, online courses had to consist of eight weeks of lessons, unlike face-to-face courses which were delivered for sixteen weeks. The difference in course time between the two formats was considerable. Kailee said:

Because of the differences in amount of time, it is hard to deliver course as same

as face-to-face course, I am trying to provide a course same level. (Kailee's

interview, December 20, 2017)

Designing a same-level online course provided many difficult requirements for Kailee.

The aforementioned design constraints explain the difference in course elements, teaching strategies, and teaching environments between face-to-face and synchronous online courses. Even though synchronous online and face-to-face courses are different, the instructors had to design a synchronous course that provided the same level of quality of a face-to-face course. Thus, designing online courses that assure the same level of course quality was a complex design task, meaning this requirement actually acted as a design constraint.

"Converting Existing F2F Courses" is a newly identified category derived by coding collected data not included in Jonassen's list. These design constraints are unique to design situations. Redesigning existing face-to-face courses into synchronous online courses requires instructors to make various design decisions regarding how to change things, what to add, and

what to remove to ensure the same level of student achievement. Existing studies discuss how to convert existing courses to asynchronous ones, but few studies investigate how instructors convert face-to-face courses into synchronous ones.

Instructor (Designer) Characteristics

I found that the instructors' experiences, teaching philosophies, and personal characteristics affected their design decisions in regard to synchronous online course design. For example, authentic learning which was one participant's teaching philosophy acted as design approach in her course design. However, I also found that those characteristics acted as limitations and barriers in that regard. As the designers of synchronous online courses, the instructors' personal characteristics and beliefs created design constraints, and the decisions the instructors made for their course designs were affected by these design constraints. This category, "Instructor (Designer) Characteristics", was the last to be identified during the coding process. This category includes following design constraints: past design experiences, learning style of new technology, technology skills, and personal characteristics.

Past design experiences. Jane removed one activity from her course based on her previous experience, saying:

> *In my synchronous course, I designed a whole classroom discussion activity that*
> *overviewed students' asynchronous discussions. I asked students to share their*
> *opinions on the previous asynchronous discussion topics. I used several strategies*
> *to facilitate that activity. However, it didn't work well. For example, I brought*

specific sentences that students posted, and then asked the student who wrote the

specific sentence to elaborate on it. However, students didn't like that activity.

They questioned why I asked them about their sentences again even though they

already posted about the topic. With this issue, the whole classroom discussion

activity was really quiet and hard to manage with the lack of participation.

(Jane's interview, December 12, 2017)

With this previous experience with a specific learning activity, Jane decided to not have a whole classroom discussion activity in my class anymore. Lorie also has a similar experience:

I do peer review. What I will do is put them together to do peer review. Last

spring, I tried to use the synchronous sessions for peer review. They didn't stay in

the room they just like logged out and did peer review. I think sent it by email and

then logged back in and they really didn't find it useful to like talk about it in the

synchronous classroom which I thought was interesting because when I do peer

review in face to face classes they talk forever. [...] I never really thought about

that before, but I did notice that it didn't go very well last year. So, I'm not going

to do that again this year, but I'm going to do peer reviews a little bit differently.

(Lorie's interview, January 19, 2018)

Both instructors had failed or negative experiences with specific learning activities, and those experiences acted as design constraints and affected the instructors' design decisions.

In addition, the instructors' past positive experiences also affected their design decisions. Lorie was really satisfied with her previous university's support system for synchronous course design. She said that her university provided one-on-one consultations and well-designed training, and most importantly she felt that the administration was willing to help. However, her

subsequent university did not provide that kind of support. Due to the differences in the levels and quality of university support, she was not satisfied with the university's support and chose to not use a synchronous session in her course. She explained:

> *ABC [previous university support team] group is amazing with what they support faculty. They do not have anything like that at this university. I remember that ABC sent a tech support person to kind of sit in the first few weeks that we did the synchronous classroom. [...] ABC is amazing. ABC have a culture of "yes" like yes we'll figure it out, yes how can we help you? I mean that culture is great, and I really missed that because this university doesn't have that sense. It's much less personal. It's much more impersonal.* (*Lorie's interview, January 19, 2018*)

As she mentioned, her prior experiences with university support was a major factor in her course. Since her subsequent university lacked the support at which the previous one excelled, she decided not to include a synchronous session in her course. The support was not there, so this experience with the support of her previous university compared to the lack of support from her current one acted as a design constraint based on experience.

The first design constraint related to the instructors' characteristics was their past synchronous course experiences, including negative experiences and design failures. These experiences acted as design constraints and led some instructors to avoid or change specific design decisions.

Learning style of new technology. The instructors tended to learn about new technology including video conferencing tool and LMS through self-training. April in her interview said, "So, blackboard to canvas... I just usually need time to get used to it," meaning it would only take a little practice with new technology for her to be able to use it. Participated instructors

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learned about technology by testing and practicing with the tools. However, self-training requires sufficient time for effective practice, so an instructor may start a semester without fully understanding a teaching tool. Poor understanding of course tools affected the instructors' limited use of synchronous tool in their courses. Kailee explained:

> *When I learned about new technology, I did self-training. This summer, our university updated a version of video-conferencing tool from Blackboard collaborate to blackboard Ultra. I used Ultra this fall for the first time. There are many differences between the two versions. [...] With a tool change, I tested functions. However, there are many changes. Thus, I am not sure I checked all the changes. Thus, I told my students, "Because this is my first time to use this tool, there will be some mistakes. Please don't be surprised." (Kailee's interview, December 20, 2017)*

Self-training, the method most participating instructors chose to use to familiarize themselves with the new tools, left them exhausted. Lorie said:

> *I'm tired. To be honest, I just get tired of always having to learn the new tools. I haven't had any downtime to really test out the tool to be sure. (Lorie's interview, January 19, 2018)*

This exhaustion caused by self-teaching affected her decision to not include a synchronous session in her course, as doing so saved her the time it would have required to learn the tool and test it.

Synchronous online courses are delivered through video-conferencing tools, so instructors should be proficient with those tools. Participated instructors tended to learn about

new tools through self-training. One possible reason why they learned about tools by themselves was that all the instructors were in the field of instructional technology, meaning they were already familiar with technology for online learning and teaching. And even though there was university training and support for new technology, they tended to not utilize the support, and learned about technology by testing and practicing themselves. For example, Kailee said:

> *Because I am a researcher who investigates online learning, I do not feel the necessity to get support from others in designing online course and learning new tools. (Kailee's interview, December 20, 2017)*

Technology skills. All participants showed confidence in using technology. For example, Lorie asserted, "I'm pretty comfortable with the tools." One reason was because all the participants had had at least five years' experience in teaching synchronous online courses at the time, and so they were familiar with the tools. However, I found one common difficulty that instructors faced: They expressed problems with managing various communication channels in synchronous courses. This difficulty limited the use of communication functions in their courses.

The instructors also expressed difficulty with the various communication channels available in synchronous online courses. In light of their skills with managing various communicational channels, they selected specific tools and tried other communication channels. This is related to the design constraints of various communication channels. As I explained in "Various communication channels", the instructors were not using specific communication methods. For example, Kailee was not using video in order to better focus on chats, while April tried to ignore chats during her lectures and checked them later.

I have identified that various communication channels are characteristic of synchronous online courses and are a design constraint in synchronous online course. To this end, the

instructors' multitasking and communication skills can also be identified as design constraints. To one instructor, various communication channels were not a design constraint because she was good at managing different communication channels. However, the other instructors had difficulty with using the channels:

> *I don't know if I have a strategy for it I kind of got used to doing all that multitasking. It becomes pretty natural to me but I do like them [the students] to be chatting and I do like them to be using the hand raising and emojis and all of that. I mean I really encourage them to be doing all of those things, but I do remember when I first started doing it; it really was overwhelming, and it felt like you could lose track of things but now it just really seems like second nature because I've done it for so long. (Lorie's interview, January 19, 2018)*

Personal characteristics. The instructors' personal characteristics created design constraints. I found two design constraints related to personal characteristics: languages and jobs. Jane was a non-native English speaker, and due to her language issue she expressed difficulty with managing synchronous online courses. She explained:

> *[In her course, due to other limitation, she did not use video function] In my course, I taught only with my voice and without video. Thus, I cannot catch students' emotional expression because I cannot check their face and gestures. With that limitation, it is hard to manage synchronous online courses. As a non-native English speaker, it is hard to manage a synchronous online course. Sometimes, I want to teach this course with a face-to-face format. (Jane's interview, December 12, 2017)*

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She recognized that synchronous courses are a more difficult environment in which to manage courses in comparison to face-to-face courses because instructors must communicate with their students through technology without eye contact or body language. She is currently looking for a solution to managing her courses effectively.

Chloe was an adjunct assistant professor. She was a full-time staff employee at the university but not a full-time professor. And because she was a full-time employee, she had issues with applying specific teaching strategies to her course. One example of such an issue was setting a specific due date for assignments. Because she was a full-time employee and most of her students were as well, she understood that it was hard for students to meet deadlines, and so she tried to be as flexible as possible. She tried to have assignments due on certain nights so she would have a few days to grade them before the next class. But because everyone was often busy, it got to the point where she said, "As long as you get it in the day before class, I'll try to get it graded or look at it." This method of accepting until just before the next class was taxing on her, as she overextended herself to get the work graded and give appropriate feedback, all the while dealing with her own full-time employment.

Learner Characteristics

Aligning with the instructors' characteristics, learners' characteristics also affected the instructors' design decisions in regard to synchronous online course as design constraints. All participating the instructors were teaching graduate courses, and students in those courses had the characteristics of graduate students. Students in synchronous online courses have the characteristics of online learners. And furthermore, each course had its unique student characteristics. These student characteristics worked as limitations and barriers in terms of

designing synchronous online courses. This category includes four design constraints: preview online course experience, expectation on online course, full-time workers, and diversity in major, goals, and background knowledge.

Preview online course experiences. April found that her students had had negative experiences in online courses. She said that most of the students had online course experiences with asynchronous courses or online discussion activities. According to her, there were students who said that taking online courses was a waste of time. Having students with negative experiences with online courses contributed to the development of her principle in designing synchronous online courses. She explained:

> *I really thought about how not to make it a waste of time and I think it's successful when students are looking forward to the next meeting. (April's interview, December 11, 2017)*

This design principle affected the overall design decisions in her course. Because they had limited experience with synchronous online courses, April tried to support her students' synchronous learning by providing an anticipated structure:

> *It was important for me that when they're in the synchronous session to not feel chaotic. It's kind of boring over time but there are very basic structures that they can always anticipate to be the same. (April's interview, December 11, 2017)*

Expectations of online courses. Participants had students come into their synchronous courses with the expectation that it indeed will be anytime and anywhere. Jane said:

> *Students have their own reasons for registering for online courses. Because they cannot attend a face-to-face class at a specific place and time, they registered for*

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an online course. Thus, they don't like taking the class at the specific time and

communicating with others in real-time. They are reluctant to participate in real-

time activities. (Jane's interview, December 12, 2017)

While Lorie said:

> *[Student expectation on anytime] that expectation is definitely the hardest part of*
>
> *teaching synchronous online course. (Lorie's interview, January 19, 2018)*

Lorie explained that she had an issue with scheduling class time. Due to expectations about

online courses, instructors spend a lot of energy ensuring that students understand synchronous

online courses. In April's case, she took the time to talk to new students before they applied. She

told them that her course was very different from what they might expect. Lorie did something

similar:

> *I'll say that the culture here in my department is mostly that it should be*
>
> *completely asynchronous and so students sign up assuming that it's anytime*
>
> *anywhere. When I have built in the synchronous components I've had to be very*
>
> *clear and upfront like months in advance that we will have synchronous sessions.*
>
> *(Lorie's interview, January 19, 2018)*

"Anytime" and "anywhere" are the traditional promises of online learning (Skylar, 2009).

However, the synchronous online course format amends this promise. I already mentioned that

many students who enroll in an online course often have online learning experiences; however,

those experiences are predominantly with asynchronous online modalities. Thus, students come

into an online course with the expectation that it indeed will be anytime and anywhere. This

expectation affects students' participation and their recognition of synchronous online courses, and acts as a design constraint in synchronous course design.

Full-time workers. All participants said that they had many students with full-time jobs. April and Chloe said that most of their students, in fact, were full-time employees. This characteristic acted as a design constraint in scheduling. All participants in synchronous online courses should be in the virtual classroom at the same time. But because students have their own work schedules, it can be difficult to find a specific time for course and group activities. Finding a specific course time with students working full-time was a difficult task for instructors. Chloe said her students typically did not have enough time to read and react to her feedback.

Diversity in majors, goals, and background knowledge. Each instructor has had students from various majors, backgrounds, and degree programs, and the diversity among these students has created some design constraints. Four interviewees mentioned that they have had various types of students, including students from outside their instructional design programs. Chloe said she had students with varying background knowledge on the topics because they worked in different areas. She said:

> *You can't assume that everybody's coming in with the same level of prior*
>
> *knowledge. (Chloe's interview, December 19, 2017)*

Due to these different levels of background knowledge, she needed to design a course structure by considering all her students. However, she felt that she already had insufficient time to deliver essential course elements, so she could not allocate extra time to also delivering the basic course concepts. In the end, she decided to cover the basic concepts through asynchronous sessions:

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I really would like to be able to package that in a way that they can go through it

asynchronously on their own time and take as long as they need. If they're already

familiar with some of it, they can skip through it. And then synchronous section

focused on an application of those concepts and principles. (Chloe's interview,

December 19, 2017)

Students' differing levels of prior knowledge created a new design task for the instructors in relation to course structure by way of interacting with another design constraint: lack of time.

In one situation, students from another department brought a design constraint with them to the course. In April's case, she designed her courses based on the students in her program. However, there were several students from other departments, and due to their backgrounds, April's choices for external tools were limited. She had usually used Google Drive, which was supported by her university, to share course materials. April explained:

I was using Google Drive just to share the readings. And then I record the videos

and post it on, again, Google Drive. I learned that when you have students that

are in our system but from the health sciences group there is an issue because

they did not subscribe to Google Drive. So they don't have access to it. This

semester I had to switch to OneDrive. (April's interview, December 11, 2017)

She needed to select a specific tool due to the students from other departments.

Jane expressed it was hard to increase participation among those students who had specific goals for their degree. She said that one student's reason for entering the online master program was career development. She found that many graduate students in her courses tended to do only the bare minimum for each assignment because their goal was to graduate as soon as

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possible. In that regard, she had difficulty increasing those students' participation in course activities. She designed several strategies to turn that around, but none worked well enough.

Technology

Synchronous online courses are more strongly connected with technology than asynchronous online courses (Butz et al., 2014; Melkun, 2012). In synchronous course format, technology is important because it is the only realistic means by which participants can communicate. Considering the crucial role of technology in synchronous online courses, there are various design constraints related to using tools for synchronous course including video conferencing tool and LMS. By analyzing the interview results, I found that most design constraints are created from tool change, which can be regarded as a design constraint itself as part of a broader term. All five participants experienced tool change, including changes to video conferencing tools and LMS, in their last or most recent semester. I specify design constraints that occurred due to tool change by analyzing the interview. "Technology" category includes following design constraints: additional effort for adapting new tool, missing functions, tool difference, tool preference, technology issues, accessibility of external tool and interactivity with video-conferencing tool.

    Additional effort for adapting new tool. In regard to adapting to new tools and the changes this requires in existing course designs, Lorie said:

> *I just haven't had time to [learn about new tool]. I'm tired to be honest like you. I just get tired of always having to learn the new tools. [...] I've just kind of dreaded having to go through trial and error again. (Lorie's interview, January 19, 2018)*

According to Lorie, investigating and adapting new tools requires instructors' time and effort. This additional effort limited the use of tools in synchronous courses. In particular, her university changed its LMS, but she did not want to make the extra effort to learn about it or any other new tool. In the end, she used external tools instead of the new LMS. She used Google's array of tools as well as Dropbox.

And in April's case, she needed to spend more time to redesign a course due to tool change. She explained:

> *It was also the first time to teach an online class on canvas. There was just a lot of prepping that was more than I would expect. (April's interview, December 11, 2017)*

In Jane's case, her university changed its video conferencing tool from Blackboard Collaborate to Zoom one semester, and her department decided to teach online courses with that new tool. Because of this, she didn't have enough time to understand the new tool, so ultimately she was unable to use the video conferencing tool effectively. She said:

> *I couldn't get a chance to use Zoom yet. Thus, I didn't figure out the specific functions of Zoom. Thus, I am not able to use all functions in my course now. (Jane's interview, December 12, 2017)*

Missing functions. Due to a change of video conferencing tools, instructors sometimes cannot use certain functions they used before. On this topic, April said:

> *I used Collaborate because our university had Collaborate. Zoom [new video-conferencing tool] is fine but there's still some features in collaborate that I miss. (April's interview, December 11, 2017)*

She added that she missed functions such as emoticons and hand-raising.

In Kailee's case, her university's video conferencing tool changed from Blackboard Collaborate to Blackboard Ultra. She said there were pros and cons that came with the tool change. In particular, she missed the functions that were not available in Blackboard Ultra. She said:

> *There are several missing functions in Ultra. In Collaborate, I was able to set up student breakout rooms and send PowerPoint slides to each. But Ultra doesn't have these functions, so I needed to give materials for group activities separately or enter each breakout room and upload them. And Ultra doesn't have a timer function. Due to these missing functions, it is really inconvenient. (Kailee's interview, December 20, 2017)*

Jane also noted that she was missing a survey function from a previous tool. Each tool has its own functions. Tool change limited their use of video conferencing functions, and the instructors needed to adjust existing learning activities to reflect these changes.

Tool difference. Previous and current tools have similar functions, but the instructors had issues with using those functions due to certain differences between tools. About functional difference of video conferencing tools, April said:

> *The chat function in zoom is somehow more intrusive than how it was in Blackboard Collaborate. (April's interview, December 11, 2017)*

The instructors had a hard time using new tools due to differences in interfaces. Tool difference acted as a design constraint and created problems in course design and delivery. In relation to LMS change, Chloe said:

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It was not as quite as easy as I thought. It was not as smooth transition from

Blackboard to Canvas. The grading function worked a little bit differently, and

the discussion boards worked a little differently. And all of that so I felt like I was

catching up all semester. I hate that feeling because I really like for the students

to be able to see what's there at the very beginning. This semester they were not

able to see everything all at once. In addition, there is a difference between

instructor view and student view. Thus, I was not able to check whether I all set

up correctly or not. Whatever it was that I did so that process was not quite as

smooth as I wanted it to be. (Chloe's interview, December 19, 2017)

Due to the tool difference, she experienced difficulty when designing the course page on LMS. She also experienced difficulty when using video conferencing tools due to a tool change. She usually used the hand-raising function in her course. She explained:

At the first night of class, I'm going through and I said, "now you're it is let's all

try raising our hand" and nothing happened and I said "you all see where that

raising hand is he's right down here you know". Then, one student said that

"Uh…Dr. Chloe we don't see that. I'm like you're kidding." I asked them to share

their screen and show me what you're seeing in sure enough. It wasn't showing up

on their screen. (Chloe's interview, December 19, 2017)

After investigating a tool by herself and consulting a technology professional, she found out how to add the hand-raising function to her video conferencing tool settings. But even though there are similar functions, the instructor had trouble applying the function they wanted due to the tool difference.

Tool preference. The instructors took three basic reactions to tool change: positive, neutral, and negative. Chloe was positive to tool change. She said:

> *Now I had already taught with canvas up in V university [her previous university]*
> *for that; so that portion of it wasn't too much of a challenge for me. But they went*
> *from collaborate to zoom and zoom was totally new to me. But I love it and it's so*
> *much better than anything else I've ever used. (Chloe's interview, December 19,*
> *2017)*

April expressed a neutral response to tool change. She liked her previous video conferencing tool more, but its replacement was also okay:

> *I like that [blackboard collaborate] structure. I am a very structured person and*
> *maybe others are just fine with zoom how it's much more fluid. I do feel like um*
> *we because zoom was not a classroom platform first. But it is okay. Zoom is much*
> *more accessible getting easier to use. (April's interview, December 11, 2017)*

Lorie had a negative view of tool change and new tools. She explained:

> *We changed platforms. The University supports Blackboard Ultra. But they have*
> *no support for it. And it's very glitchy. There's a lot of bugs in it. (Lorie's*
> *interview, January 19, 2018)*

This tool preference affected her decision whether to use synchronous sessions in her course. As a constraint, tool preference creates a design tension that interacts with other design constraints, specifically that of no support from the university. She decided to not include synchronous sessions that semester, and she explained her decision:

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I mean I think that if I felt better support with going back to the Blackboard

Collaborate, I would have been a little more encouraged to use it this semester.

but I've just kind of dreaded having to go through trial and error again. I think it

does I think it does affect it. (Lorie's interview, January 19, 2018)

With a negative view of the tools available, she planned to use another tool to provide her needs in regard to video conferencing. She said:

I was thinking about just paying for zoom myself because it seems more stable

then messing around with collaborate. (Lorie's interview, January 19, 2018)

This explained how the choice of a video conferencing tool is important when using synchronous courses.

Technology issues. The interviewees did not talk about whether or not they were suffering from technological issues at the time. They agreed that recent tools are fairly stable compared to prior tools. But they had experienced technological issues in the past. For example, April said:

I've used Adobe Connect before but that's a long time ago. That used to crash all

the time back then. (April's interview, December 11, 2017)

Participants in synchronous online courses interact and collaborate through technology. Thus, the instructors worried about potential technological issues that might occur during class and felt it necessary to design back-up plans and support for such an event. In April's case, she said that she tried to make sure that students understood that when there was a computer-related problem they needed to contact the university technology team. She also put this information in

her syllabus. In the past, she had a website that students could refer to if the learning management system was down.

In Lorie's case, she designed a session to test student equipment (such as headsets) and checked for any potential technological problems. She said that this session was effective. She reduced the number of technological issues this way, but said that she needed to spend an extra hour of her time for that session. That is, preparing for technological issues required additional time and effort.

Chloe once experienced a connection issue. She explained:

I do have students every semester have connection issues. Maybe they're trying to be to connect on a tablet or their phone. I had a student who was in the Air Force who frequently had issues with connection. […] Sometimes the access issue is such that it's out of our control. (Chloe's interview, December 19, 2017)

Given this experienced, she included in her syllabus contact information for the university support team which could help when students had connection issues. In addition, to prevent connections issues, she asked students to upload their presentation materials the night before each presentation just in case they had connection problems the next day. She also designed a back-up plan for handling technological issues.

Lorie had her own experience with technological issues. She said:

I wasn't really sure if students would get kicked out or if the system would freeze or if something would happen, you know, it's hard to navigate that whole synchronous environment when you're trying to do lots of different things. (Lorie's interview, January 19, 2018)

And due to this experience, she started including in her syllabus information about handling

technological issues and emphasized the importance of university support for online courses.

Accessibility of external tools. In April's course, there were students who were not able

to access Google Drive because they came from departments which did not subscribe to Google

Drive. Because of this issue, she had limited options for choosing external tools. Students'

accessibility can limit an instructor's choice of external tools.

Interactivity with video conferencing tools. Two instructors faced issues in using video

conferencing tools due to its interactivity with presentation applications. Jane created

presentation materials with Google Slides. It is her preferred and main presentation application.

She uploaded Google Slides files to LMS to share presentation materials with her students.

However, there was a conflict when using Google Slides in Blackboard Collaborate because that

application's "share screen" function does not support Google Slides. Thus, she created two

types of presentation materials for each topic: one using Google slides and the other using

PowerPoint. Still, when there was a change to PowerPoint or Google Drive, Jane needed to

update the materials separately according to each software. She said it was difficult, time-

consuming work, and she expressed that she didn't know how many versions of presentation

files she had due to that issue.

Chloe also thought about interactivity issues when using external tools and developed her

own strategy. In her course, one assignment was to design a prototype. For this assignment, both

PowerPoint and Storyline were effective applications, so she allowed her students to choose

which program they used. However, she found that Storyline was not entirely compatible with

the video conferencing tool. She had to develop a strategy to handle that:

If there are students who did the prototype in Storyline, I ask them to take

screenshots and said don't worry about the interactivity. (Chloe's interview,

December 19, 2017)

And so, students could present their prototype in PowerPoint by first creating a PowerPoint

presentation incorporating screenshots from Storyline. When the instructors decided to use

external tools for their courses, they had to check the interactivity of those tools with their video

conferencing tools.

In a class, instructors and students present their work via presentation applications such

as PowerPoint, Word, Prezi, and Google Slides. They share their materials using a "share screen"

or "application sharing" function. However, there are some applications that cannot be shared

appropriately though an application-sharing function, and some functions of the presentation

application do not work well in video conferencing tools. This interactivity issue with video

conferencing tools limited the instructors' choices of external tools or required another design

strategy or task to use specific tools.

Organizational Rules

Organizational rules that instructors must follow when they design synchronous online courses

affect their design decisions. Organizations can include universities, colleges, or departments. In

each design case, there were different rules that acted as design constraints. Thus, identified

design constraints are varied according to each case, and the interviewees' universities did not

always share the same design constraints. Design constraints in "Organizational Rules" category

includes decision on online course, course time, graduate teaching assistant regulation, no

regulation on synchronous online courses, and uploading students' photos.

Decision on online courses. Kailee's university had specific rules for online courses. It offered two formats for each course: online and face-to-face. However, decisions regarding online courses were made by the university, not the instructors. In addition, decisions about online and face-to-face courses were different each semester. Kailee explained:

> *The decision on online courses or not it varies from semester to semester. Depending on the needs at that time, the course is delivered online or as a face-to-face course. There are a number of online courses that we must provide each semester for online students. To enable online students complete their program of study, we need to provide online courses each semester. In addition, if one course has been delivered only in online format for several semesters consecutively, that course needs to be delivered as a face-to-face course next semester. (Kailee's interview, December 20, 2017)*

This regulation brought uncertainty into the course format. Instructors had to prepare and update course materials for both formats every semester.

Course time. According to Kailee's university policy, online courses must take eight weeks of lessons, unlike face-to-face courses which are delivered across sixteen weeks. Compared to face-to-fact courses, she had to condense sixteen weeks of course content into eight weeks, literally half the course time of face-to-face courses. She said:

> *"When I teach the course with an online format, I need to adjust a 16-week course to 8 weeks. In other words, what I need to teach in a week and the activities my students have to do are greatly increased. Since online students often ask about classes by e-mail, they are many of emails that instructors need to read and respond each week. In online course, there is a lot of content that I should*

cover in the class, and there is a great amount of homework for students. I'm

really busy for 8 weeks."

Due to this regulation, she removed and modified several course elements that she had designed for the face-to-face course and changed her teaching strategies because of the time limit. To Kailee, the course time acted as a design constraint. When a university notifies an instructor that they will deliver their course with an online course format, the instructor must design that online course according to established online course design rules.

Graduate Teaching Assistant (GTA) regulations. Kailee's university provided GTAs for online courses. In her class, there were relatively more students compared to other classes. Whereas the other four cases had between 10 and 20 students, Kailee's course had an average of 30, and sometimes as many as 50. Kailee had been using the chat function as her main communication tool, but there were too many open chats for her to check on her own. Thus, she felt she needed a GTA.

However, her university had a regulation regarding the use of GTAs. That is, to have a GTA for an online course, that course must have at least 25 online students (students who are in an online program). If there were 24 online students and eight on-campus students in her online course, she could not have a GTA despite having more than 30 students overall. She said she was usually unable to have a GTA due to this GTA regulation and subsequently had great difficulty managing more than 30 students on her own. Except for Kailee's case, the instructors did not have a graduate teaching assistant (GTA) in their synchronous online courses. They did not talk about GTAs during the interviews because having no GTA was a formal thing at their universities.

No regulations on synchronous online courses. Lorie was the only instructor who did not have synchronous sessions as an essential. The other four instructors were required to design and teach their online courses in a synchronous course format. Lorie's department, though, mainly delivered online courses using an asynchronous format. Nevertheless, Lorie has a lot of experience in teaching synchronous online course, and from her experience she developed the pedagogical belief that online courses that have both synchronous and asynchronous components are pedagogically better for online courses.

With this in mind, she designed her course as a synchronous course format. But, the university had little understanding of online courses. For example, the university did not provide an appropriate system for synchronous online courses because its views on online courses favored asynchronous course formats. The course registration system was designed based on the asynchronous online course format. There were no places that she could put date and time information in the registration system. At Lorie's university, a synchronous online course was not an essential requirement. There was simply no regulation related to synchronous online courses at that point. And so, Lorie always had to make attending synchronous sessions optional. She said, "Technically, I can't require that students come." Due to this limitation, she needed to develop a strategy to deliver course content to students who could not or would not attend the synchronous sessions.

Uploading students' photos. Chloe had asked student to upload their photos. She said:

> *I always do at the beginning of the semester is that I had them do like a personal*
>
> *biography and they can they can upload a photo. But I can't insist that they do*
>
> *that because of University policy. (Chloe's interview, December 19, 2017)*

Uploading photos to asynchronous discussion board on LMS was part of her teaching strategy

intended to build the social presence of online learners. However, a university policy limited this

teaching strategy, so she designed an alternative strategy: She told her students that they could

either upload a photo of themselves or their doppelgangers. Instructors developed their own

teaching strategies for synchronous online courses. However, instructors did not use a specific

teaching strategy due to university regulations.

Environmental and Cultural Factors

Each case has its own environmental and cultural characteristics. For example, Chloe's

department emphasized the accessibility of learning materials in the semester I examined. Within

this department environment, she needed to redesign her course materials to increase

accessibility. In Lorie's case, her university did not encourage the use of outside tools. This

culture restricted her uses of some tools in her synchronous course. These environmental and

cultural factors affect an instructor's synchronous online course design. In some cases, these

factors are more significant than the technological, instructor, and learner factors that are directly

related to that course. These factors differ in regard to organization rules. Organization rules are

clarified and communicated, and instructors must follow them. However, environmental and

cultural factors act as hidden rules that have no overt compulsion. And yet, instructors are under

pressure to take into account those factors. Environmental and cultural factors include the culture

of the university, department, or class and are subjective according to each instructor's

viewpoints. Design constraints of environmental and cultural factors also vary in this respect. I

introduce design constraints related to environmental and cultural factors with several sub-

categories, namely: university culture, department culture, teaching environments, and design environments.

University culture: Lack of university support. One limitation Lorie faced in her course design was a lack of support from her university. According to her, the university had three different university level institutions that were in charge of supporting online course delivery and the use of technology: the information technology office, the center for teaching and learning, and the office of online learning. However, she was not satisfied with their services, as each operated differently and did not adequately provide practical support to instructors. She explained:

> *[Support team] They are not available and not responsive at all. […] None of them do professional development or support for online instructors. So, I think faculty feel really unsupported when it goes like trying to teach online even asynchronously. Let alone try to figure out a synchronous classroom. […] University supports Blackboard Collaborate Ultra but they have no support for it. (Lorie's interview, January 19, 2018)*

Due to this lack of support, she became overwhelmed when learning new tools, and this led to a limited use of LMS and video conferencing tools. Ultimately, it affected the decision to offer no synchronous courses that semester.

University culture: University size. Lorie thought that one reason why she did not get practical support was because of the school size. At her previous university, there had been a support team which was willing to support her. Even if they had no solution for an instructor's issue, the support team found a suitable fix in some other manner. Reflecting on this experience, she said:

ABC [previous university support team] have a culture of yes like "yes we'll

figure it out", "yes how can we help you?" "Yes, we will try to find the solution."

Just the opposite it's like no we can't do that now. That's the culture there. I mean

it's great and I really missed that because they don't have that that sense and part

of it's just because this university is so much bigger than that university [previous

university]. It's much less personal, and it's much more impersonal. (Lorie's

interview, January 19, 2018)

Her response says much about how university size affects the quality of its support to instructors.

University culture: No outside tools. Under pressure to learn and incorporate new tools,
Lorie decided to use external tools instead of the new LMS system. However, the use of this
external tool was limited:

For whatever reason, I did not want to mess with desire-to-learn. So one year I

just set up a Google site and Dropbox. I did that and then I got in trouble for that

because this university doesn't like you to use systems that aren't university based.

(Lorie's interview, January 19, 2018)

The university culture did not encourage the use of outside tools, restricting their use and
allowing her to use only university-based tools and systems.

Department culture: Accessibility of learning materials. Chloe was a full-time
instructional designer on the course support team at her university. One semester, her team
focused on accessibility and universal design for learning. Their team was designing and
delivering a training course regarding the increasing accessibility of learning materials. Also, all
team members had participated in accessibility training and were asked to apply that experience

to their work. Within this department environment, she felt pressure to redesign her course materials to increase accessibility. She said:

> *With the push that we had in the department here, I have started trying to go through my materials slowly and surely and see. I found several issues on my existing materials. I'm gonna have to do something about it. So I started to go through and adjust that. I haven't gotten through all of them yet. Okay, it's time consuming. (Chloe's interview, December 19, 2017)*

She said redesigning course materials was time-consuming. For example, she redesigned a course syllabus to make it work well with screen readers. For online students who will read materials on a webpage such as LMS, she tried to increase web accessibility, and for that work she changed all the table formats and title styles. In addition, the screen reader software she used was inconvenient. She needed to restart her computer every 40 minutes when using that format. It was a tedious and complex design task. The department culture about accessibility forced her to redesign course materials, necessitating an additional complex design task.

Department culture: Different view on online courses. Lorie's department had its own view of online course formatting that also led to needless work and stress. She explained:

> *There's a lot of misunderstandings around what online courses [are] and what distance education is. I'll say that the culture here in my department is mostly that it should be completely asynchronous and so students sign up assuming that it's anytime anywhere. [...] My colleagues insisted that it was impossible to do a class for longer than an hour yeah in a virtual classroom and I'm like no it's not. I do it all the time like if you design it right like you can do that, but I do understand the hesitation. (Lorie's interview, January 19, 2018)*

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With this view, she faced several difficulties that affected her course design, such as arranging schedules with students who had the expectation of an anytime, anywhere course, setting synchronous sessions as an optional activity, and explaining the rationale of synchronous sessions in online courses to her colleagues.

Department culture: Active approach to new tool. Jane's university had changed its video conferencing tool one semester. Her department decided to adapt a changed tool for their courses just after the switch even the university still allowed to use existing video conferencing tool. This meant that she changed her course development tool during the semester as well because her department had decided to adapt the new tool immediately, and her department was actually focused on investigating learning tools.

Jane was a professor in the department of instructional technology, a field which investigates the use of technology in learning, including in online course and classroom technology. And so, the department decided to take an active approach with this new tool, and since this was a departmental decision, Jane needed to alter a synchronous course delivery tool during the semester. This change brought tensions. Primarily, she needed to learn about the new tool quickly in order to use it properly in her course, and she made several changes to her existing course design and teaching strategies in response to the characteristics of the new tool.

Department culture: Departmental graduate assistant (GA). Lorie's department had a departmental graduate assistant (GA), and the GA's role was to support technology use in the department. This GA had a basic knowledge of LMS, video conferencing tools, and other tools for teaching and learning. She thought that they were helpful for some faculty members who were inexperienced in course design. However, Lorie was not sure that the departmental GA

would be helpful or not when it came to Lorie's course design. In particular, she didn't ask for the GA's support because, as she said:

> *I do think that maybe if there was something I really couldn't figure out, one of those GA's would help. But I've never gotten in touch with them because they change every semester too so there's no continuity you just aren't sure how much they really know. (Lorie's interview, January 19, 2018)*

That is, considering the GA system of her department, Lorie thought that she had more knowledge than the GA. She had already had a lot of experience in LMS and video conferencing tools by teaching synchronous online courses for more than seven years, so though she had complained about the university's lack of support, she didn't try to get any additional support with her course design.

Teaching environment: Students' registration patterns. Kailee was teaching the same course both face-to-face and in a synchronous online course format from semester to semester. By teaching that course for several years, she had discovered a pattern of student registration. If the course was held in a synchronous online course format, there were more students than in the face-to-face course. Online courses were open to both online and on-campus students, thus there were more students in online courses than in face-to-face courses.

When I compared the number of students in each case, it seemed that she had relatively more students than instructors, and this large number of students acted as a design constraint. Kailee needed to develop strategies for managing that volume of student communication and group work. She needed to make more groups and develop a more effective strategy for managing student participation than she would have to in a face-to-face course.

Teaching environment: course dates. Chloe had insufficient time to cover all her course topics. However, she also faced a design constraint due to course dates. In the semester I examined, Chloe taught her course on Thursday nights. However, Thursdays in that semester were frequently days off for events like Thanksgiving. Chloe said:

> *We lost a Thursday to fall break and to thanksgiving and it was bad so really. We really suffered from losing two Thursday nights. (Chloe's interview, December 19, 2017)*

She had originally designed her course based on a fifteen-week schedule, but due to missing classes on two Thursdays, she had trouble accommodating all the topics and had to revise her original design.

Design environment: Designing with another instructor. The course that Jane was teaching was also being delivered in a face-to-face format by another instructor. It was a core course, so the learning objectives and content had already been assigned. She and another instructor needed to redesign the course together in order to have something that could provide the same level of academic achievement to both online and face-to-face students.

They decided to adopt the same main contents and learning activities, then change or modify minor things based on their different learning environments. Designing a course with a face-to-face instructor was a design constraint of its own. When the instructors made a design decision, they had to consider both learning environments. They tried to align the courses' designs as much as possible. It was a complex and hard task to design a course that met the needs and conditions of both formats. In addition, the face-to-face instructor had her own concrete views of that course because she had taught it for nearly 25 years. Thus, Jane needed to explain, negotiate, and persuade the other instructor regarding her own design ideas.

Design environment: Limited design resources. Participants recognized the limited resources for synchronous online course design. With this in mind, they used strategies for asynchronous online courses by adjusting them or transferring their existing design experiences with face-to-face and asynchronous courses to synchronous course design through trial and error. For example, April used strategies for asynchronous online courses (e.g. setting ground rules) by transferring those strategies to her synchronous course design. April said:

> *[For my course design] I read a lot about online courses in general and a lot of the principles are specific to asynchronous courses. But then I really thought about how that would look like in a synchronous and I kind of just translated. […] That is something about straight from online course design books about asynchronous courses that you need ground rules. (April's interview, December 11, 2017)*

Instructors who teach synchronous online courses need to find alternative resources they can use due to limited design resources. Limited design resources that I introduced as a design constraint in the adaptation of synchronous courses also can be categorized as a design constraint under environmental and cultural factors as well. Most of the design recourses on online courses are based on asynchronous online course formats, and in this way they used strategies for asynchronous online courses by transferring those strategies to synchronous course design. This design constraint, "limited design resources", is the rationale for why I am conducting this study.

Physical Learning Environments

In this study, physical learning environments are tangible factors of learning and teaching environments such as teaching places and other infrastructure related to synchronous online courses. Thus, physical learning environments are different from environmental and cultural factors which are intangible factor. The instructors considered physical learning environments in course design because they had realized that physical learning environments can produce negative effects when managing synchronous courses. This category includes two design constraints: bandwidth limitations and teaching place.

> **Bandwidth limitations.** Jane reported issues with bandwidth. She said:
>
> *In my course, there are several students who are living at an out-of-the-way place or at the foot of a mountain. They have poor internet infrastructure. When I taught synchronous online courses by turning on my video, they said that their internet in particular, video streaming is getting slow after 30 minutes. Due to students who were having this bandwidth issue, I decided to not turn on my video during class. (Jane's interview, December 12, 2017)*

This was the only one report about bandwidth issue. Other than this, no instructors mentioned anything about bandwidth issues in teaching synchronous online courses. Current studies on synchronous online courses say that one common contributing factor to the rising popularity of synchronous online courses in recent times is the expansion of bandwidth accessibility (Martin & Parker, 2014; Romero-Hall & Vicentini, 2017). With increased bandwidth, instructors can design various learning activities and manage them more efficiently and with less error and delay. Still, bandwidth issues can be a design constraint depending to the location of students. Several

interviewees said that they had had students who were attending their courses from different locations, such as a military camps or other countries.

Teaching place. Chloe preferred to teach her synchronous online course at her home. However, she decided to teach her course at the office after experiencing an unpredictable internet connection issue. She explained:

> I always led the course from home. And one time my internet went out. Totally went out ten minutes before class started. I panicked. I called another faculty member and I said my internet went out. I said can you just go in. I said they're supposed to do breakout rooms, but we usually meet right at the beginning and then they go. And you know everything should be ready for them but can you just kind of be in there at the beginning and tell them to go into their breakout rooms in case. I can't get connected and I ran over to Starbucks and that connection was kind of iffy. It was going on and off and everything. It's just terrible. (Chloe's interview, December 19, 2017)

As Chloe's case shows, an instructor's teaching place in relation to internet connectivity can be a barrier to delivering an online course. Given this, instructors must decide carefully where they teach synchronous courses. If they decide to teach at home, they must prepare a back-up plan for internet issues. In regard to teaching places, April remarked:

> I always do my synchronous sessions from work. I like to be at work as an instructor and maybe it'll be different with other participants. I've have enough people saying that it's very valuable to them that they can log in at a very comfortable location not in a classroom but it's their own space. I teach from my office. I can rely on a steady connection. I have a reasonably powerful computer.

So, I know that I'm taking advantage of that. (April's interview, December 11,

2017)

One advantage of online courses is that both instructors and students can attend the

courses at home or any other comfortable place. Thus, many online instructors teach at home.

However, unlike asynchronous online courses, the instructor's internet connection is vital in

synchronous online courses because all participants join the online course simultaneously, and

the instructor is responsible for managing the course. Specifically, only instructors can use

moderator functions in video conferencing tool, such as recording a class and creating breakout

rooms. And so an instructor's teaching place affects the online course delivery. To synchronous

online course instructors, deciding on a teaching place is a mandatory design decision.

Design Considerations in Synchronous Online Courses

Design considerations are factors that need to be addressed in regard to design as well as factors

that might affect decisions made by the designer (instructor). By identifying design constraints, I

found factors which are not limitations but things which simply added a design task for the

instructor or factors that created design tensions by interacting with other design constraints and

considerations.

The purpose of this study is to understand synchronous course design activities in order

to support instructor's effort to develop their own synchronous courses. I believe that design

considerations are also a useful recourse that support synchronous course design. Instructors can

understand possible factors that they need to consider when they design synchronous courses.

The following section provides a list of design considerations I derived from data analysis and

examples of how those considerable factors affect course design decisions. I will introduce

design considerations with the same categories as design constraints. Table 9 shows list of

categories and associated design considerations in synchronous course design.

Table 9. Design Considerations

Category	Design Consideration
Adaptation of Synchronous Course Formats	• Course structure
Instructor (designers) Characteristics	• Teaching philosophy • View on synchronous online course
Learner Characteristics	• Online learner • Skillfulness in using technology
Technology	• Tool affordance
Organizational Rules	• Tool choice by university • Fund
Environmental and cultural factors	• University support • Colleagues • Freedom to tool choice

Adaptation of Synchronous Course Formats

Course structure. All participants had their own structure and time plan regarding their courses. In regard to the structure of her course, April said:

> *I always go with the agenda. I have a logistical check-in and then it's either*
>
> *lecture or activity something breakout whole class conversation and then just*
>
> *another advising checking session. (April's interview, December 11, 2017)*

She thought that the structure of synchronous online courses was vital. With a basic structure for each course, students can anticipate the courses to be the same, and when they are in synchronous sessions there is more order and reliability.

Designing a course structure means including a time plan for the course. An instructor must make design decisions on how much time they will spend on specific course elements. In relation to course time management, April added:

> *The first twenty to thirty minutes is spent checking introductory remarks, then I*
>
> *will put them in breakout rooms which usually take an hour, in comparison to the*
>
> *thirty to forty-five minutes it would require in a face to face classroom. Breaks*
>
> *are always encouraged and after the breakout rooms the whole group takes a*
>
> *break before a final hour. Final hour is spent to debrief their group activity and*
>
> *talk about next tasks. (Lorie's interview, January 19, 2018)*

And Lorie mentioned that she found that doing a specific activity in a synchronous online course takes more time than in a face-to-face course, even if it is the same activity. Synchronous online courses require the careful distribution of time based on their unique characteristics, such as Technology barrier in communication and difficulty with managing group activities due to tool

limitations. These characteristics of synchronous online courses have been introduced as design constraints. Also, course structure is a considerable factor when instructors design a synchronous online course.

Instructor Characteristics

Teaching philosophies. Each instructor had their own teaching philosophy which affected design principles and their overall design decisions with synchronous online courses. Kailee said her teaching philosophy is authentic learning and modeling. She explained:

> *I tried to design a course based on authentic learning theory. The nature of my course is focusing on applications in real life. Thus, I tried to design authentic learning activities including a client-based activity and case study. […]*

> *Instructor modeling is also my approach to teaching. For example, I believe that prompt response is an essential etiquette in online communication. Thus, when I get a question from a student, I tried to respond to their questions within a few hours. The reason why I respond to their question as quickly as I can, is to show a basic expectation of online communication to students. (Kailee's interview, January 19, 2018)*

She designed her synchronous course by reflecting her teaching philosophy.

Chloe also thought that authentic learning was an important value in her course. She said:

> *The guiding principle is to make it as an authentic experience to what they're going [to be doing] so that the transfer is better when they go to design themselves [at their work]. (Chloe's interview, December 19, 2017)*

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With this teaching philosophy, Chloe designed learning activities and teaching strategies. She added:

> *It is a very intense course because the students are the team and the instructor is the project manager. Students are doing a project for an actual client. So I have to play the role of making sure the students are not overworked for a semester's worth of work and the client still gets the product they need. (Chloe's interview, December 19, 2017)*

With this in mind, Chloe needed to develop strategies for providing enough feedback to students regarding their progress. For example, she designed an individual session to provide feedback and in turn answer questions about that feedback.

Lorie said her teaching philosophy involved designing task-oriented courses:

> *My big strategy for both face to face and in synchronous classes is to really make it very task oriented and let students actually be doing something. So, I usually will put them in small groups with a task, and they have to talk to each other and I make them use their webcam [for active participation]. (Lorie's interview, January 19, 2018)*

And April explained her simple design principle:

> *Design three weeks in advance! It doesn't always work that way, but I always try. (April's interview, December 11, 2017)*

Each instructor had their own teaching philosophy which acted as a design principle which affected overall course design.

However, their teaching philosophies created design tensions which interacted with design constraints. For example, Kailee's teaching philosophy created a design tension in terms of working with university regulations about online course scheduling. According to university policy, online courses had to be scheduled across eight weeks, whereas face-to-face courses were delivered for sixteen weeks. Given only half the time of face-to-face courses, Kailee felt a certain squeeze. With her belief in the importance of formative feedback, she tried to provide sufficient feedback regarding students' projects three times each semester, but she said she simply did not have enough time to provide consistent, productive feedback. She explained:

> *Because providing formative feedback is difficult task and require much of my energy, I always regret my decision on providing formative feedback. (Kailee's interview, December 20, 2017)*

Views on synchronous online courses. Chloe believed that one benefit of synchronous online courses is to get a chance to interact with an exporter which can be understood as building teaching presence. She said:

> *I was saying it takes advantage of the time with the students to provide that access to the expert that they need and because, frankly, any type of lecture or content they can get some other way and so this this time where you are there for them. They need to be able to ask you if they've got a question or if they don't understand something they need to be able to interact with their instructor and with their peers. (Chloe's interview, December 19, 2017)*

She tried to design a course that provided those benefits to students. She designed many sharing sessions in her course, and she minimized the lecture portion as much as possible during

synchronous meetings to instead allow more time for sharing her experiences. Instead of giving lectures, she designed more asynchronous presentations that summarized course contents.

April said that a successful online course is one that gets the students who used to say "That was a waste of time" to look forward to the next session. Thus, she designed a course that could keep students engaged. With this view, she designed a type of learning activity called a participatory online activity showcase (POAS) that asked students, as a team, to design and manage online learning activities by themselves.

Jane said a synchronous online course could be something that allows participants to interact with each other in real-time, just as they do in face-to-face courses, and allows participants to do learning activities which are not possible in asynchronous courses. With this view, she designed many real-time group discussions and group activities using breakout-rooms. Instructors had their own views of what makes a successful synchronous online course. These views also acted as design principles to that effect.

Learner Characteristics

Online learners. The instructors assumed that their students in their synchronous courses may feel, as online learners, isolated due to the distance between them and other students. For example, Lorie said:

> *I would say it [a synchronous online course] is successful when the students feel a sense of engagement and they have they feel like they can interact with other people in the class so that they don't feel isolated. (Lorie's interview, January 19, 2018)*

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Understanding this characteristic, the instructors tried to design courses that could make students feel connected to a learning community. Chloe asked students to introduce themselves in her first synchronous session. She introduced herself first, talking about her interests, background, places she had worked, and what her field was, then asked students to introduce themselves and explain why they signed up for the course. This was all to build a greater sense of presence and connectivity among the students.

Kailee said she was always trying to provoke student engagement due to their characteristics as online learners:

> *Online students are bored because they cannot see their peers' face and there is a distance between them and other students. In addition, it is easy for them do something else instead of focusing on class. (Kailee's interview, December 20, 2017)*

Kailee also discussed her communication strategy in regard to online learners' characteristics:

> *In online learning environments, students will be frustrated if they don't get a response to their questions from their instructor within 24 hours. Thus, I tried to answer students' questions as soon as possible. (Kailee's interview, December 20, 2017).*

Skillfulness in using technology. The instructors experienced students who were familiar with and good at using technology, and students' skills with technology often affected the instructors' design decisions. When April first taught her synchronous online course in 2011, she used a questionnaire to check students' preparation for an online course. However, she stopped doing that:

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I've stopped doing that and the students seem to be fine. […] Students are so

used to communicating through video. (April's interview, December 11, 2017)

For student group activities after class, Jane needed to create an online place where student could interact with one other. However, the video conferencing tool was limited and not available for use in students' activities after class. But she found that students were good at using Google Hangouts, so she didn't need to worry about finding a resource for them; the students had provided their own.

Due to her design conditions, Lorie realized that synchronous sessions were to have in her course. As an alternative, she asked her students to create video posts. About this decision, she said:

I can pretty much assume that students know how to do a video post. I don't even

have to teach them how to do that because that's just like a thing now. So I kind of

feel like some of that is helping maybe reduce the need for the synchronous

discussions. (Lorie's interview, January 19, 2018)

By considering the students' level of skills in using technology, Lorie was able to design her course differently.

Technology

Tool affordances. The instructors used various functions of video conferencing tools according to their purposes of use. For example, group activities using break-out rooms were a main learning activity in all five instructors' courses. Lorie explained:

If there weren't breakout rooms, I don't know if I would use the synchronous tool

at all. […] Breakout rooms are really important. I mean I don't want to just do a

presentation for an hour. (Lorie's interview, January 19, 2018)

All different kinds of video conferencing tools had a breakout room function. Five instructors designed group discussions and activities by using a breakout room function of video conferencing tool. Kailee and Jane decided to not use the video function due to the limitation of their teaching environments. Chloe contacted her university's staff to integrate a polling function within a new video conferencing tool, though April was not able to use polling or emoticon functions due to tool change at her own university.

Common functions of video conferencing tools are browser sharing, application sharing, interactive whiteboards, chat, audio and video conferencing, polling tools, and group break-out rooms. When instructors were asked to deliver courses via video conferencing tools, they tried to use those functions. Each function of a video conferencing tool provides an idea or motivation of actual use of function to instructors by acting as affordances, and the instructors I interviewed were using most of those functions. The instructors needed to consider the proper use of those functions according to their design situations and teaching strategies.

Organizational Rules

Tool choice by university. In all cases, the choice of video conferencing tool was made by the universities or colleges. The instructors were compelled to follow those choices without their own preferences. In particular, all five interviewees experienced a change of video conferencing tool. However, despite video conferencing tools being the most important factor in

all their courses, they had no input deciding which tool to implement. Some of them disagreed

with their university or college, though, and either accepted the decision or found another option.

Funds. April's university has a fund for a distance education program. It allowed her to

maintain hardware requirements for synchronous online courses such as headsets. The funding

also affected the preparation of synchronous course.

Environmental and Cultural Factor

University support. All universities had a support team for designing and delivering

online courses. The interview results show that there were some instructors who received

assistance from the support team, though other instructors did not ask for help because they were

confident or familiar enough with technology and online learning. Regardless, all of the

interviewees were aware of the existence of support teams at their universities and their roles.

Some instructors considered and used university support for their synchronous course

design. April took a tool training class from the support team, and Chloe contacted support team

staff about a specific function of a video conferencing tool. Both instructors provided students

with information about their university support teams and their services. Jane said that when she

first taught a synchronous online course, the support team offered to assist her and stay in her

office during her first synchronous session in order to guide her through any difficulties that

might have occurred.

Additionally, support institutions were different from university to university. Chloe and

April had university-level support teams which provided consultation on online course design,

technology training, and problem-solving in synchronous online courses. Lorie said her

university had one department-level team, one college-level team, and three university-level support institutions, but she was not satisfied with any of them. Jane said she had a college-level support team. Nevertheless, the instructors recognized where they could get assistance on synchronous online course if they needed it.

Colleagues. Lorie's program has a pedagogy meeting where members of the faculty could discuss teaching strategies. She said that the meeting was helpful in her course design:

> *That's been really nice because I get good ideas from them. (Lorie's interview,*
>
> *January 19, 2018)*

Specifically, there are two colleagues who had started putting face-to-face courses into online formats. They had taken a lot of training workshops, learned a lot about the process, and did their best to put the courses online. Lorie said they even had very different philosophies of teaching online than her but communicated with her to help in converting existing face-to-face courses into online ones. She said got productive, encouraging support from them.

They had a template for their learning management system which consisted of an introduction area, a content area, and an activities area. And so, when Lorie redesigned a face-to-face course into a synchronous online one, she just imported a master class and then tailored it according to what she wanted. Her colleagues' experiences and support affected her synchronous course design positively, and Lorie herself was later the inspiration for a colleague's choice to change an online course format from an asynchronous course to a synchronous one.

Freedom of tool choice. Jane's university gave instructors permission to choose their LMS. The instructors could choose among Sakai, Laulima, Canvas, and Google Sites. Jane selected the LMS for her course by considering her teaching style, preferences, and tool characteristics.

In this chapter I have reviewed the results of the study: design cases, design constraints and design considerations. I have written design cases to capture the experiences of the course design activities of experienced instructors and have identified a variety of design constraints. In the final chapter I will discuss the conclusions and implications learned from the design experiences of others'. I will introduce the common characteristics of synchronous course design and implications for designing and supporting synchronous course design, and propose directions for future research in synchronous online course design

CHAPTER FIVE

CONCLUSIONS AND IMPLICATIONS

In this study, I collected data on synchronous design experiences of five instructors and analyzed them with one broad research question: How do instructors design synchronous online courses? With the data I collected, I wrote design cases while paying attention to design precedent, and identified design constraints through a thematic analysis. Each design case includes the designer's information, design objects, design situations (student information, university rules and culture, tools, and course support), design features corresponding to the design constraints, design tensions (that I identified as an investigator) and solutions to identified tensions. Instructors can develop their understanding of synchronous online courses by reading the design cases and using them as design recourses. In other words, instructors can get an idea for solving their design issues by learning from others' design experiences.

I came to this dissertation after having been an instructional designer in South Korea, and I am currently a member of the instructional design unit at UT Knoxville. Through these experiences, I have designed online courses and supported synchronous course design. I am also a doctoral student and have enrolled in several synchronous online courses since starting at UT Knoxville. I have experienced synchronous online courses as a course designer, a student, and an instructional designer, and through these direct experiences I have come to realize the benefits of synchronous online courses as a course delivery format, observed the difficulties of designing and delivering synchronous online courses. I have also come to recognize the limited support of synchronous online course design. These experiences led me almost inevitably to this dissertation.

The most common form of online course has been in the asynchronous format (Butz & Stupnisky, 2016; Gibson, 2011; Yamagata-Lynch, 2014). Researcher have identified various benefits of asynchronous courses including flexibility, convenience, increased reflection, in-depth discussion and cost efficiency (Ching-Wen, Hurst, McLean, 2015; Huang & Hsiao, 2012; Hrastinski, 2008; Hrastinski, Keller, & Carlsson, 2010; Johnson, 2006; Wang & Reeves, 2007). These benefits have contributed to the popularity of asynchronous online courses.

However, there is a growing interest in synchronous online courses with its unique benefits and limitations of asynchronous course (Bell, Sawaya, & Cain, 2014; Martin, Ahlgrim-Delzell & Budhrani, 2017). I have confirmed this through my own experiences as part of a university instructional design and training team as well as from existing studies in online learning. Several factors have contributed to the increasing interest in synchronous online courses, including the limitations of asynchronous online courses, the advantages that supplement the limitations of asynchronous online courses, the unique pedagogical affordances of synchronous online courses, and the increased bandwidth and advanced technology that make synchronous online courses possible. In response to this growing interest, several programs have started to adopt a synchronous online course format as the main course delivery format. Among the four universities I investigated, three delivered their online courses with synchronous online course formats according to specific university regulations.

However, synchronous online courses design is a series of complex and often ill-structured problems which is called a wicked problem. Jonassen (2011) asserts that instructional design work is essentially a complex and ill-structured problem-solving activity. He claimed that in instructional design there are various constraints and that designers should recognize them and make proper design decisions in response. Yamagata-Lynch (2014) also approached online

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course design as an ill-defined problem-solving activity in her study. I myself found that there were various design constraints in synchronous online course design. Moreover, I found design tensions which were created by the interaction of different design constraints and therefore too complex to solve with a single solution.

Another factor that contribute to the complexity of design work is that all learning events in synchronous online courses take place via technology (Butz et al., 2014; Tabak & Rampal, 2014). Researchers have asserted that integrating technology into teaching practices is a difficult design task due to technological attributes, instructors' personal beliefs, the social and institutional contexts in which instructors work, and the situations inherent in new tools (Koehler & Mishra, 2005; Tsai & Chai, 2012). Moreover, synchronous online courses involve unfamiliar course formats for instructors, as they are still not especially popular or common. Synchronous online course design provides new and various design tasks (e.g. handling various communication inputs, using break-out rooms) which many instructors have never experienced in face-to-face or asynchronous course design (Bower et al., 2013; Chen et al., 2015; Piskurich, 2004; Romero-Hall & Vicentini,2017).

Based on these academic discussions and my own experiences, I regarded synchronous online design as a wicked problem and felt that instructors need practical support with the related complex problem-solving activities. However, most existing design resources for online courses rely heavily on asynchronous online course formats (Szeto, 2015; Yamagata-Lynch, 2014). I found that there are few design recourses that instructors can use for designing synchronous online courses. In addition, it was at times difficult to find design recourses that can be used when I supported instructors' synchronous course designs as a member of the instructional design unit at the UT Knoxville.

To support instructor's effort to develop their own synchronous courses, I provided an understanding and design resources of synchronous course design in two ways: first, to identify design constraints and second, to capture the design experience and knowledge embodied in the synchronous course design cases of the experienced instructors. Based on my findings, in this chapter I will address common characteristics of synchronous online course design. By comparing the similarities and differences I found in the design cases and relevant constraints, I conceptualized common characteristics of synchronous online course design. I will introduce implications for both designing synchronous online courses and supporting synchronous online course design at universities. Finally, I will make suggestions for future research.

Common Characteristics of Synchronous Online Course Design

Synchronous online courses have unique characteristic distinguished from asynchronous online courses.

In this study, I defined a synchronous online course as an online course in which planned learning events take place in real time between a remote instructor and geographically dispersed students by means of video conferencing tools. Synchronous online courses have characteristics unique from asynchronous courses including: participants sharing same time, place independence, and all technology enhanced communications. This study found that these characteristics created several design complications such as scheduling meeting times, using video conferencing tools, relying on various communication channels, having hardware requirements, and coping with technology barriers.

Existing studies of synchronous online courses have mentioned the following issues in teaching synchronous courses: scheduling (Lee, Nakamura, & Sadler, 2016; Lowenthal, Dunlap,

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& Snelson, 2017), asking students use a specific equipment for course communication (Yamagata-Lynch, 2014), designing a collaborative activity for students who are uncomfortable working together online (Robinson, Kilgore, & Warrant, 2017), and handling technical problems such as headset issues (Wang & Chen, 2007) and functional errors related to video conferencing tools (Bower et al., 2015). These issues were unique design issues that participants in this study had never experienced in other course formats, yet instructors must consider these qualities when they design synchronous online courses.

Synchronous course design is influenced by unique environmental, organizational, and cultural situations.

This study found that each design case had different design constraints and considerations. Particularly, each instructor had different environmental, organizational and cultural factors that affected their course design, such as university policies, department culture, and student characteristics. I found that some of environmental, organizational and cultural factors heavily influenced instructors' decision making. For example, one had to teach her synchronous course within an eight-week schedule due to university policies. Another felt pressure to redesign all her course materials due to a department culture that focused on the accessibility of course materials. Therefore, even though this study provides design cases as recourses that instructors can use in their future synchronous course design, it will be impossible to use other instructors' specific design strategies in that same way. Instructors need to identify the characteristics of their own design situations and use others' strategies by reflecting on those characteristics.

Wang (2007) found that students' cultural orientation affected their synchronous learning activities and perception of online learning experiences. She suggested that instructors should

design online courses which are distinct combinations of asynchronous and synchronous activities by considering students' cultural orientation. However, it is hard to find studies that introduce how the differences between design situations affect synchronous course design. This is because most studies of online course design have focused on online courses at the same institution or simply did not consider design situations. This dissertation shows the importance of understanding the environmental, organizational and cultural factors of design situations in regard to synchronous online course design.

Participants shared similar design challenges, but did not necessarily share similar strategies to address them.

By comparing each case, I found that instructors faced similar challenges while designing synchronous courses. Among such challenges were handling students' expectations of the online course format, having students who were full-time employees, handling internet connection issues, and adjusting to tool change. However, to these design challenges, each instructor reacted differently.

For example, instructors responded differently to tool change. All of them experienced tool change and reported that it entailed some limitation in design, such as missing functions and having to spend time learning new tools. However, I found three diverse reactions to tool change: positive, neutral, and negative. One instructor who had a positive view of tool change just put in the effort to learn the new tool. And despite having difficulty figuring out a specific function of the tool, she was satisfied overall. Another instructor had a neutral view of tool change, saying that even though she liked a previous tool, she was okay with the new one. She was worried about using new tools but participated in training. Yet another instructor had a

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negative view of tool change because she did not like the new tool and did not want to use it in her class. As a result, she decided to not design a course with a synchronous course format.

These examples show that the same design challenge affected course designs differently according to each instructor's preferences and skills. This finding explains that it is impossible to have a single perfect solution to any given design challenge. Design constraints are subjective depending on each design situation.

Synchronous online courses have their own pedagogical and tool affordances that need to be carefully address in course design.

I observed two pedagogical affordances of synchronous online courses that the instructors had applied: group activities and one-on-one meetings with the course instructor. The instructors participating in this study integrated these affordances into their courses in order to use the synchronous online course format more effectively. In most studies about synchronous online courses, instructors commonly designed group activities and provided individual and immediate feedback to increase presence (e.g. Bower et al. 2013, Tabak & Rampal, 2014, Yamagata-Lynch, 2014). The increasing presence of online courses has been regarded as one of the most important tasks for instructors (Garrison, Anderson, & Archer, 2000, Palloff & Pratt, 2011). And researchers have discussed that real-time interaction in synchronous online courses increases presence (Clark, 2015; Hrastinski, Keller, & Carlsson, 2010; Olson & MaCracken, 2015).

However, these affordances also created several design challenges. Instructors reported facing difficulties in assigning groups, providing group work time, and developing strategies of monitoring and managing group activities. Existing studies of synchronous online courses that used group activities also introduced design issues and strategies in implementing group

activities: group assignments (Bower et al., 2015), group sizes (King et al., 2010; Pfister & Oehl, 2009), the preparation of group work (Bower et al., 2015; Yamagata-Lynch, 2014), and students' difficulty and discomfort with online group activities (Jaggars & Xu, 2016; Robinson, Kilgore, & Warren, 2017).

Synchronous online instructors' teaching philosophies and expectations can act as design challenge.

Each instructor has their own teaching philosophy, view of successful online courses, personal characteristics, and experience related to synchronous courses. These beliefs and experiences support their synchronous course design but can sometimes interrupt them. Instructors' beliefs in both general and online teaching philosophy act as design principles and bring design challenges which are self-imposed.

For example, an instructor who emphasized providing feedback needed to design an individual session despite the challenge that she did not have a lot of time for it in the course structure. In addition, instructors' past experiences introduced design challenges. An instructor who was satisfied with her previous university's support was not satisfied with support from a later university. Instructors' experiences related to synchronous online courses, both negative and positive, affected their decisions regarding synchronous online course design.

Among the five participants, two were from the same university and program. They designed their synchronous online courses within similar design environments, including the same course support, rules, students, and tools, but they faced different design challenges due to their personal beliefs, characteristics, and experiences. This shows how an instructor's individual characteristics affect their synchronous online course design. Instructors as designers should

recognize that their personal beliefs and experiences will affect their course design, and they need to identify any personal qualities that might affect their design in order to make appropriate solutions for challenges they encounter.

Advanced information technology development and increased bandwidth have provided a stable teaching environment for synchronous online instructors.

Studies of synchronous online courses have pointed out that the biggest concerns with implementing synchronous online course in the past were inadequate tools and insufficient bandwidth (Chao, Hung, & Chen, 2012; Lowenthal, Dunlap & Snelson, 2017; Park & Bonk, 2007). In the early 2000s, video conferencing tools were expensive and had limited functions and prone to errors (King et al., 2010). In addition, high network traffic created time lags in audio and video transmissions (Bower et al., 2015). Instructors faced technological barriers due to a lack of sufficient infrastructure. However, rapid improvements in information and communication technologies have all but alleviated these concerns (Martin & Parker, 2014; Romero-Hall & Vicentini, 2017). Robinson, Kilgore and Warren (2017) assert that advances in technology, increased bandwidth and internet speed, and the availability of video conferencing tools have made synchronous online courses more widely available and easily accessible.

This dissertation also found that none of the five instructors were suffering from technological barriers with their video-conferencing tools or insufficient bandwidth. They reported that they had experienced problems in the past. Advanced technology has largely resolved the crucial limitations of implementing synchronous online courses and providing stable teaching environments.

The nature of synchronous online teaching environments still involves unpredictability because all communications in synchronous online courses heavily rely on video conferencing tools and internet connections (Butz et al., 2014; Melkun, 2012). If there are any unexpected technological problems, such as internet disconnection, participants are unable to participate in any learning activities. All interviewees worried about potential technological issues during class and felt it necessary to design back-up plans and support for such an event. They included solutions to common technological issues in their syllabuses and designed orientation sessions to anticipate and prevent such occurrences.

Emerging issues in teaching synchronous online courses include learning and adapting to new tools.

While participants of this study did not experience difficulties with technology infrastructure, they faced a challenge related to adapting to new tools to design and teach their courses when their university changed contracts for their LMS and videoconferencing tool. With rapid improvements in information technology, many video conferencing tools and LMSs have been developed, and new versions are released frequently. With various options, university or colleges change the tools that they provide support for synchronous online courses. All five participants experienced tool change, including changes to video conferencing tools and LMS, in their last or most recent semester, and they faced several challenges in adapting to these new tools. They needed to make an extra effort to learn about new tools. In this experience they found that some of the features that were useful for teaching were no longer available in the new tool. In addition, there were instructors who had negative views of tool change and new tools, and their views

affected their course design decisions. Tool change is an emerging issue in teaching synchronous online courses.

Many synchronous online course students are adult learners, and instructors address this in their course design.

Researchers have indicated that most online learners are adults who have full-time jobs (Moore & Kearsely, 2005; Park & Choi, 2009). This characteristic makes it more difficult for instructors to find a specific date and time for synchronous sessions. Unlike asynchronous online courses, instructors must set a specific date and time for synchronous online courses. Existing studies of synchronous online courses have pointed out the difficulty of scheduling synchronous online courses, saying it was a barrier to adapting to a synchronous online course format (Gregersen & Youdina, 2009; Lee, Nakamura & Sadler, 2016; Olson & McCracken, 2015).

All participants said that they had had many students with full-time jobs and that characteristic acted as a design constraint in scheduling. All participants in synchronous online courses should be in their virtual classroom at the same time. But because many students have their own work schedules, it can be difficult to find a specific time for course and group activities. One instructor said that scheduling has been the hardest part of her course design. Indeed, finding time for synchronous sessions was one of the most difficult design tasks for many instructors.

Converting a face-to-face course to the synchronous online format is a unique and complex design task for any instructor.

With the increased interest in synchronous courses, several postsecondary institutions have started to deliver online courses with such a format (Bell, Sawaya, & Cain, 2014; Butz, Stupnisky, Peterson, & Majerus, 2014). Instructors are often asked to convert their existing face-to-face courses to synchronous online ones. Among the five synchronous online course design cases I researched, four instructors had designed their courses based on existing face-to-face courses.

The synchronous online course format has different communication types, teaching and learning environments, and design constraints in comparison to the face-to-face course format (Bower et al., 2013). Piskurich (2004) asserted that many activities, such as lectures, that work well in face-to-face courses are inadequate in synchronous online courses due to these differences. And even though these differences exist, instructors are asked to convert existing face-to-face courses into synchronous online courses all the same. This task is unique to synchronous online design cases, so naturally design issues emerge throughout the process of converting existing courses. Redesigning courses requires instructors to make various design decisions regarding how to change elements, what to add, and what to remove to maintain the same level of student achievement. Three instructors were teaching both a face-to-face course and a synchronous course, and even though synchronous online and face-to-face courses are different, these instructors had to maintain the same level of student achievement for both courses and felt that ensuring the same level of achievement was a complex, difficult design task.

Blending asynchronous activities in a synchronous course design can alleviate the design

challenge related to not having enough time in synchronous online courses.

All five participants had designed asynchronous activities and used them as essential elements in

their synchronous courses. Specifically, two participants said that they used asynchronous

activities as solutions to a lack of course time. For example, one participant designed more

asynchronous presentations that summarized course contents instead of giving lectures. Due to

her students' differing levels of background knowledge, she needed to design a session that

delivered basic course concepts to students who were unfamiliar with them. However, she felt

that she already had insufficient time to deliver essential course elements, so she could not

allocate extra time to also delivering the basic course concepts. In the end, she decided to present

basic concepts in asynchronous sessions.

Falloon (2011) also introduced the use of asynchronous discussions to handle such issues.

It reported that students felt a lack of time for discussion activities in synchronous sessions and

suggested using asynchronous discussions to provide more course time. Studies that shared their

synchronous online courses also reported that they used asynchronous activities and that it was

an effective strategy (Lee, Nakamura, & Sadler, 2016; Olson & McCracken, 2015; Yamagata-

Lynch, 2014).

Although there is increasing interest in synchronous online courses, asynchronous online

courses are still regarded as the representative form of online instruction.

The most common form of online course delivery is the asynchronous format (Butz & Stupnisky,

2016; Gibson, 2011). To this day, compared to asynchronous courses, synchronous courses have

received far less attention (Lowenthal, Dunlap & Snelson, 2017; Park & Bonk, 2007). Thus,

most studies about online learning have been limited to the asynchronous online delivery format (Oyarzun & Martin, 2013; Szeto, 2015). Studies investigating synchronous online courses have pointed out the limited discussion inherent in synchronous online courses in comparison to asynchronous online courses (Gayol, 2010; Palloff & Praff, 2007; Yamagata-Lynch, 2014).

The lack of popularity of synchronous online courses as for course delivery and research topics has created a design challenge in synchronous online course design. First, instructors have faced students, colleagues, and universities with limited views of online courses and have needed to put great efforts into making them understand synchronous online courses delivery. People have general assumptions that all online courses should be anytime and anyplace. This assumption has created design issues in synchronous online course design, such as difficulty in scheduling, unsupportive culture, limited support from universities, and the need for extra sessions to develop an understanding of synchronous courses. Four instructors reported that they had put extra effort into developing students' understanding of synchronous courses.

Second, there are few academic resources that instructors can use for synchronous course design. Most design recourses of online courses are based on asynchronous online course formats (Yamagata-Lynch, 2014). Participants recognized the limited resources for synchronous online course design, and with this in mind they used strategies for asynchronous online courses by adjusting them or transferring their existing design experiences with face-to-face and asynchronous courses to synchronous course design through trial and error.

Synchronous online course design is a wicked problem.

I began this study with the assumption that synchronous online course design is a wicked problem, being ill-defined, complex, and unsolvable through existing rational systematic processes (Rittel & Webber, 1973; Whelton & Ballard, 2002). Several studies have supported this assumption based on the characteristics of synchronous online courses (Ertmer, 2005; Jonassen, 2011; Mishra & Koehler, 2007; Yamagata-Lynch, 2014). The lack of popularity of synchronous online courses also contributes to the complexity and difficulty of synchronous online course design because it creates issues such as limited design resources and a lack of understanding of synchronous online courses overall.

Through this dissertation, I am concluding that synchronous online course design is in fact a wicked problem. The above characteristics of synchronous online courses that I addressed explain how synchronous online course design is difficult and complex as well as unpredictable. Specifically, I have found that each design situation contains various largely undefined, fluid, and contrasting design constraints. The instructors I interviewed needed to design strategies to overcome those limitations.

Moreover, I also determined several design tensions in each design case which had been created by interactions of contradictory design constraints. These tensions were higher-level problems and too complex to solve with simple solutions. For example, one tension was a "lack of time to address all the activities that the instructor wants to include." The inherent constraints clashed: a lack of course time, the instructor's teaching philosophy, essential course elements, and students' diverse background knowledge. These design tensions were design problems that the instructors had never experienced in designing other course formats. To address these tensions, the instructors developed their own solutions by integrating their experiences,

knowledge, and skills. From their processes in regard to solving tensions, I was able to observe

the instructors' design strategies, including creative processes to solve complex problems and

find desirable solutions (Buchanan, 1992; Rittel & Webber, 1973).

Implications of Designing Synchronous Online Courses (Instructors)

Following statements are the implications of designing synchronous online courses for

instructors. Instructors who will teach synchronous online courses can use these implications as

guiding principles for their synchronous course design.

Instructors need to identify design constraints unique to their situation to make appropriate design decisions.

This dissertation found that each instructor encountered unique design constraints according to

their situation. Specifically, I found that each design case had environmental, organizational, and

cultural factors that acted as design limitations in synchronous course design. Additionally, I

found that one factor acting as a design constraint to one instructor would not be a design

constraint to another.

For example, instructors had different views and approaches to the use of lectures in their

courses. One instructor found that there was no difference between a student reading the

instructor's presentation materials and receiving a lecture. Therefore, she removed all lecture

sections from her course and decided to focus on discussion group activities instead. Existing

studies also indicate that lectures are inadequate in synchronous online courses (Piskurich, 2004).

However, another instructor regarded lectures as essential course elements to communicate

concepts from readings to students. This example illustrates that including lectures acts as an

effective design element for synchronous online courses to one instructor but not to another. Instructors can make appropriate decisions when they understand the constraints in their designs (Jonassen, 2008). In synchronous course design, identifying constraints inherent in their designs is the first and essential design to instructor.

Instructors are likely to experience more preparation when designing synchronous online courses in comparison to asynchronous and face-to-face courses.
Participants reported that teaching synchronous online courses requires more preparation than other course formats. They said that they typically needed to design an extra session to avoid students' potential technological issues, put much more effort into syllabus design and handouts for learning activities, assign groups before the semester to save course time, and test tools to use them properly in their courses.

By analyzing the interview data, I found many design tasks that only synchronous courses have such as using various communication inputs, using break-out rooms for group activities and preventing technical issues. Researchers have also emphasized the importance of extensive preparation in synchronous course design (Anderson et al., 2006; Bower et al., 2013; Chen et al., 2015; Piskurich, 2004). Anderson and his team (2006) identified several problems in managing synchronous course activities, including tools unfamiliar to participants, multiple communication tools, a short-time frame in which to cover course contents, and miscellaneous technical problems. They emphasized the importance of planning in order to solve these problems. Piskurich (2004) insisted that implementing a synchronous course requires 20%-30% more preparation time than other course delivery options. Instructors who teach synchronous online courses should recognize that designing synchronous online courses requires more

preparation related to the increase of design tasks and plan ahead to ensure enough time to design a sufficient course.

Instructors must understand the various communication channels and develop strategies for how to use them in synchronous sessions.

Synchronous online courses provide real-time communication to participants in several ways. Both instructors and students in synchronous courses can communicate via chat, audio, and video as well as by sharing their screens. The instructors I interviewed were having issues with using and managing various communication channels, and each had made their own decisions regarding how to use them. One instructor had turned off her video during class to focus on students' chats, the main communication channel in her course. Another instructor also turned off the video stream because there were students with bandwidth challenges. And yet another instructor urged her students to turn on their video streams when they spoke. Each instructor developed her own way of using various communication channels. Researchers have warned of cognitive overload among instructors caused by multiple communication channels and have stressed the importance of careful design in using those options (Anderson et al., 2006; Bower et al., 2013). Instructors should have a plan for how to use various communication channels in their synchronous courses.

Instructors have a responsibly to create stable teaching and learning environments.

Insufficient infrastructure and technological challenges have been reported as main limitations in synchronous online course design. These challenges are unpredictable. All participants recognized the probability of occurrences of such challenges in their courses and designed back-

up plans to prevent or work around them. For example, one instructor decided to teach her synchronous online course from her university office to ensure a stable teaching environment.

Teaching synchronous online course always includes potential technological challenges, and instructors need to develop strategies for preventing and resolving technical issues (Earnshaw, 2017; Robinson, Kilgore, & Warrant, 2017; Wang & Chen, 2007). King et al. (2010) asserted that potential technological issues must be tested and resolved before synchronous sessions by providing tutorial and practice sessions. One popular strategy among participants of this study was providing contact information for university support teams which could help when students had tool or connection difficulties. All participants included this information in their syllabuses. Instructors need to be aware of support teams at their universities and what they can do to facilitate online course design and assistance.

Instructors need to clarify their views regarding successful synchronous online course because their views will act as principles for their course design.

Each instructor had her own view of what makes a successful synchronous online course. These views acted as personal design principles. For example, one participant said that a successful online course is one that gets students who used to say "That was a waste of time" to look forward to the next session. Thus, she designed a course that would keep students engaged. With this view, she designed a type of learning activity called a participatory online activity showcase (POAS) that asked students to design and manage online learning activities in teams. The instructors' views of successful synchronous online courses acted as part of the overall design approaches that guided their course designs.

Instructors can use syllabus as a useful tool to provide students with an understanding of synchronous online courses and prevents technological barriers.

Participants of this study used their course syllabuses as a useful course support tool. They included in their syllabus not only course-related information such as objectives, assignments, and weekly plans but also information about taking synchronous online courses. Their syllabuses typically included information about what synchronous online courses are, how to handle technological issues, how to communicate in synchronous online courses, and what technological requirements were needed for successful synchronous communication. Instructors who teach synchronous online courses can use syllabuses to improve students' understanding of synchronous courses and provide guidelines for successful synchronous learning experiences.

Instructors need to be mindful of course structure because it plays an important role in synchronous online courses.

In this study, I found that each instructor had their own course structure. One participant emphasized the importance of structure in synchronous online courses. She had found that synchronous online courses were much more fluid and open, but there was a lot of chaos as well. Due to these characteristics, she thought that structure is important to guide student learning in synchronous online courses. Researchers have emphasized course structure in synchronous online courses (Olson & McCracken, 2015; Piskurich, 2004; Yamagata-Lynch, 2014). Each participant had her own structure and plan because they all had different course elements and different priorities. Designing a course structure means selecting course elements, ordering them, and planning time for the course as a whole.

Instructors need to find resources they can use for their course designs but also contribute to the development of new design resources.

There are few academic resources that instructors can use for synchronous course design because most of the design resources for online courses are based on asynchronous online course formats (Palloff & Pratt, 2011; Szeto, 2015). While reviewing these limited design resources, participants reported that they transferred their existing design experiences with face-to-face and asynchronous courses to synchronous course design through trial and error. One participant used strategies for asynchronous online courses (e.g. setting ground rules) by transferring those strategies to her synchronous course design. Instructors who teach synchronous online courses need to find alternative resources they can use. This dissertation asserts that design cases, which are the collection of an instructor's design experiences, can serve as authentic and useful design resources. By writing about and sharing their design experiences in synchronous online course design, each instructor can contribute to the development of synchronous online course design resources.

Implications of Supporting Synchronous Online Course Design (Universities)

This dissertation found that organizational factors heavily affected synchronous online course design. Following statements are the implications of supporting instructors' synchronous online course design that universities need to be consider.

When universities decide to change tools such as video conferencing tools and LMS, they
should listen to instructors who will actually be using those tools.

The success of synchronous online courses often hinges on the choice of appropriate video

conferencing tools and LMS, as they strongly impact functionality and reliability (Bower et al.,

2015; Stewart et al., 2010). The rapid pace of technology change is driving a continuous

development of those tools, and today there are various tools available for synchronous online

courses. Among these many options, universities change their video conferencing tools and LMS

for various reasons.

All five participants had experienced a change of tools in their last or most recent

semester. However, each said that adapting to new tools in their synchronous online course was a

difficult and time-consuming task. All participants reported that tool change brought limitations

to their course designs. Existing studies also explain the challenges of adapting new tools in

synchronous courses (Chao, Hung, & Chen, 2012; Ng, 2007). According to Lee, Nakamura, and

Sadler (2016), new video conferencing tools can bring a lack of confidence or usability to users

and demand extra effort to become familiar and practical for regular use. Due to sudden tool

change, the participants said that they had lost some functions they had relied on before, were not

able to use all the tool's functions, did not like the new tools, or needed to put more effort into

learning them.

Because tool change can create difficulties with teaching synchronous courses, decisions

regarding tool change should be done carefully. In every case I investigated, the choice of video

conferencing tool was made by the university or college, and the instructors were compelled to

follow those choices regardless of their own preferences. Despite video conferencing tools being

the most important factor in all their courses, instructors had no input deciding which tool to

utilize. Many disagreed with their university but either accepted the decision or found another option. Thus, when universities decide to change elements such as video conferencing tools and LMS, they must integrate as many synchronous course instructors' voices as possible in their decision.

Universities, colleges, and departments must have a basic understanding of what synchronous online courses are if they have instructors who are teaching courses with a synchronous course format.

Universities, colleges, and departments must have a basic understanding of what synchronous courses are and how they differ from asynchronous online courses if they have instructors who are teaching courses with a synchronous course format. Their understanding of synchronous courses will directly affect synchronous online course design. Tabak and Rampal (2014) explain the importance of supportive and encouraging university culture to the successful implementation of synchronous online courses. Steward et al. (2011) also point out that a lack of institutional recognition in regard to difficulties in teaching synchronous online courses can make instructors feel unsupported.

One participant taught her synchronous online course within a university institution that had a lack of understanding of synchronous online courses. Her university and department favored asynchronous course formats, and due to this limited view of online courses she faced difficulties in teaching her synchronous online course. For example, she had to make attending synchronous sessions optional, unlike other instructors who made attendance mandatory. With limited understanding of online courses, there were simply no policies related to synchronous online courses at her university. In addition, the course registration system at her university was

based on the asynchronous online course format. She was not able to add date and time information on the registration page, and without this information, students assumed her course was asynchronous, meaning that it was tough to notify students of this distinction and be sure they understood that they were signing up for a synchronous course. Her case highlights the importance of institutional understanding of synchronous online courses.

Based on an understanding of synchronous courses, universities need to develop specific regulations for synchronous online courses to support instructors. By analyzing interviews, I identified several design issues that must or can be addressed with university-level policies. First, universities must make attending synchronous sessions mandatory in synchronous courses. Each student's attendance in all synchronous sessions is an essential teaching condition inherent in synchronous online courses (Olson & McCracken, 2015). Second, universities need to limit the number of students who can register for synchronous courses. One participant reported that it was hard to manage learning activities in her synchronous online course because she had far too many students. Several studies have explained the necessity of limiting enrollment in synchronous online courses (Bower et al, 2013; McDaniels, Pfund & Barnicle, 2016; White et al., 2010). Little, Passmore, and Schullo, (2006) assert that synchronous sessions ideally needed to be fewer than 15 students in order to encourage participation and anticipate relevant technical issues. Third, universities need to provide graduate teaching assistants (GTAs) to instructors. In synchronous online courses instructors often experience cognitive overload by handling various communication inputs and operating video conferencing tools in addition to handling related technical issues (Bower et al., 2013). To prevent this eventuality, researchers have suggested providing GTAs who can respond to students' text chats and deal with any technological issues

(Bower et al., 2015; Piskurich, 2004; Wang, 2007). One participant also pointed out the necessity of GTAs who can support course management.

University support for synchronous online course design needs to include individual and customized support because each instructor has their own design environment.
University support for synchronous online courses is essential for success (Bell et al., 2013; Bower et al, 2015; Robinson, Kilgore, & Warrant, 2017). Bower et al. (2015) explain the importance of the right institutional support at the design stage of a synchronous online course. They say that institutions need to provide appropriate support to instructors, such as technical help, professional development, and sufficient preparation time.

In relation to the institutional support, participants expressed the necessity of personal support with course design. One participant was dissatisfied with her university's support, pointing out the absence of personal support and professional development. Due to this lack of support, she became overwhelmed when learning new tools, and it ultimately affected her decision to offer no synchronous courses that semester.

Unlike her case, other participants appreciated the customized support from their institutions. I reviewed their support services and found that some universities provided one-on-one consultation with synchronous course design. Little, Passmore, and Schullo (2006) recommend taking a multidisciplinary team approach for teaching synchronous online courses that forms a team consisting of faculty members and an instructional designer who can design and deliver a course together. According to them, in the course design process, an instructional designer can provide instructors and students essential technological support.

This dissertation found that each instructor had different environmental, organizational, cultural, and personal factors that affected their course designs, such as university rules, department culture, student characteristics, past experiences, and teaching strategies, thus university support for synchronous online course design needs to include individual and customized support that supports course design by reflecting each instructor's own design conditions.

If a university decides to deliver existing face-to-face courses in an online course format, they must provide enough time and support for redesigning such a course.

With an increase in the interest in and need for online courses, there are many universities and departments deciding to deliver their courses online (Yamagata-Lynch, 2014). In particular, several universities have started to deliver online courses with a synchronous format (Butz et al., 2014). For example, four participants were from programs that delivered online courses within a synchronous online course format. When a university or department had decided to adopt an online course format, the instructors had been asked to convert their existing face-to-face courses to synchronous online format. Among the five synchronous online course design cases, four instructors had designed their courses based on existing face-to-face courses.

The synchronous online course format has different communication types, teaching and learning environments, and design constraints when compared to the face-to-face course format (Bower et al., 2013). Due to these differences, converting existing face-to-face courses into synchronous online ones is a complex and difficult task for most instructors. Redesigning work includes various design decisions of instructors: how to change things, what to add, and what to remove to ensure the same level of quality as existing courses. They need to think of the

appropriateness of existing course elements and strategies in synchronous online courses and redesign learning activities as well as teaching materials by considering the characteristics of synchronous online courses. This work requires more time and support in course design. In addition, synchronous course design itself has more design tasks in comparison to other course formats (Anderson et al., 2006; Chen et al., 2015; Piskurich, 2004). A university should understand that synchronous course design needs more preparation than face-to-face course design and provide enough time for instructors.

Directions for Future Research

Based on findings and experiences from this dissertation, I propose directions for future research in synchronous online course design. First, more design cases need to be shared. Design cases are the way of disseminating design precedent (Boling, 2010; Howard, 2011). Design precedent in the form of design cases is a representation of the knowledge from past design that can be reused in new or similar situations (Flemming & Aygen, 2001). This precedent is a critical component of learning and practicing design because it provides an understanding of a design situation and facilitates the creation of new solutions (Boling, 2010; Boiling & Gray, 2017; Lawson & Dorst, 2009). This dissertation regards the design case of synchronous online course as an authentic design recourse for synchronous online courses. In synchronous course design instructors can understand design situations by reading design cases and gain insights from design precedents of others in their own course design by choosing to make a similar design decision, avoid the decision, or choosing to take alternative design decisions. Even with this usefulness of stories about design challenges of others, it is hard to find design cases in synchronous online courses. More design cases need to be shared. Ultimately, each instructor

who has experience with teaching synchronous online courses needs to share their design stories with other instructors. They can contribute to the development of design resources for synchronous online courses by sharing their design stories.

Second, scholars need to address how synchronous online course instructors first design their synchronous courses. Participants of this study had each had at least five years of teaching experience in synchronous online courses. Reflecting on these experiences, they typically shared their most recent experiences with synchronous online course design and how it had reached a stable, productive stage. I investigated the instructors' design cases, as each was already familiar with teaching synchronous online courses. I believe that with designing synchronous online courses there were noticeable differences between first-time instructors and experienced instructors. To support instructors who will teach synchronous online courses for the first time, scholars need to recruit experienced synchronous online course instructors who can share their first-time design experiences.

Third, researchers need to conduct a study that can identify more design constraints in synchronous online courses. Researchers have emphasized the importance of identifying constraints in design (Gross, 1986; Jonassen, 2008; Silber, 2007). Instructors who will teach synchronous online courses can guess the possible design constraints in their course design by checking identified design constraints and develop design strategies to address those constraints. Thus, understanding possible design constraints in design situations is an important and meaningful form of preparation in regard to synchronous course design. This dissertation investigated design constraints from five instructors' design experiences. However, design constraints of synchronous courses have not yet been identified and are typically fluid or different in each design situation. To identify design constraints to as detailed an extent as

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possible, researchers need to identify design constraints from more varied design cases. Those studies will contribute to developing a resource pool of design constraints.

And finally, further studies need to investigate synchronous online course design process and focus on specific design tasks. This dissertation investigated the overall design process of synchronous online courses and did not focus on specific design tasks. This approach allowed me to understand the overall design process and identify general design issues in synchronous online courses. This study cannot provide specific design strategies to design constraints in each specific design task because it did not investigate a specific design task in depth. Through this study, though, I found that synchronous online courses have their own design tasks: designing group activities by using break-out rooms, designing asynchronous discussions, addressing technological barriers, developing technological skills, adapting new teaching tools, and developing students' understanding of synchronous online courses. Each design task included various design challenges. Researchers need to investigate each design task in synchronous online courses more deeply, and those studies can contribute to developing design strategies for specific design tasks of synchronous online courses. All these suggested studies will support instructors' synchronous online course design by serving as authentic design resources.

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APPENDIX

Appendix A. Interview Protocol

Title: Understanding Instructors' Synchronous Online Course Design Activity

Research Purpose

- The purpose of this study is to understand synchronous course design activities in order to support instructor's effort to develop their own synchronous courses.

Research Question

- How do instructors design synchronous online courses?

Before Interview

- Tell an interviewee that I will record Zoom session and recorded data will remain confidential, and pseudonyms will be used for yourself, your course, your department and university

- Mention I target 60 minutes

- Thank you for your participation in this process.

Interview Questions

Personal perspective and understanding on synchronous online course

- How long have you been teaching a synchronous online course?

- Do you have experience regarding synchronous communication such as skype, chatting, video-chatting, etc. If so could you tell me your experience with it; what you found easy/difficult when experiencing the synchronous communication?
  If no experience, have you heard of any of the aforementioned methods? Which would you be interested in trying?

- How do you define a successful synchronous course? Do you have a particular standard in mind when designing your course? If so what is this standard and how do

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you wish to emulate it? If not, do you think your course could have the potential to become someone else's standard? What aspects of your course do you think others would want to emulate?

- Do you think there is much difference between asynchronous courses and synchronous courses? Which do you find to be more beneficial? Preference of one over the other?

- In your opinion, what is the difference between face-to-face courses and synchronous courses? Do you find any particular benefits that lead to a preference over one to the other?

- Is there anything would like to know more about regarding synchronous courses?

Design Process

- Can you describe your synchronous online course design process?

- What do you find to be the most important aspect with relation to designing your course?

- When thinking about your course design, is there any person or special considerations that affect your course design? Examples are taking into consideration the students and their abilities to make the course more accessible or if you have an assistant and how their involvement affects the course.

- If needed, is there a source for help when you are designing a course. If so, what is it and how do you implement its use and why did you choose that particular source. I not, what sources of help would you like to be available in order to make the design process easier?

- What experiences that you have that may affect your course development decisions— for example positive or negative experiences that one would like to include in their course or skip out on all together.

- How does the university/department (any group you are involved in)'s culture affect your decisions regarding course design?

- Are there any other rules/stipulations you must consider when designing your course? These can include budget, course size, contents, etc.

- What do you find difficult when you design your synchronous course?

- What constraints do you find when you design your course? These constraints can include unfamiliarity of synchronous tools, distractions, or any hindrances during the design process.

- Can you tell me about any unforeseen obstacles or aspects of the design that needed revisions that you only found out about after decisions were made?

- On a personal note, how would you value your course design? There is no right or wrong answer, but do you feel satisfied with the overall design of the course? Is there anything you would have done differently knowing what you do now?

Appendix B. Informed Consent Statement

INFORMED CONSENT STATEMENT
Understanding Instructors' Synchronous Online Course Design Activity

INTRODUCTION
The purpose of this qualitative research study is to understand how instructors design synchronous online courses. The researcher is asking that you participate in this research study as instructors who design synchronous online courses in two ways: 1) by submitting your synchronous online course materials such as syllabuses and handouts for learning activity through the provided Qualtrics survey, and 2) by consenting to a 1.5-hours follow-up interview that will be recorded and transcribed about your course design process.

Recently research has identified various benefits of synchronous online learning such as enhancing a sense of connectivity and promoting interaction, have recently captured the attention of many educators. However, there has not been much discussions among educational researchers about how higher education instructors engage in the design of synchronous online courses. This study will examine that very issue, and will provide concrete examples of how instructors design synchronous online courses.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY
You have been selected to participate in this study because you are teaching a synchronous online course.

If you elect to participate in this study by completing the demographic survey and document submission, your responses and documents will be collected and analyzed. The survey will take approximately 5-7 minutes of your time. You will be also asked for a 1.5-hours follow-up interview that will discuss your course design process. In the interview, the researcher will ask your synchronous course design process with in-depth explanations of design environments, design decisions, design challenges, and reflection on design processes. The interview will be conducted through Zoom web-conferencing tool and recorded.
This study will use only audio data of this recording as a study data. Audio file will also be transcribed.

RISKS
Breach of confidentiality is a possible potential risk that may result from this study due to the small (n=6) number of participants who will be interviewed. Pseudonyms will be created for all participants and their real names, departments, course titles, and universities will not be identified. If at any time during this process you decide to stop the survey or the interview, all data collected will be destroyed.

BENEFITS

There are no direct benefits to your participation in this study. Although you may not directly benefit from the results of this study, it may help answer questions about how instructors design their synchronous courses.

CONFIDENTIALITY

The information in the study records will be kept confidential. Any digital copies of collected data will be kept on a password-protected computer for three years; all identifying information will be removed and pseudonyms used in the dissertation. All paper copies of informed consent documents will be kept in a locked office of the PI's faculty advisor. Data are only accessible by the researcher, Jaewoo Do, and his supervising research professor, Dr. Lisa Yamagata-Lynch.

CONTACT INFORMATION

If you have questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact the researcher, Jaewoo Do, at jdo3@vols.utk.edu, and (865) 455-6608, or his advisor, Dr. Lisa Yamagata-Lynch, at lisayl@utk.edu and (865) 974-7712. If you have questions about your rights as a participant, you may contact the University of Tennessee IRB Compliance Officer at utkirb@utk.edu or (865) 974-7697.

PARTICIPATION

You must be 18 years or older to participate in this study. Your participation in the study is entirely voluntary; you may decline to participate without penalty. You will not be penalized if you request that your information not be used for the study or interview. If you withdraw from the study before data collection is completed your data will be destroyed.

CONSENT

I have read the above information. I have received (or had the opportunity to print) a copy of this form. My signature below indicate my agreement to participate in this study.

Participant signature   Date

Appendix C. Activity System Analysis Results

Through activity systems analysis, I identified the subjects, tools, objects, rules, communities, and divisions of labor in each synchronous course design. According to the definition of each activity component, I checked the coding results and re-classified each again. And I matched specific components with design constraints which had been identified through the constant comparative analysis. And then, I identified tensions which are created by the interaction of different components. I identified the relationships between the components and how those relationships created tensions. This section is an example of activity system analysis results that include activity components and its specific items, activity system model, and identified tensions.

Example of Activity System Analyses Result: Chloe's Design Activity

Activity Components and Its Specific Items

Table 10 shows the result of activity system analysis about Chloe's synchronous course design activity. I identified the subjects, tools, objects, rules, communities, and divisions of labor in her synchronous course design activity.

Table 10. Chloe's Synchronous Course Design Activity

Component	Specific Items
Subject: Chloe	- A full-time staff employee of the course support team - An adjunct assistant professor in the instructional technology program - Teaching philosophies: authentic learning, collaborative learning - Design principles: sharing expert's experiences, promoting interactions, providing both group project and individual project - Various LMSs and video conferencing tools experiences 6 years teaching experiences in synchronous courses - Personal preference: tool, tool functions and teaching place
Object	Designing a synchronous online course that - Provides authentic learning experience; - Provides chances to interact with an instructor who is an expert in their field; - Increases interactions between students; and - Achieve course objectives.
Tool	- LMS: Canvas, Video conferencing tool: Zoom - Tool change: tool difference - Other course tools: PPT, Storyline - Limited resign resources for synchronous course design - Textbook: a main teaching material - A syllabus
Rules	- Anywhere, same time - Using tools that are provided by her university - Communicating and interacting through technology in real-time - Increasing accessibility of course materials - Course date: Thursday (two holidays) - Having a stable internet connection and preventing technical issues
Community	- Students: full-time employees, different background knowledge levels, different locations, online learners - Team (she belongs): focusing on accessibility of course materials - University and Course support team: supportive
Division of Labor	- Course Support team: providing tech support, one-on-one consultation, recourses for using tools, face-to-face training related to use tools - University: deciding tool change and choosing tools - Program coordinator: deciding a date of synchronous online course
Outcome	A synchronous online course: "Instructional System Design" course

Activity System Model

Figure 29 shows activity system model of Chole's design activity. Based on activity system analysis result, I drew the activity system model of her synchronous course design activity, and identified three design tensions in her design activity.
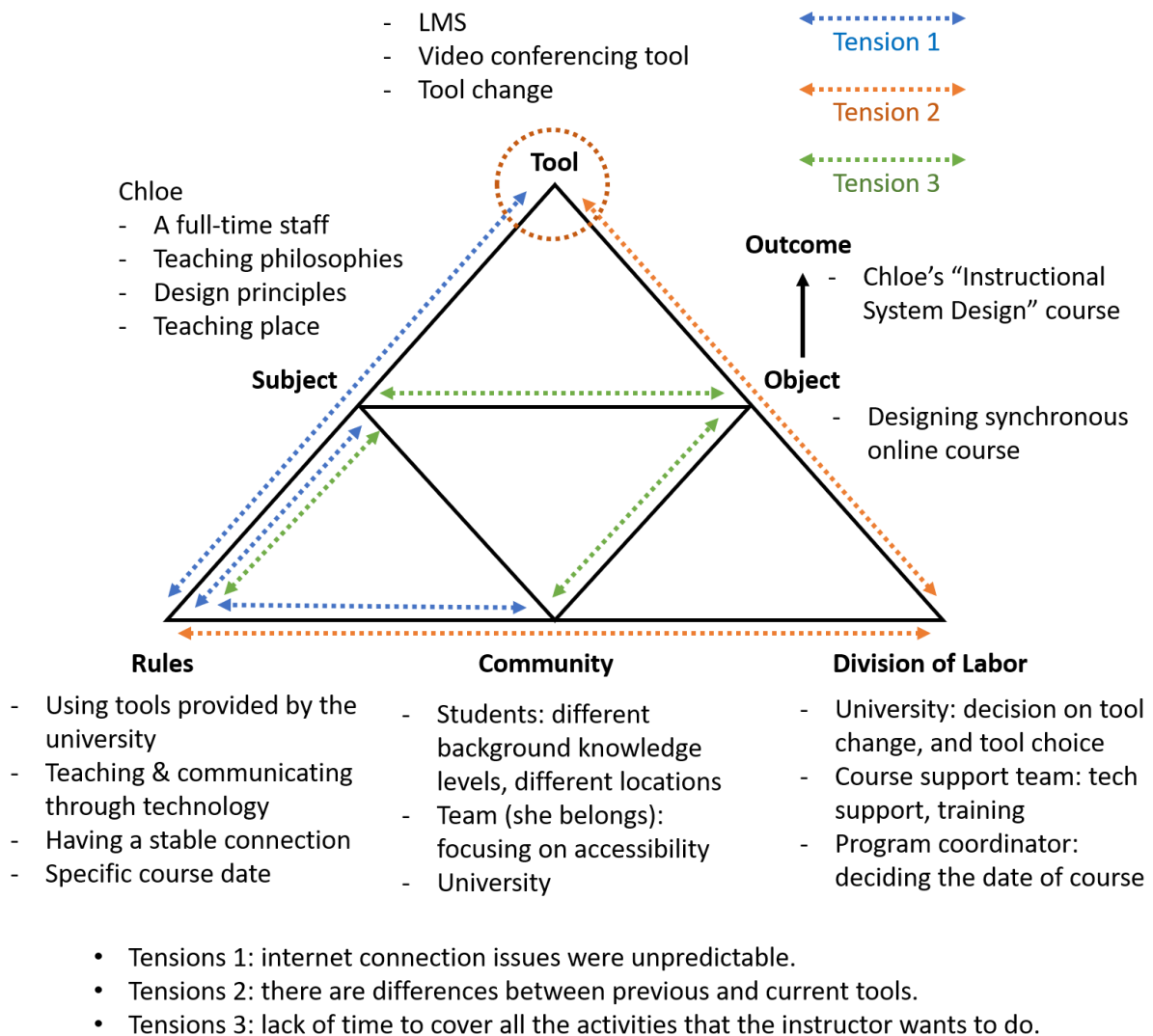

- Tensions 1: internet connection issues were unpredictable.
- Tensions 2: there are differences between previous and current tools.
- Tensions 3: lack of time to cover all the activities that the instructor wants to do.

Figure 29. Activity System Model of Chloe's Design Activity

Tensions

Tensions 1: internet connection issues were unpredictable. Chloe experienced losing

her internet connection by teaching at home **(Subject: preference-teaching place)** and was

unable to access her synchronous classroom **(Rule: having a stable connection, teaching**

through technology). And it made impossible for her to manage her course because in Zoom

only instructors can use moderator functions such as recording class and creating breakout rooms

(Tool: video conferencing tool). In addition, Chloe also had students who had connection issues

because that students were in the U.S. Air Force **(Community: students-different location)**.

Chloe realized that the connection issue was out of her control.

Tensions 2: there are differences between previous and current tools. Chloe's

university switched its LMS from Blackboard to Canvas and its video conferencing tool from

Blackboard Collaborate to Zoom **(Division of Labor: university-tool change, Rule: using tools**

provided by the university). The tools had broadly similar functions, but Chloe had issues with

certain functions due to key differences between them **(Tool: tools difference)**. In relation to the

LMS change, she said that the transition from Blackboard to Canvas was not as smooth as she

thought it was going to be despite her previous experience with Canvas **(Tool: tool difference-**

LMS). She also did not like that there were differences between the instructor's view and the

students' view of the course on the LMS.

Chloe also experienced difficulties when transitioning from one video conference tool to

another. Chloe tried to use the same teaching strategies that depended on specific functions of

her previous video conferencing tool, but the new tool just did not work as well. She also had

thought that her students could see what she was seeing until one student shared their screen with

her and she found out that they did not have access to the function she was explaining **(Tool:**

tool difference-video conferencing tool). Even though there are similar functions, the instructor had trouble applying those functions due to the tool differences.

        Tensions 3: lack of time to cover all the activities that the instructor wants to do.
Chloe felt a lack of time to cover all the course activities that she wanted to deliver to achieve the course objectives **(Object)**. Chloe had designed various course elements, such as lectures, group projects, and individual projects, to help students achieve the course objectives **(Subject: teaching philosophies)** but felt that it was difficult to include all these activities in her three-hour synchronous course.

        About a certain course element, she had specific reasons to include it. First, she wanted to have more time to share with her students her field experience. Chloe believed that the most attractive benefits of synchronous online courses is to get a chance to interact with an instructor who is an expert in their field **(Subject: design principle)**. She tried to design a course that provided this benefit to her students.

        Second, Chloe felt it was necessary to lecture due to her students' diverse background knowledge and levels. She said that she had students with varying background knowledge on the topics because they had worked in different areas **(Community: students- different background knowledge levels)**. Due to these differences, there were students who were already familiar with specific course topics and other students who had little knowledge in that regard. Thus, Chloe needed to find a way to deliver the basic contents of specific topics to students who were not familiar enough with them **(Object)**.

        Third, she wanted to include an individual project as well as a group project in her course. Chloe thought that in synchronous online courses there was the possibility that students misunderstood or did not understand important course topics. She thought that it was hard to

have one-on-one interactions with individual students. Thus, she tried to include the individual project as a course element to create more opportunities to interact with each student and provide a better understanding of course contents and activities. **(Subject: design principle)**

In addition, Chloe had another issue that made her feel a lack of time. In the semester, she taught her course on Thursday nights. However, Thursdays in that semester were frequently days off for events and holidays like Thanksgiving **(Rule: specific course date)**. She had originally designed her course based on a fifteen-week schedule, but due to missing classes on two Thursdays, she had trouble accommodating all the topics.

VITA

Jaewoo Do was born in Seoungju, South Korea, to parents Suk-Hwan Do and Sung-Ja Lee. He grew up in Seoungju and graduated from Gimcheon High School in February 2003. He attended Andong National University in Andong, where he received a Bachelor of Science degree in Educational Technology in February 2009 and Master of Science degree in Educational Technology in February 2011. He began working as a freelance instructional designer in 2007. He has designed online courses, training programs, and education systems for companies, universities, and Korean government institutions.

He started his Ph.D. in 2012 at the University of Tennessee. Continuing into a Ph.D in Educational Psychology and Counseling, he earned a master's degree in Instructional Technology and worked as both a research and teaching assistant at the University of Tennessee. During his studies, his research interests included online course design, synchronous online courses, design thinking, and qualitative research. Beginning in the fall, 2018, he will be a faculty member of education in Mongolian National University.