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Exploration and Description of Nature and Significance of Course Participants' Interactions in a Multi-Site Distance Learning Course with Implications for Design in Distance Education

A dissertation submitted in partial satisfaction of the

requirements for the degree of Doctor of Philosophy

in Education

by

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DEDICATION

I dedicate this work to my parents

Norik and Maral

and to my brother

Goris

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This dissertation would not have been possible without the continuous help of many people who throughout the years have provided guidance for my educational pursuits and have supported my academic endeavors. I feel immensely fortunate to have had the mentors and teachers that I've had and for the gift of education that I have received here in America. Here I acknowledge my gratitude toward select significant individuals who have played a key role in my academic career.

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Instruction and Instructional Design in Distance Education
Impact of MOOCs on Higher Education
Teaching Technologies
Organizational and Leadership Theory
Teaching and Learning Disabilities
Teaching and Emotion
Communication Studies and Speech
Teaching Culture through Second language Acquisition

ABSTRACT

Title: Exploration and Description of Nature and Significance of Course Participants' Interactions in a Multi-Site Distance Learning Course with Implications for Design in Distance Education (DE)

By

Kanakara Petrosian

This study sought to explore and describe the nature and significance of course participants' interactions in a multi-site engineering DE course where learners in actual classrooms engaged in interactive and collaborative learning across different countries (USA, China, and Taiwan). The objective of this exploration, carried out via a qualitative case study methodology, was to first investigate what is actually occurring in a distance learning course that utilized advanced synchronous technologies, in order to then provide insights concerning possibilities for instructional design in DE. To this end, I conducted classroom observations, artifact analysis, surveys, and interviews to examine in-depth the nature of course participants' (i.e., the instructors and the learners) live interactions across the different geographical sites. From this in-depth exploration I then discuss possibilities for design in DE.

Classroom observations and artifact analysis revealed that live synchronous sessions were not used for delivery of content but were utilized as an instructional space for discussions and guided activities. To enable productive discussions during the live synchronous sessions, an inverted approach to learning was used where learners learned the

course material on their own and engaged in group discussions with peers prior to the scheduled live sessions. During live sessions instructors guided learners' learning by engaging the learners in discussions and by examining their understanding of course concepts. During these live sessions different opportunities were provided for learners to interact with their peers and by sharing their perspectives and insights co-construct disciplinary knowledge and contextual understanding of course concepts. Survey and interview reports further validated observations and revealed that purposeful interaction with peers contributed to more learning. Learners also found instructors' guidance during live sessions helpful and reported learning more from those peers who contributed to discussions. Notably, given the global nature of the multi-site course, most learners reported having learned more from their own classmates as opposed to remote learners. Face-to-face interaction with their own classmates was noted to be the significant factor that increased opportunities for interaction and thus contributed to more learning. However, most learners found interacting and doing projects with remote learners a great learning experience that expanded their knowledge.

Drawing on this study's findings and current research and trends in education, I discuss possible future changes in the nature and scope of instruction both in DE and higher education in general. I note that all learning will become a form of distance learning with a content delivery that heavily relies on instruction through video. I also elaborate on the idea of "connected classrooms," where distance learning with actual remote classrooms may become a common instructional design.

Keywords Distance Education – Interaction – Instructional Design – Distance Learning – Interactive and Collaborative Learning – Multi-site classrooms – Flipped or Inverted Learning – Global Learning – Connected Classrooms

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CHAPTER ONE

PROBLEM STATEMENT

Research in DE has emphasized the importance of interaction among course participants (i.e., instructors and learners) for effectiveness in DE and learning outcomes (e.g., Bernard et al., 2004). For this research project, I examined a multi-site engineering DE course within a DE program in which interaction among course participants was emphasized for the intended learning outcomes of the course. In this multi-site engineering DE course, learners within actual classrooms across different universities located in different countries (USA, China, and Taiwan), participated live via internet technologies in the same course with the same instructors and engaged in collaborative learning with classmates across the different campuses. I conducted a qualitative case study and employed various methods, such as classroom observations, artifact analysis, surveys, and interviews. For my study, I first examined the nature of course participants' interactions in order to explore course design and instructors' intentions for learning outcomes. Then, I examined the significance of the live synchronous interactions in order to explore new possibilities for instructional design and practice in DE.

While a growing number of educators and educational institutions are experimenting with new ways of teaching and learning (i.e., instruction) and course design in distance education (DE), there are few qualitative research studies that examine the nature and significance of course participants' interactions in DE environments in order to investigate and describe what is actually occurring in new DE environments to then inform instructional design and practice in DE.

Background

Although DE was noted as being one of the more innovative approaches to teaching prior to the turn of the twenty-first century (Faibisoff & Willis, 1987), DE itself is not a new phenomenon and has been practiced for over 150 years (Simonson, Schlosser, & Orellana, 2011; Williams, Nicholas, & Gunter, 2005). From its inception, DE has been closely intertwined with the available technologies of the time. In fact, DE emerged because of the existence of specific technologies that made education across geographical distances possible. The corollary of this link with the existing technologies has been the dynamic development of DE with the corresponding development of various technologies. Scholars have delineated the different phases of DE's development over the past century (e.g., Bernard et al., 2004; Simonson et al., 2011), which clearly illustrates its link to developments in technology. DE has now become an integral form of education in different kinds of higher education institutions. New approaches to teaching and learning in various DE programs are being tested, such as Massive Open Online Courses (MOOCs) (Gerber, 2014; Young, 2013), which in turn can greatly impact the educational system in general.

Interaction in DE

Researchers have specified that it is through human interaction within the social context of the classroom that teaching and learning occur (Reveles, Kelly, & Durán, 2007). Research has pointed out the importance of interaction for learning in different kinds of educational environments. For example, interaction has been considered to have a vital role in contributing to successful technology-mediated education in blended learning (Prokofieva, 2013), and the importance of interaction and communication among learners and instructors has been emphasized in DE consistently across various DE literature (e.g., Bernard et al., 2004; Moridani 2007; Park & Bonk, 2007b; Simonson et al., 2011; Tallent-Runnels et al.,

2006; Uzuner, 2009; Wanstreet, 2006; Zhao, Lei, Lai, & Tan 2005).

While research has pointed out the challenges of engaging DE learners in interaction (e.g., Fox, McDonough, McConatha, & Marlow, 2011; Moradini, 2007; Stewart, Harlow, & DeBacco, 2011; Teng, Chen, Kinshuk, & Leo, 2012), there are few studies that describe the nature of interactions in DE in order to show the significance of these interactions and their contribution to the intended learning outcomes of the course. Most studies that have looked at interaction in DE, have employed either surveys or interviews as methodologies to investigate either the different types of interaction in DE (e.g., learner-learner, learner-instructor, learner-content, and learner-interface), the benefits and challenges of interaction in DE environments, or learners' perceptions concerning interaction in DE (e.g., Blankson & Kyei-Blankson, 2008; Falloon, 2011; Martin, Parker, & Deale, 2012; Mattheos, Nattestad, Schittek, & Attstrom, 2001; McBrien, Jones, & Cheng, 2009; Park & Bonk 2007a; Park & Bonk 2007b; Pukkaew, 2013; Yamada, 2008). Moreover, while a growing number of institutions are incorporating synchronous technologies in their distance or online learning environments, especially because they enable instant feedback (Mattheos et al., 2001; Hrastinski et al., 2010) and enhance participation and interaction (Falloon, 2011; Fujioka-Ito, 2013; Yang & Liu, 2007), research on the effectiveness of these learning environments is limited (McBrien et al., 2009; Park & Bonk, 2007b; Pukkaew, 2013). Researchers have also observed that most educators are not familiar with how to hold online synchronous class sessions (Teng et al., 2012), because of the novelty of these environments. Consequently, there are few studies that have explored the nature and significance of course participants' interactions during live synchronous sessions, especially in regards to course design. This exploration can inform instructional practice and reveal new directions for course design in DE, which this present study intended to do.

Defining DE

In this study the following working definition of DE, which is a widely accepted definition in the existing literature in the field of DE (e.g., Bernard et al., 2004; Bryant, Kahle, & Schafer, 2005; Lou, Bernard, & Abrami, 2006), was utilized. This definition provided a general description of what is considered to be a DE course in literature.

- A quasi-permanent or semi-permanent separation (place and/or time) of instructor(s) and learners throughout the length of the learning event.
- The provision of two-way communication and media that facilitates dialogue and interaction both between instructor(s) and learners and among learners.
- Presence of an educational organization's influence on preparation and planning of the learning material and learner support services, and recognition of course completion by the organization.

In addition, for this study any kind of online learning that met the above criteria was considered a form of DE. By online learning I refer to learning that takes place either entirely or partially over the internet (U.S. Department of Education, 2010).

Research Project

Hausera (2013) has observed that research in DE has progressed beyond investigating whether something works to studying why and how something works in a given environment. Qualitative studies that examine in-depth what is occurring in DE programs can shed light on how these programs function and what new ways of teaching and learning are possible in DE. The purpose of this study was to first examine the nature and significance of course participants' interactions in a multi-site DE course, where learners across different geographical cites learned together in real time via synchronous internet

technologies, in order to then explore new opportunities for instructional design in DE. A case study methodology was employed for the purposes of carrying out this investigation. To this end, a strategic research site (Bazerman, 2008), i.e., the case, was chosen where course participants' live interactions in a DE course could be examined. Bazerman (2008) defines a strategic research site as a place that may offer a robust example of the phenomenon a researcher is interested to investigate.

Research has emphasized the importance of the following factors in DE: (a) interaction and communication among learners and with the instructor(s) (Bernard et al., 2004; Simonson et al., 2011; Tallent-Runnels et al., 2006; Uzuner, 2009; Wanstreet, 2006; Zhao et al., 2005), (b) course design, that is what the instructor(s) and learners do (Bernard et al., 2004; Simonson et al., 2011; Tallent-Runnels et al., 2006), (c) incorporation of problem-based or project-based learning that fosters collaboration (Bernard et al., 2004; Lou et al., 2006; Simonson et al., 2011; U.S. Department of Education, 2010), (d) inclusion of a face-to-face component in DE (Lou et al., 2006; U.S. Department of Education, 2010; Zhao et al., 2005), and (e) the role of instructors in terms of facilitating interaction (Lou et al., 2006; Tallent-Runnels et al., 2006; U.S. Department of Education, 2010; Uzuner, 2009; Zhao et al., 2005). Given these research findings, a multi-site DE course was selected where the abovementioned elements could be observed.

Implications for Design in DE and Higher Education

The exploration of the nature and significance of course participants' interactions in the multi-site engineering DE course investigated in this present study revealed instructors' intentions for learning outcomes and course design. I outline the main design features of the engineering course and discuss their nature and utility for obtaining instructional objectives. Based upon this present study's research conclusions, I present implications for design in

both DE and higher education in general. Given existing advanced internet technologies and current trends in education, I argue that "traditional" or "regular" learning or classrooms will take a more defined form of DE and in fact will become DE. The incorporation of advanced internet technologies into every aspect of our lives is directing the move from regular classrooms to a learning environment that has a virtual space, where a significant portion of course participants' interactions will occur there. I then argue that if regular classroom learning becomes a form of DE, then it can also become global learning that is situated locally. This way, not only the advantages of face-to face interaction is not lost but opportunities for learning are increased, due to interaction and learning with more diverse peers who have different academic and cultural backgrounds.

Research Questions

For the purposes of this study I examined the following research questions:

1. How does the nature of interactions among course participants reflect the course design and instructors' intentions for learning outcomes?
2. What are the significance of course participants' interactions during live synchronous sessions that influence learning?

CHAPTER TWO

REVIEW OF SELECT LITERATURE

In this chapter I reviewed literature and empirical studies that provided a theoretical and conceptual base for the exploration of the nature and the significance of course participants' interactions in the multi-site engineering DE course investigated in this present study. Based upon the reviewed literature I constructed criteria for identifying interaction events which I present in the following chapter.

Literature Review Methodology

This literature review includes major literature reviews and meta-analysis in DE that illuminated the nature of course participants' interactions, as well as empirical studies that investigated issues concerning interaction in DE. For the purposes of this review, the year 2000 was chosen as a cut-off line, with few exceptions that provided theoretical or conceptual background (e.g., Johnson, 1981; Moore, 1993; Sutton, 1996; Vygotsky, 1978). Literature reviews and meta-analysis that did not provide a description for the methodology employed for the review were excluded. That is, reviews without a description of the inclusion and exclusion criteria for the selection of research studies were discarded, with the exception of one study (Simonson et al., 2011) which was itself a review of reviews. For the empirical studies, studies that investigated interaction in DE in multi-site courses were selected. That is the course investigated in the empirical studies had to have learners in distributed sites. The distributed sites could have been either classrooms or individuals.

The literature reviews were selected by searching the publically available peer-reviewed literature. First, the following databases were searched for published, peer-reviewed articles: EBSCO, Education Full Text, ProQuest, and Google Scholar. In addition to searching these databases, the following recognized online journals in the field of distance

education were also reviewed: *Distance Education, Distance Learning, Computers & Education,* the *American Journal of Distance Education,* the *Journal of Distance Education,* and the *International Review of Research in Open and Distance Learning.* The searches were made by using the following keywords, both individually and in various combinations: *distance learning, online learning, distance education, synchronous, distributed environments, virtual, and interaction.*

The Value of Interaction in Learning

In this section I first present literature that shows the value of interaction in learning, which provides basis for examining the significance of course participants' interactions in the present study. The importance of interaction in learning has been uniformly stressed by different educators and scholars mainly for its instrumental effects. For example, Laurillard (2000) has underscored the importance of interaction by explaining that while access to information constitutes one aspect of knowledge acquisition and building, it does not always translate into the effective learning that is accompanied by understanding. Laurillard has pointed out that learning for understanding requires active engagement with subject content and interaction with other learners in order to shape the gradual progress of learners' personal understanding.

The importance of interaction in learning has also been investigated from a psychological and developmental perspective. Vygotsky, for example, explained that learning occurred in the social interaction between humans and not in the isolated individual (DeVane & Squire, 2012). For Vygotsky, specifically it was through interaction with a more knowledgeable other that an individual received guidance and advanced in learning. The notion of *zone of proximal development* (ZPD) was one of the significant concepts in Vygotsky's work defined as "the distance between the actual developmental level as

determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). From this perspective, learning in effect creates the ZPD. That is, in interacting with the environment and cooperating with peers, learners' internal developmental processes are activated, and when internalized, solidify and transform into an actual developmental achievement or capability. From this line of work, closely associated with the concept of ZPD is the concept of *scaffolding*, defined as "the support given to assist learners as they engage in a task" (Hill, 2012, p. 272). Through the process of scaffolding, learners gradually become more competent in a given task and work more independently (Hill, 2012). Therefore, from this perspective interaction is important for the learning process, because it actually results in mental development and contributes to a deeper understanding.

The above mentioned conceptualizations, that emphasize the value of interaction in learning, demonstrate the view of social construction of knowledge (social constructivist) or constructivism. Oliver et al. (2006) have argued that within e-learning constructivism is the most widely recognized social position. While within constructivism there are a cluster of related positions, each with their distinct view of learning, for the purposes of this study I followed the constructivism view that emphasizes the importance of social interaction exemplified by theorists such as Vygotsky. According to this view, the learning process is influenced by interactions with others (Hill, 2012). That is, learning for both individuals and groups occurs through dialogue and in the process of collaborative activities (Oliver et al., 2006). To be exact, an individual, through interaction with peers or other knowledgeable persons, transforms old knowledge into new or constructs new knowledge, and thereby gains understanding (King, 1990). In social constructivism, the interdependence of the individual

learner and the context of learning are emphasized (Hill, 2012).

In addition and particularly within the context of DE, Moore (1993) provided an apropos rational for the significance of interaction in distance learning. Moore observed that in DE environments the separation of learners and instructors by space and/or by time impacts both teaching and learning, because the distance creates a psychological and a communications space between the separated parties. From this perspective, distance is conceptualized as a pedagogical concept, not limited to geographical separation. Given these clarifications, Moore asserted that dialogue played an important role in expanding or reducing the "sense of distance" in DE. Moore noted that the concepts of dialogue and interaction are very similar. However, he used the term 'dialogue' to describe an interaction or a series of interactions that were purposeful, constructive, and valued by the participants. To this end, Moore suggested that by increasing dialogue, i.e., meaningful interaction, in DE environments, the sense of distance experienced by learners could be significantly reduced.

In summary, interaction is vital in teaching and learning because disciplinary knowledge is communicated, constructed, and assessed through language (Reveles et al., 2007), i.e., discourse processes. Notably, knowledge construction and learning accompanied by understanding occurs through interactive discourse processes (Laurillard, 2000) that engage learners in joint activities such as exploring, sense making, and persuading, as opposed to mere transmission of information (Sutton, 1996).

Taxonomies of Interaction and Different Types of Interaction in DE

The term interaction has been defined conceptually and operationally in various ways in DE literature. While there exist a variety of definitions of interaction, for the present study the following well accepted definition of interaction, presented by Wagner (1994), applicable to all educational environments, will serve as a primary and grounding definition: "reciprocal

events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another" (as Cited in Anderson, 2008, p. 43). This definition's abstract conveyance of the concept of interaction simultaneously encompasses learners' engagement with other learners, instructors, subject content, and technology (Prokofieva, 2013). Anderson (2003a) has observed that this definition also captures the important components of reciprocity and multiple actors, without restricting its meaning and application concerning a variety of potential types of interactions; for example, mediated synchronous and asynchronous discussions and dialogues, and feedback and responses from inanimate devices and objects such as interactive computer programs.

Following Wanstreet's (2006) framework, for the purposes of this review I first discuss the prominent taxonomies of educational interaction, specifically in DE. To this category belong the following forms: (a) interactions as instructional exchanges in form of learner-instructor, learner-learner, learner-content, and learner-interface; and (b) interactions as computer mediated communication supported by synchronous and asynchronous technologies (Wanstreet, 2006). These interactions illustrate the form of the interaction per se, in terms of the medium[1] of interaction. Then, I discuss the different types of interaction in terms of learners' learning style. From this category, the following styles of learning are emphasized in literature: (a) individualistic; (b) collaborative/cooperative[2]; and (c) competitive (e.g., Johnson, 1981; Wanstreet, 2006). However, in the present study attention

[1] The term medium instead of actor is used, because it is more encompassing and includes computer mediated interactions as well. See, for example, Prokofieva (2013) for using the term actor with reference to the entities involved in instructional exchange interactions.

[2] The term cooperative is used in conjunction with collaborative here, because in some of the literature these terms are not distinguished, and are used interchangeably or in isolation, often without any provision of a definition. For the purposes of this study however, first an encompassing generic definition is given that shows the essence of this type of group learning style. Then, a distinction between these two terms is made. In this present study I focused on collaborative learning.

is given only to the first two styles (a & b), which are more closely applicable to DE, and correspond respectively with cognitive behaviorists and connectivism approaches to learning discussed in DE literature (e.g., Rodriguez, 2012; Yuan & Powell, 2013). I have presented this distinction for clarification, because the different learning styles can take place through any of the various mediums of interaction presented above. In addition, individualistic learning parallels closely learner-content interaction, whereas collaborative/cooperative parallels learner-learner interaction.

Interaction as an instructional exchange. Research has shown that interaction as an instructional exchange is the predominant framework used in both DE and educational technology fields (Wanstreet, 2006). According to the instructional exchange model of interaction developed by Moore (1989), learner-learner and learner-instructor interactions are reciprocal communication between the involved parties (Kuo, Walker, Belland, Schroder, & Kuo, 2014; Wanstreet, 2006), supported by asynchronous and synchronous technologies in all varieties of text, audio, and video (Anderson, 2008). The inclusion of a face-to-face component in DE (Lou et al., 2006; U.S. Department of Education, 2010; Zhao et al., 2005) and incorporation of problem-based learning that fosters collaboration (Bernard et al., 2004; Simonson et al., 2011) have been encouraged by educators, precisely for the purposes of promoting learner-learner interactions, the value of which has been stressed by constructivist theorists for exploring and developing multiple perspectives (Anderson, 2008; Lou et al., 2006). With regards to learner-instructor interactions, as mentioned earlier, the importance of the role of instructors has been emphasized in research for providing constructive feedback, guidance, and scaffolding in order to help learners construct knowledge. In addition, instructors' opinion has been noted to be especially important for encouraging learner-learner interactions (Prokofieva, 2013).

Learner-content interaction is the process in which learners intellectually interact with subject content through an internal didactic conversation (Moore, 1989). That is, learner-content interactions enable learners' personal knowledge construction (Akarasriworn & Ku, 2013). Learner-interface interaction, on the other hand, is a forth type of interaction added to Moore's original model (Martin et al., 2012), defined as a process of manipulating tools and various technologies to achieve a given task, especially in order to facilitate learners' participation in course activities and to provide learners access to instruction (Akarasriworn & Ku, 2013). For supporting learner-content and learner-interface interactions, the importance of course design, that is what instructors and learners actually do, has been emphasized in DE literature (Simonson et al., 2011; Tallent-Runnels et al., 2006), and the use of supplementary video material, computer-based instruction, and media that supports interactivity has been encouraged (Bernard et al., 2004; Lou et al., 2006).

While the importance of learner-learner and learner-instructor instructions has been emphasized uniformly in research, Anderson (2003b) has stated that with the development of advanced technologies and programming tools and environments, there is opportunity and pressure to transform learner-instructor and learner-learner interactions into enhanced forms of learner-content and learner-interface interactions. For instance, he has observed that learner-instructor interactions can be automated and transformed from based forms, such as emails and conferencing discussions, to learner-content interactions in form of instructor videos, personalized FAQs, and virtual lab. Likewise, traditional learner-learner interactions can be substituted by most forms of recorded learner-content interactions which can be displayed asynchronously.

The possibility of transforming the abovementioned interaction forms into learner-content interactions raises the issue of individual value of these various forms of interactions

for obtaining desired educational aims. However, Anderson (2003b) has developed the following equivalency theorem, implying that substitution of one form of interaction for another can occur with little loss in educational effectiveness:

> Deep and meaningful formal learning is supported as long as one of the three forms of interaction (student–teacher; student-student; student-content) is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience. (p. 4)

It can be concluded then that these different forms of interaction, while valuable on their own account, are replaceable, and the substitutions, if done effectively, can produce the same desirable educational outcomes. Anderson (2003b) further has noted that high levels of more than one of these forms of interaction will afford a more satisfying learning experience. Other researchers have likewise recommended the incorporation of various types of instructional exchange interactions for successful learning outcomes (Rodriguez & Armellini, 2015; Yun, 2005).

It is important to note here that scholars have related Moore's classification of learner-instructor, learner-learner, learner-content interactions to perceptions of teaching, social, and cognitive presences in online learning, respectively (Teng et al., 2012). To this end, Szeto (2015) has observed that the nature of a given course affects the balance of these three components. He explained that while in his reported study the teaching presence played a prominent role and facilitated and managed the social and cognitive presences, a different course, for instance, a course in education, may lend itself to a more social and/or cognitive presence. Because the present study focuses on interaction, the perspective of presence perception, being beyond the immediate scope of this study, will not be discussed any further.

In summary, interaction as an instructional exchange includes learner-instructor,

learner-learner, learner-content, and learner-interface exchanges. While the importance of learner-instructor and learner-learner exchanges has been consistently emphasized in DE, high levels of at least one of the first three exchanges can contribute to a more meaningful learning experience, and learner-instructor and learner-learner exchanges can be replaced by enhanced forms of learner-content and learner-interface exchanges.

Interaction as computer mediated communication. While traditionally the concept of interaction denoted dialogue between learners and instructors, due to advances in internet technologies, the concept has been expanded to include mediated synchronous and asynchronous discussions at distance as well (Anderson, 2003a). Zhao et al. (2005), reporting findings from a meta-analysis of 51 research studies in DE, broadly identified asynchronous interaction as computer mediated communication where there was a lag time between course participants' interaction; and synchronous interaction as computer mediated communication where there was a potential for course participants to interact at the same time.[3]

In terms of learning outcomes, Lou et al. (2006) reported the following findings from a meta-analysis of 103 quantitative studies in DE: (a) in synchronous instructor directed DE, where the same instruction was delivered simultaneously by the same instructor with the same course activities, learners at both remote and host sites achieved equally in terms of learning outcomes; (b) in independent asynchronous DE, where the media supported individualized learning, while variations existed in the findings, on average there was no

[3] Other researchers however have distinguished between synchronous and asynchronous interaction in DE by defining synchronous DE as being "group-based," and time and place dependent, where remote learners are synchronized with a live classroom connected via video or audio conferencing technologies; and asynchronous DE as being "individually-based," where remote learners work independently or in asynchronous groups, usually with the support of an instructor and through asynchronous communication mediums (Bernard et al., 2004). In the text of this research report the terms live and synchronous are used interchangeably and at times combined for clarity. Both terms refer to the real time nature of interactions.

significant difference in achievement between DE learners and regular classroom learners; (c) in asynchronous undergraduate DE, where collaborative discussions among learners occurred, on average the DE learners significantly outperformed the classroom learners, due to having the opportunity to learn reflectively and actively, and for having access to multiple sources of feedback. These findings show that both synchronous and asynchronous DE are legitimate alternatives to traditional instruction, and yield comparable learning outcomes.

The importance of instructors' role has also been emphasized for both asynchronous and synchronous learning environments, for example, in guiding and mentoring learners' learning in asynchronous discussions (Lou et al., 2006), and in promoting meaningful interactive learning experiences for learners in synchronous discussions (Ng, 2007). However, the nature of interaction and the type of support required in synchronous and asynchronous learning environments differ (Ng, 2007). In asynchronous learning environments, learners experience learning events independently (Johnson, 2006), and reportedly feel a greater sense of social disconnection (Branon, & Essex, 2001). However, asynchronous learning environments are particularly useful for encouraging thoughtful and in-depth discussions, for allowing all learners to respond to a topic, and for holding ongoing discussions especially when archiving is required (Branon, & Essex, 2001). To this end, researchers have observed that via asynchronous discussions, communication and collaboration is enhanced, and because learners are not restricted to a set time/day for their participation, they have more time to prepare responses to a set of questions or directions (Skylar, 2009).

On the other hand, synchronous learning environments are very interactive (Skylar, 2009) and afford an environment that is closer to the traditional classroom environment (Karal, Cebi, & Turgut, 2011). In computer-mediated synchronous learning environments,

various communication resources, such as electronic whiteboard, audio-video conferencing, desktop sharing, joint web browsing, and text messaging, enable learners to participate in class meetings from dispersed locations together at the same time (Teng et al., 2012). These synchronous technologies enable instant feedback and communication (Karal et al., 2011). For example, in Teng et al.'s (2012) reported study the learners used synchronous text messaging to post questions for in-depth clarification, and statements for informative and analytic opinions.

Research has shown that the receiving of immediate feedback in synchronous learning environments supports interaction among learners and thereby supports their learning (Martin et al., 2012). This is significant, because lack of live interaction with distance learners in synchronous learning environments has been shown to contribute to feelings of dis-connectivity (Stewart et al., 2011) and a lack of a sense of social presence (Park & Bonk, 2007b). To this end, researchers have pointed out the necessity of establishing a sense of social presence or feeling of connection with other learners, in the context of online learning, which significantly contributes to learners' overall satisfaction (Jolivette, 2006). For example, a study conducted by Skylar (2009), examining learners' achievement and satisfaction in different online learning environments where instruction was given either through asynchronous text-based lectures or synchronous web conferencing lectures, showed that while both types of learning environments were effective in delivering online instruction, the majority of learners reported that they would rather take an online course using a synchronous learning environment than one using asynchronous learning. Skylar noted that the findings suggested the importance of interaction on learner satisfaction in DE.

However, educators have pointed out the difficulty in moderating large-scale

conversations in synchronous learning environments, and the lack of reflection time for learners' responses (Branon, & Essex, 2001). For instance, Asterhan and Schwarz (2010), in reporting findings on moderation of small-group synchronous argumentation in blended multi-site learning environments, have pointed out that the role of instructors or moderators in synchronous discussions is of a complex nature. In their reported study, learners had various and even contradictory expectations in relation to this medium of communication. To this end, Asterhan and Schwarz reported the following learners' perceptions on effective moderation in synchronous learning environments: the moderator should be (a) "involved but not impose personal opinions"; (b) "scaffold but not interfere"; and (c) "be supportive but also elicit critical thinking and reasoning" (p. 272). In a similar vein, Teng et al. (2012) have observed that in online synchronous learning environments, learners may feel frustrated when they experience discrepancies in learning between the accustomed face-to-face environment and the online synchronous environment.

Synchronous and asynchronous learning environments have distinct advantages and disadvantages, and are used for different purposes by distance educators (Branon, & Essex, 2001). Researchers have observed that instructional practice found to be effective in asynchronous learning environments cannot simply be transferred to synchronous learning environments (Asterhan & Schwarz, 2010). This in turn calls for new approaches to teaching and learning in DE where both synchronous and asynchronous technologies are used.

In summary, interaction as computer mediated communication includes synchronous and asynchronous interaction. Unlike asynchronous interaction, synchronous interaction enables learners to interact at the same time across distances. While synchronous learning environments are more interactive, asynchronous learning environments enable in-depth discussion. Research has shown that synchronous and asynchronous DE are valid

alternatives to traditional instruction and can serve different instructional purposes.

Interaction in terms of learners' learning style. Johnson (1981) has distinguished the following types of goal interdependence among learners, which may be structured during learning activities by instructors: (a) individualistic; and (b) collaborative/cooperative. An individualistic goal structure occurs within a learning environment where individual learners' obtaining of their goal is unrelated to other learners' goal achievement. Traditionally, DE was designed to support individualistic learning (Bernard et al., 2004; Simonson et al., 2011). Lou et al. (2006) have noted that this was especially true for the early DE correspondence models, and is still true for DE applications that primarily use web-based resources. However, Lou et al. have pointed out that while the individualistic learning enables the highest degree of flexibility for anytime, anyplace, and anywhere learning, it is low in interaction.

Collaborative/cooperative goal structure occurs within a learning environment where learners' obtaining of their goal is linked to other learners' goal achievement (Johnson, 1981). Lou et al. (2006) have explained that the collaborative/cooperative learning is a recent and a more emphasized approach to learning, particularly in DE, due to both advances in internet technologies and a shift in education toward a more collaborative learning model, advocated by recent constructivist and cultural learning theorists. Lou et al. have further observed that this kind of learning contributes to greater effectiveness in learning outcomes, because it enables learners to learn from each other by challenging ideas, and creating new and multiple perspectives. In addition, it has long been noted that this group approach to learning promotes effective exchange of information and communication among learners, and results in higher achievement and productivity, greater commitment to learning, lower fear of failure, and greater acceptance and support by peers (Johnson, 1981).

As noted earlier, scholars have distinguished collaborative learning from cooperative learning. Prokofieva (2013) for instance, has explained that while in cooperative learning the group product is a collection of learners' individual results, in collaborative learning the learners construct knowledge together through group interaction. That is, whereas in cooperative learning the learning takes place individually, in collaborative learning the learning occurs socially, and the activities the learners engage in are group interactions that involve negotiation, social sharing, and creation of group meanings (Stahl, Koschmann, & Suthers, 2006). Collaboration then is a process of shared meaning construction, achieved through interaction among learners (Stahl et al., 2006).

In summary, DE supports both individualistic and collaborative/cooperative learning. How the DE environment is used depends upon the instructional objectives. However, while initially DE supported individualistic learning, advanced internet technologies have enabled collaborative/cooperative learning across distances. Given the collaborative/cooperative type of group learning contributes to deeper learning and greater learning outcomes, it has gained more significance in the past decades. The above taxonomies illustrate the different ways in which interaction is conceptualized and studied in DE, and show the various mediums through which interaction occurs in DE. This in turn served as a framework for investigating the nature and significance of interactions in the present study's DE course.

Issues Concerning Interaction in DE

Interaction in lecture based DE courses. Numerous empirical studies have reported on the importance of interaction and issues concerning the limited nature of interaction in DE. Empirical studies have shown significantly lower participation from distance learners in multi-site lecture based DE courses. For example Pukkaew's (2013) study found more engagement from learners on the regular site and less interaction from distance learners, with

the subsequent result of some distance learners preferring to learn in a regular classroom. Pukkaew reported that to reduce problems of distance and communication, a social media networking site (Facebook) was used by course participants. Still, the researcher reported that fewer questions were asked from remote site learners. In addition, Pukkaew noted that while both synchronous and asynchronous technologies were available for learners' interactions with peers, such as live chat, email, and discussion boards, they were sparingly used and were utilized more by male distance learners than by their female counterparts. In this study while live sessions were recorded and made available for learners, the researcher also recommended making learning materials in digital format available before class.

Other studies have shown that lower participation from distance learners in multi-site lecture based DE courses impacts the learning experience of distance learners (Fox et al., 2011; Moradini, 2007). For example, in Fox et al.'s (2011) study distance learners reported feelings of isolation from the instructor, who was not present at their physical site. While synchronous technologies enabled distance learners to ask the instructor questions from their campus in real time, nevertheless limited interaction was one of the issues raised by distance learners. The lectures in this study's course were recorded and were made available for both regular and distance learners. However, the results showed that watching the recorded lectures as opposed to attending class was favored by both regular and distance learners. This in turn could explain the reason for limited interaction among course participants.

In a different study conducted by Moradini (2007) limited interaction with the instructor and remote learners contributed to a negative learning experience. Moradini (2007) reported a survey study where a lecture based pharmacy course was taught to learners located on three separate campuses using synchronous videoconferencing. In one version of the course recorded lectures were provided in advance to learners who viewed the lectures

and the course material on their own and attended synchronous review sessions on scheduled lecture days. During these review sessions learners asked questions and the instructor reviewed the material covered in the recorded lectures. Concerning the method of content delivery, Moradini reported that learners preferred live interactive sessions or a mix of interactive sessions and recorded lectures. Interestingly, Moradini observed that in their study, learners did not like active learning or problem solving in any format unless supported by some kind of direct interactive session with the instructor. Again, the reported lack of interaction can be attributed to a lecture based course design where collaborative learning was not built into the design of the course.

Other research has shown that interaction among distance learners does not occur without effort from the instructor. For example Szeto (2015) examined teaching, cognitive, and social presences in a blended synchronous course with online and face-to-face learners. In this study, the instructor observed that the two groups did not always actively participate in learning activities. More time was devoted then to promote discussion between them in the blended synchronous learning environment during problem-solving exercises. Nevertheless, inter-group interactions did not occur on their own and without instructor's effort. In group discussions, knowledge exchange and sharing was much more explicit among face-to-face learners, who reported that discussions with the instructor and online learners encouraged their knowledge sharing. However, both online and face-to-face learners expressed approval on the instruction for being comprehensive and extraordinary, indicating a satisfying learning experience.

Given the lack of interaction among learners in DE courses and the importance of providing opportunities for interaction, other researchers have suggested creating meaningful interactions among course participants. For example, to explore the learning experience of

learners in an international online synchronous seminar, Teng et al. (2012) in their study conducted surveys and examined the content of learners' synchronous text messages. The online seminar was lecture based and the learners participated from the following countries: Canada, Italy, New Zealand, and Taiwan. Learners in this study reported having few interactions with the instructor and other learners and recommended having collaborative and interactive group work. Learners' responses regarding learner-learner interactions showed that they were expecting to interact with peers from other countries, and to collaborate and establish a virtual learning community, which did not occur as expected. The use of social media was also suggested by Teng et al. for connectivity and interaction outside of scheduled course sessions. Teng et al. suggested that educators can create opportunities for promoting group work and collaboration among learners which can promote meaningful interactions among course participants that can contribute to building a sense of learning community during synchronous online sessions. To this end, Teng et al. pointed out the importance of interaction for the purposes of collaborative group work, both in class and after class meetings.

In a similar vein, research has shown that creating opportunities for interaction with distance learners can in turn increase learning opportunities for all learners. For example, Stewart et al. (2011) reported a two-year ethnographic investigation on learners' experience of synchronous learning in multi-site environments in graduate level education courses. In this study distance learners were individuals who joined the course through videoconferencing technologies by way of "cultural guides" who hosted them on their individual laptops. As participant observers the researchers recorded classroom interactions and made ethnographic records and descriptive observations. They also surveyed the learners regarding their experience in the course. Stewart et al. (2011) reported that while

the instructor interacted with distance learners and engaged them in course discussions, the analysis of the video records revealed that there was no evidence of distance learners speaking directly to local learners. Because of distance learners' contributions to course discussions, local learners reported learning as much or more from distance learners. However, similar to the reports of the above studies, lack of interaction with distance learners contributed to feelings of dis-connectivity with distance learners. In addition, local learners reported not developing relationships with distance learners. While in this study learners worked on group projects, local and distance learners did not work in the same groups, which could have in turn promoted connectivity among course participants. In addition, because the collaborative projects did not take place during course synchronous sessions, the researchers did not have access to learners' interactions during their collaborations on their group projects.

Prior to this present study, I conducted a pilot study in 2012, in the same multi-site engineering DE program presented in this present study taught by the same U.S. instructor, where participants across geographical distances interacted during live synchronous course sessions. This pilot study was a qualitative study done with an ethnographic perspective in order to explore the culture of the engineering DE course. I examined the following research questions in this pilot study: (a) what the DE course meant for course participants, (b) how time was spent in this course, and (c) in what ways the engaging of learners' across the different geographical sites shaped the conditions for their learning during synchronous sessions. My findings from this pilot study were consistent with the abovementioned studies' findings in relation to meaningful interactions' impact on a sense of connectivity among course participants. The findings of my pilot study showed that advanced internet and synchronous technologies were used in this course not merely to provide content

knowledge but to engage the learners across the different sites in interactive learning with the objective of having learners learn from each other, which resulted in a sense of connectivity and community among the learners in that course. In addition, a social networking site was used for the purposes of communication and interaction among learners. My investigations in the pilot study showed that different opportunities for peer interaction were provided which were incorporated into the design of the course.

In summary, low participation or interaction in lecture based DE courses can be attributed to lack of opportunities for meaningful interaction and discussion among course participants, which consequently results in feelings of dis-connectivity in turn impacting learners' learning experience. Conversely, meaningful interaction does not occur on its own account and must be purposefully integrated into the course design and promoted by instructors.

Integrating interaction into the course design. While research has shown a strong relationship between social interaction with both learning achievement and learners' satisfaction with their learning experience, as mentioned previously, learners' active participation in interaction does not occur on its own account, but must be intentionally integrated into the course design (Jung, Choi, Lim, & Leem, 2002). Conversely, Simonson et al. (2011) have cautioned that although interaction seems intuitively important to the learning experience, it should not be added without real purpose, especially in the context of DE. Simonson et al. further noted that in DE focusing on building group interaction and collaboration may be more important than focusing on individual participation.

To this end, the importance of group interaction and collaborative work in DE has been emphasized by other researchers. For example, Tallent-Runnels et al. (2006) have observed that to help learners construct knowledge in DE, it is important to promote both

learner-instructor and learner-learner interactions, and to have instructors participate in discussions and provide scaffolding. Lou et al. (2006) have also advised for the usage of technology and pedagogy that support interaction among course participants, over technology and pedagogy that is directed towards individual interactions with subject content only. To this effect, Hart (2012) examining factors that contributed to learners' ability to remain "persistent" in online educational programs, reported that while quality of interaction and feedback was positively correlated with persistence in online learning programs, isolation and decreased engagement was negatively correlated with persistence. Hart defined persistence as "a phenomenon resulting in learner success or completion of an online course" (p. 20). In short, integrating interaction into the course design must be purposeful in order to be productive. To this end, collaborative learning has been noted to be an effective way of promoting meaningful interaction among course participants.

Interaction and collaborative learning in small groups. There exists a desire to promote specifically collaborative learning in higher education (Naismith, Lee, & Pilkington, 2011). Empirical research has shown that collaborative learning has distinct advantages especially in DE. For example, Park and Bonk (2007b) reported that complaints on dis-connectivity in a course taught with both regular and distance sites disappeared, when learners were jointly involved in task-oriented meaningful group interactions. Thus, engaging learners in collaborative works in DE has the potential to reduce the sense of distance experienced by learners. Similarly, in Mattheos et al.'s study (2001), in which learners from various European countries participated in a virtual classroom, learners reported that team work and interaction contributed to a sense of "team spirit," which was considered by most learners one of the strengths of the course. The significance of this study was that learners engaged in collaborative work during synchronous sessions and expressed a

positive attitude regarding the problem-based learning (PBL) approach in the online environment. These researchers suggested the usage of various media in distance learning to allow for communication of knowledge and skills, and collaboration among learners.

Other educators have reported that engaging learners in collaborative learning enables meaningful discussions. For example, Holliman and Scanlon (2006) reported a study in which postgraduate learners engaged in collaborative group work in a "near synchronous" conferencing. The conference was near synchronous in that learners worked in real time over the course of a single day but were not expected to be online at the same time. The learners worked in small groups to conduct analysis and produce reports of their findings. These researchers reported that learners engaged in rich interactive discussions. The researchers observed that by structuring productive activities, with the aim of promoting collaborative learning, it is possible to engage learners in discussions of complex issues at a distance from multi-site locations.

Despite these potential advantages in collaborative learning, researchers have reported that lack of interaction and participation among distance learners and perceived lack of feedback from instructors are still major hindrances to effective collaborative distance learning (Muuro, Wagacha, Kihoro, & Oboko, 2014), thus pointing out the importance of interaction in DE. Muuro et al. (2014) have noted that for more effective collaborative learning in DE, not only instructors should motivate and actively engage learners in collaborative activities, in order to increase learners' level of participation, but it is important for instructors to be motivated to actively monitor learners' collaboration and to be trained in e-pedagogies that enhance collaborative learning. In summary, collaborative learning increases opportunities for interaction among course participants. However, for effective collaborative learning instructor's guidance is crucial because it increases purposeful

interaction among learners.

Inclusion of a face-to-face component. While researchers have consistently recommended the provision of opportunities for interaction and communication among course participants for effectiveness in DE (Bernard et al., 2004), Zhao et al. (2005) in addition have specified the inclusion of a face-to-face component in DE, especially with the availability of various synchronous technologies. In terms of effectiveness, research has shown that instruction that combined online and face-to-face elements was found to be more advantageous than purely online instruction (U.S. Department of Education, 2010). For example, Lou et al. (2006) have noted that inclusion of face-to-face interactions with peers in DE could help learners to get to know each other better, which in turn could potentially reduce problems that arise in purely asynchronous discussions, such as problems associated with group learning, misunderstandings among group members, and unequal participation. Therefore, meaningful interaction or collaborative learning that includes a face-to-face component can contribute to more effectiveness in DE.

The impact of culture on interaction in DE. Culture plays an important role in course participants' interactions**.** For example, Uzuner (2009) reported on the impact of learners' culture on their interactions. Reviewing studies that investigated questions of culture in DE, Uzuner suggested the importance of interaction among learners for becoming acquainted with one another and for developing relationships, especially with regards to reducing discomfort, frustration, and misunderstandings among individuals with different cultural backgrounds. Uzuner's review of 27 studies revealed differences in expectations and behavior in learners who were predominantly of American and Asian backgrounds, in asynchronous online learning networks. Most notably, Uzuner presented the following synthesis from the research findings: Learners from high uncertainty avoidance cultures such

as Chinese, Korean, and Arab cultures, preferred structured online learning situations, with formal and clear rules that guided behavior. Learners from less individualistic cultures had more of a passive presence online, asked fewer questions, and held back their thoughts. In a similar vein, learners from high power distance cultures were intimidated by the thought of approaching the instructor, saw the instructor as an authority figure, and valued instructor's feedback more than their peers'. However, for learners from high context cultures social presence and relationship building was important.

Uzuner's (2009) synthesis also revealed that in learning environments consisted of learners from various backgrounds, lack of knowledge regarding the dominant culture was frustrating for learners. A number of the studies also pointed out that leaners' skills and experiences, which learners bring to the learning environment, are influenced by their cultural background. In a similar vein, Sterling (2015) also reported differences in satisfaction with online learning among learners from individualistic cultures (Caucasian) versus learners from collectivist cultures (Asian/Latino). For example, concerning their interaction with the course TAs and other learners, Caucasian learners perceived the TAs and other learners as being more available. This reported difference in perceived availability of the TAs is significant, given the participants reported having opportunities for human interaction as an important factor that contributed to satisfaction in DE in general.

The abovementioned research exemplified the impact of culture on learners' learning experience. To this end, researchers have observed that there is a "great need for more research on the role of culture and cultural differences in global distance learning" (Zawacki-Richter, Backer, & Vogt, 2009, p. 44). Similarly, Uzuner (2009) has pointed out that successful online learning besides "available technologies, teachers' pedagogical-content knowledge, and learners' motivation level," also depends upon the "cultural (mental)

representations learners and teachers bring to the learning situation" (p. 1). Uzuner noted that it was interaction among learners that provided the opportunity for learners to become acquainted with other learners' cultures, with the result of enriching the learners' learning experience. To summarize, the cultural background of learners impacts the nature of their interactions in learning environments especially in DE. That is, leaners come to the learning environment with differing expectations, where their interaction and behavior is influenced by their cultural background.

Although the abovementioned empirical studies pointed out issues concerning interaction in DE, due to their methodological approach, the nature and significance of interactions were not explored. That is, these studies did not reveal or describe what was actually occurring in these DE courses and what the significance of interactions were for learners' learning. Conversely, while the multi-site DE course under investigation in this study was not lecture based, the instructors utilized live synchronous sessions to explain and clarify course concepts. That is, a significant portion of synchronous sessions consisted of instructors' dialogue which is similar to lecture based model of instruction. To this end, research findings in lecture based DE courses, especially those that utilized synchronous technologies, informed the present study by revealing issues that are prevalent in a great number of DE courses which traditionally have been lecture based.

Examining Interaction in Collaborative Learning

For the purposes of this study, the following definition which operationalized collaborative learning, served to guide the analysis of live interactions among course participants. According to Dillenbourd (1999), collaborative learning is a learning situation in which "two or more people learn or attempt to learn something together" (p. 1). Dillenbourd explains that "two or more" may refer to a pair, a small group (3-5 subjects), a

class (20-30 subjects), a community, or even a society. "Learn something" may refer to studying course material, follow a course, performing learning activities such as problem solving, or learning from lifelong work practice. "Together" may encompass different forms of interaction including both face-to-face and computer mediated.

As discussed earlier, learning in part is supported by social interaction. Stahl (2006) has further argued that the construction of shared meaning is especially visible at the small group unit of analysis, mainly because members' interactions in small groups can be more clearly observed and studied. Stahl further has explained that the small group lies at the boundary of the individual and the community, and the knowledge making that takes place within the small group becomes internalized as individual learning by members, and in turn contributes to the community's knowledge.

Given these explanations, the focus of this study was on the nature and significance of course participants' live interactions during collaborative learning, encompassing various combinations of two or more course participants. Stahl et al. (2006) have observed that in collaborative learning, as opposed to individualistic learning, learners visibly display their learning during their interactions, which takes place over short periods of group interaction. Stahl et al. further have explained that because a necessary feature of collaboration is the display of learners' understanding in the meaning construction that takes place during group interactions, learners' utterances, texts, and diagrams display their learning as part of the collaborative process, which can be recorded and studied by researchers.

Conclusion

The literature review presented in this study revealed important issues concerning interaction in DE and provided a theoretical basis for examining the nature and significance of course participants' interactions. Notably, the literature showed that the presence of

dialogue and interaction in DE is crucial for effectiveness but that interaction among distance learners does not occur on its own account and must be integrated into the course design. To this end, the role of instructors in promoting meaningful interaction and the incorporation of collaborative activities has been emphasized. In addition, through this literature review I presented the different conceptualizations and frameworks concerning interaction in order to have a criterion for identifying interaction events and the significance of course participants' interactions.

Drawing on the literature review presented in this chapter, my objective then in this present study was to first examine the nature and significance of course participants' interactions in a multi-site DE course in order to then provide insights concerning new possibilities for instructional design in DE, given that through advanced internet technologies a new realm of collaborative inquiry and knowledge construction has become possible (Chun, 2007). Based upon the research reviewed in this chapter and the theoretical conceptualizations of interaction presented, I conducted my study with the assumption that interaction supports learning and increases learning opportunities for learners. Therefore, in my analysis presented in the next chapter, I first verified to what extend interaction occurred among course participants and then examined the significance of course participants' interactions.

CHAPTER THREE

DESIGN AND METHODOLOGY

To investigate how the nature of interactions reflected course design and instructors' intentions for learning outcomes, it was crucial to examine the different kinds of interactions and instructional exchanges (Moore, 1989) as well as the significance of interactions that occurred during the two-hour live synchronous sessions. Therefore, I took a methodological approach, i.e., a case study (Yin, 2013), that would enable me to thoroughly study the variety of interactions among course participants.

In order to investigate new possibilities for instructional design in DE, given prevailing advanced internet technologies, it was necessary to first examine what is actually occurring in existing DE programs. To this end, I had the privilege of conducting research in a multi-site engineering DE course, where learners from universities located in different countries took a course together and engaged in interactive learning during live two-hour synchronous sessions. This DE course was selected because it emphasized the importance of interaction for obtaining learning outcomes. Therefore in my investigation I first examined the nature of course participants' interactions and their significance in order to then explore new possibilities for instructional design in DE.

Overview of Methods

I conducted a case study to investigate in-depth the nature and significance of course participants' interactions. My objective was to first examine how the nature of course participants' interactions reflected the course design and instructors' intentions for learning outcomes as well as the significance of these interactions that influenced learners' learning. I explored the following research questions in my investigation:

1. How does the nature of interactions among course participants reflect the course design and instructors' intentions for learning outcomes?
2. What are the significance of course participants' interactions during live synchronous sessions that influence learning?

To explore these research questions, I observed the live synchronous sessions that took place over a 15 week period, and took detailed fieldnotes. Most of these observations were done from recorded lectures made available to me by the founder of the DE program. In addition to observing the recorded lectures, I made five observations in person at one of the participating universities (University A). Because case studies rely on multiple sources of evidence to converge data in a triangulating fashion (Yin, 2013), I also analyzed various artifacts and documents (e.g., course syllabus, course website), and conducted surveys and interviews in order to obtain a deeper understanding of the phenomenon being studied through the triangulation of methods (Ashley, 2012). Artifact analysis, the surveys, and the interviews enabled me to validate ideas from classroom observations, which in turn can increase the reliability of my research. This triangulation of methods then enabled me to examine the nature and significance of interactions from three different perspectives/lenses: (a) my perspective as a researcher (classroom observations), (b) learners' perspective as course participants (learner survey & interviews), and (c) instructor's perspective as course participant and instructional guide (instructor interview).

Because these other research methods, namely survey and interview, are embedded within this present case study research, this case study research represents a form of mixed methods research (Yin, 2013). However, because these methods were a means of collecting evidence for the case study approach, for the investigation of the nature and significance of interactions in a multi-site DE course, the research methodology of this study is considered

to be a case study and not a mixed methods research, which traditionally has been defined as a type of research where both quantitative and qualitative research approaches are combined (Biesta, 2012).

In summary, for this present case study research the following levels of analysis were conducted: (a) video analysis of classroom interactions, which included identification of learner- instructor and learner-learner live interactions based upon criteria constructed from reviewed literature, (b) artifact analysis of available course material, (c) learner surveys, (d) learner interviews, and (e) instructor interview. These analyses were conducted to show how the course design enabled opportunities for live interaction, and how and in what ways more interaction among course participants increased opportunities for learning.

Criteria for Identifying Interaction Events

Based upon the literature review presented in chapter two, I constructed the following criteria for identifying live interaction events and episodes for subsequent detailed examination of the nature and significance of these interactions. Any learner-instructor or learner-learner live synchronous reciprocal communication (exchange) (Kuo et al., 2014; Wanstreet, 2006) that had the following characteristics was identified as an interaction event.

(a) Reciprocal exchanges including at least two individuals and two actions that mutually influence one another (Anderson, 2008). Comments and questions (actions) with their corresponding replies (their influence) are reciprocal exchanges. A comment not followed by a corresponding reply is not considered for analysis.

(b) Reciprocal exchanges that are purposeful, constructive, and valued by course participants (Moore, 1993), and which promote meaningful interactive learning experience (Ng, 2007). Actions that pertain to course concepts, the objectives of the course, or reveal engagement with subject content (Laurillard, 2000) are purposeful and meaningful

exchanges. Actions that contribute to learners' construction of disciplinary knowledge, especially when accompanied by guidance (Vygotsky, 1978) or scaffolding (Hill, 2012) are constructive exchanges. Exchanges that are encouraged by course instructors are valued exchanges (Simonson et al., 2011), in particular those that encourage discussion and reflection with subject content (Laurillard, 2000).

(c) Reciprocal exchanges that reveal course participants' skills, experiences, disciplinary knowledge, or cultural background (i.e., mental representations) (Uzuner, 2009). These exchanges may include the challenging of ideas, may be informative in nature revealing new perspectives (Lou et al., 2006), or may involve negotiation, social sharing, or creation of group meanings (Stahl et al., 2006).

The Case Study Methodology

For this research project I used a case study (Yin, 2013) methodology to examine in-depth the nature and significance of course participants' interactions during the live synchronous classroom sessions in a multi-site engineering DE course. Qualitative case studies are an established form of research in the field of education and have illuminated educational practice for decades (Merriam, 1998). In particular, a case study is an empirical inquiry that investigates a "case," that is, a contemporary phenomenon, in depth, and within a real-world context (Yin, 2013). What counts as a "case" for empirical research is wide ranging, and may be an individual, a program, or an event (Ashley, 2012). In a general sense however, a case is a bounded unit or a single entity (Merriam, 1998). Yin (2013) further has explained that a case study research is a preferred method when the main questions of investigation are questions of "how" or "why," when the researcher has little or no control over events, and when the study investigates a contemporary phenomenon in a real-world context. The case study methodology then was an appropriate approach for this study which

allowed for an in-depth examination of course participants' interactions.

Notably, the case study approach entails the collecting of a variety of evidence from observations, interviews, artifacts, and documents. Yin has pointed out that this reliance on a variety of evidence is considered to be a unique strength of case studies, which in turn makes them particularly useful for doing evaluations. However, it is important to note that the DE course, i.e., the case, chosen for this study did not represent a "sample." Therefore the results are not generalizable to populations (Yin, 2013).

The case study methodology is often employed when the research questions require an "in-depth" exploration, description, or explanation of some contemporary phenomenon (Yin, 2013). This in-depth exploration of a phenomenon is considered to be a strength of the case study research methodology, which enables to investigate the complexity of a phenomenon through long term immersion or repeated encounters or visits with the case (Ashley, 2012). Yin (2013) also has explained that the term "in-depth" implies the probable need for some kind of fieldwork or participant observation. Both of these research methods are also regularly used in ethnographies. For the present study however, I chose the case study approach as opposed to ethnography.

Commonly defined as the approach to the study of everyday life of a social group, ethnographies examine and particularly focus on the culture of the social group being studied (Anderson-Levitt, 2006). Because through ethnographic work insider knowledge is attained, ethnographies have great potential to provide a more in-depth understanding of the cultural processes of the social group under investigation (Gold, 1997; Jeffrey & Troman, 2004). While for this study I intended to explore course participants' interactions in-depth, my primary goal was not to study the culture of the group, which is the main objective in ethnographies (Brenner, 2006; Heath, 1982). The case study approach was chosen instead

because it enabled the investigation of the phenomenon of interest, namely the nature and significance of course participants' interactions in a multi-site DE course.

Moreover, the in-depth approach taken in case studies differs from the one taken in ethnographies, in terms of both data collection processes and data presentation (Yin, 2013). That is, ethnographies usually require long hours and immersion in the field (Agar, 1994). In contrast, while in case study research data collection from institutions and people occurs in their everyday situations (Yin, 2013), the presentation of "thick descriptions" (Geertz, 1973) often used in full-scale ethnographies (Spradley, 1979), or detailed observational evidence present in most qualitative research, is not always required in case study research (Yin, 2013).

The DE Program

Research site. I conducted my study in an engineering course in a multi-site DE program, at a university located in California. The course was taught in the Fall semester of 2015. This program was chosen because it served as a critical case (Ashley, 2012; Yin, 2013), offering a robust example of the phenomenon I was interested to investigate. In this multi-site DE course, learners from different countries (USA, China, and Taiwan) studied a course under the guidance of the same instructors, with the same content materials, using synchronous technologies that enabled telepresence capability over the internet. All sites followed the same course syllabus and academic requirements. The course however was taught in English.

The multiple interactive sites that connected via internet were actual classrooms with learners who attended the classes in person on scheduled lecture days. These scheduled sessions took place once a week over a 15 week period and were two hours in length. Each two-hour live session was led by an instructor from one of the sites and was seen

synchronously via internet at remote sites. Through various online technologies learners were also able to individually participate in the course when their campus was closed, for example on national holidays. For this study, the following pseudonyms are used for the three participating universities: University A for the university located in California, University B for the university located in China, and University C for the university located in Taiwan. Similarly, for instructors the following pseudonyms are used that correspond with each university pseudonym respectively: Instructor A, Instructor B, and Instructor C.

Description of classroom environment and applied technologies. Each classroom had screens in the front of the class. In Figure 3.1, I present a schematic picture of the engineering course at University A, showing the ways in which the screens were placed in the classroom for synchronous interaction.

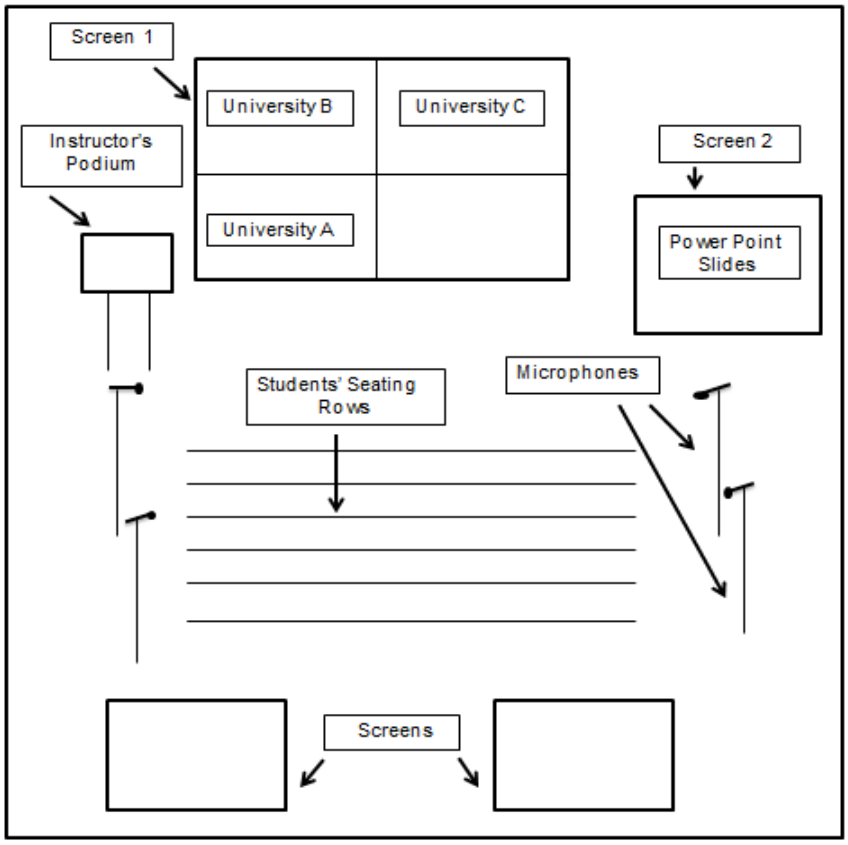

Figure 3.1. Engineering course located in University A

The other classrooms were similar in structure. Live scenes from the remote sites were projected on screens for learners. Cameras were installed in all participating sites that captured scenes from each site and transmitted these images to remote sites via internet. Another camera aimed at the instructor or other speakers - for instance, when learners made comments - in order for remote sites to see the instructor or the speaker clearly on their screens. For example, in University A, screen 1captured scenes from the three Universities, enabling the live synchronous interactions. In order for the instructor at University A to see remote learners, two smaller screens were placed in the back of the class (as shown in Figure 3.1). This in turn enabled the instructor to face the learners at his site.

The number of learners in each site varied but was kept limited to 20 to ensure full participation and peer-to-peer direct interaction. This also ensured that classroom cameras would capture learners' faces in ways that would be visible for course participants at remote sites. In Table 3.1, I have provided the number of learners in each site along with the gender breakdown.

Table 3.1

Number of Learners in Each Site with Gender Breakdown

University	Male	Female
University A	11	12
University B	3	3
University C	7	7

In addition, multiple microphones were placed in each site to enable the learners to engage in live discussions with their peers across the different sites. Each live session was recorded and made available on the course website. The recorded lectures were the recording of the live scenes that were projected in each campus on the main screen for

learners (e.g., Screen 1 in Figure 3.1 for University A). That is, viewing the recorded lectures was equivalent to being a participant at one of the sites and observing the interactions and dialogues occurring at the other remote sites. I attended five selected sessions in person at University A and viewed all other sessions from the recorded lectures, which were made available to me by the instructor from University A.

All course materials and resources (e.g., recorded lectures, syllabus, reading material, and links to synchronous software for learners' interactions such as Slack), were made available for learners on the course website. While various tools for learners' online interactions were provided for them, learners were held responsible for their interactions outside the classroom time for accomplishing their presentations and projects. For example, *Slack* was a virtual platform used by course participants for their interactions, both during the live two-hour sessions and outside of classroom time. The resources made available for learners on the website were presented in weekly modules, each module containing content related to a given week's topic, such as required reading material, videos, lecture slides, assignment descriptions, and learning activities. While I was given access to the course website, I did not have access to the virtual meetings, which were not recorded, and was not able to observe course participants' interactions that took place online during the live synchronous classroom sessions.

It is important to note here that because of the design of this multi-site DE program, the different participating universities depending upon their national calendar and different local campus academic calendars, started their joined participation in the course on different dates. For example, for the course I researched for this project, while University A started the course on week 1 (8.31.2015), Universities B and C joined the course on week 3 (9.14.2015), that is, two weeks later due to their national holiday. Given that each live

session was recorded and made available on the course website, this starting of the course on a different date did not seem to hinder the learning of University B and C learners. During these first weeks one introductory lecture was given (on week 1). The first team projects, which consisted of teams with learners from the same university, were presented on week 10. For a multi-site DE course that had learners learning together across geographical distances with different time zones -in this instance different continents- this un-synchronized joining of the course seemed necessary.

Research Participants

Instructor(s). There was one instructor present in each participating university. Two of the instructors were responsible for the discussion and explanation of subject content during the live synchronous sessions. Each live session was led by one instructor, while the other instructors or the TA facilitated the group and cross campus interactions. Five of the 14 sessions were led by the instructor from the university located in California (i.e., the founder of the DE program), four of the sessions were led by the instructor from the university located in China, one session was led by the TA of the course from the university located in California, and the learners' interactive presentations were led by the instructor from the university located in Taiwan. The focus of this study however, was on the instructors who led the live synchronous discussions and engaged in interactive dialogues with learners across the three campuses.

Learners. The learners in this 2015 engineering DE course were all undergraduates, 43 learners in total. The course was open to only sophomores, juniors, and seniors, and no technical or disciplinary specialty was required as prerequisite. However, those enrolled in the course were selected from competitive pre-registration interviews by the instructors of the course. Most learners were from various engineering and business majors. The

American learners from University A were from different ethnic backgrounds, including Indian American and Latino, with the majority consisting of White American and Asian American backgrounds. Learners at Universities B and C were mainly Chinese and Taiwanese, respectively, with the exception of a German and a Latino learner at University C.

Participant access. I had the opportunity of conducting my investigations in a multi-site engineering DE program that was engaged in research with select faculties within my graduate program. I obtained permission from the founder of the DE program to conduct first a pilot study and then this research project with two different iterations of his engineering course. Learners were informed by instructors and the TA of my presence in their course and were told that I was a researcher from University of California Santa Barbara (UCSB) observing and studying their live interactions. For classroom observations, I did not obtain informed consent from individual learners. During the time that I was observing course participants' interactions, I also did not have any kind of interaction or communication with any of the learners.

Classroom Observations and Fieldnotes

Data collection for the present study began with observations of the two-hour live synchronous sessions involving the three participating universities. The primary data source for the classroom observations was the recorded videos of these live sessions, made available to me by the instructor from University A. These recorded videos of the live two-hour sessions provided a comprehensive account of the classroom interactions (approximately 28 h of video record, recorded on 14 days, spanning 4 months). Following the video analysis method explained by Derry (2007), I observed all recorded lectures, took detailed notes, and constructed time-indexed fieldnotes that made visible the basic outline of the classroom

events during the live synchronous sessions. In addition to observing the recorded classroom videos, I observed five sessions in person at University A's engineering classroom. To this end, my observations were limited to only the visible live synchronous interactions.

Video records, while not considered automatically to be data, are characterized as an information source from which data could be identified (Goldman, Erickson, Lemke, & Derry, 2007). Selection of data, that is specific events and timescales from video, is in turn determined by the interest of the researcher (Derry et al., 2010). From a video analysis perspective, Goldman et al. (2007) have explained that video segments represent events captured from the environment, which are brought into focus through selection for deeper analysis. Video records of classroom interactions and discourse is highly valued, because it allows the revisiting of salient episodes of instructional interactions that are of interest to the researcher (Derry, 2007; Reveles et al., 2007).

Classroom observation analysis. The unit of analysis for the classroom observations was course participants' live interactions. For the purposes of this study, interaction referred to reciprocal exchanges among course participants that mutually influenced one another (Anderson, 2008). I examined course participants' interactions to investigate how the nature of interactions reflected the course design and instructors' intentions for learning outcomes as well as the significance of interactions that influenced learners' learning. This examination, with the intend to describe what is occurring in this multi-site DE course that utilized synchronous technologies, then enabled me to explore possibilities for instructional design in DE.

For analysis of observations made of participants' interactions, I first viewed all recorded videos of the live synchronous sessions and took copious notes guided by my research questions. I did this in order to identify individual events, sequences of events for

each session, and their duration (Reveles et al., 2007). Specifically, events and boundaries for events were identified by shifts in purpose, topic (Kelly & Chen, 1999), and type of interaction (e.g., learner-instructor interactions, learner-learner presentations). While watching the videos I also made content logs of classroom interactions which guided the identification of interaction topics for subsequent marking of interaction events. Barron and Engle (2007) have noted that the creation of intermediate representations, such as time-indexed fieldnotes, content logs, and preliminary transcripts are important because they allow for the identification of key events pertaining to the phenomenon of interest under investigation. The subsequent event selections were then based upon a part-to-whole deductive approach, concerned with only specific types of events (Barron & Engle, 2007) that best matched my constructed criteria. It is important to note here that the viewing of the live synchronous sessions enabled me to take detailed notes and thereby capture all reciprocal interactions that occurred during these sessions. In chapter four in Table 4.1 I present the frequency of all reciprocal exchanges that occurred during the live sessions. This table represents a summary of my notes demonstrating my systematic approach for capturing and identifying course participants' reciprocal exchanges. The subsequent selection of significant reciprocal exchanges was guided by the criteria constructed from the literature reviewed in chapter two, explained next.

For classroom observations the first step was to identify reciprocal interactions. To do this, I took notes while watching the videos identifying reciprocal interactions based upon the criteria I had constructed from the reviewed literature. While watching the videos I first marked any live interaction that was a reciprocal exchange. Reciprocal exchanges were those interactions that consisted of a comment or a question followed by a corresponding reply. After locating reciprocal exchanges for each week's session, I then identified learner-

instructor and learner-learner interactions. In my notes I used the following notations for these interactions: LI for learner-instructor interactions and LL for learner-learner interactions. For learner-instructor interactions I further categorized them as instructor initiated versus learner initiated interactions. However, these two types of learner-instructor interactions were similar in nature and only differed in the source of the comment or question initiator as shown in the episodes presented in chapter four.

For learner-learner interactions I distinguished between learner presentations (LLp), mediated learner-learner interactions (LLm), and learners' discussions in groups (Ld). From these interactions whenever a learner had a reciprocal exchange with either individual learners or all learners, I marked this interaction as LL (please refer to Table 4.1 for a presentation of the total number of LI and LL interactions). That is, for counting LL interactions I did not count the group presentations, because some of these presentations were in video format or were not reciprocal in nature. However, during presentations any reciprocal exchange that occurred between learners in form of a comment or a question was marked as a LL interaction. Because I could not observes learners' group discussions, both virtual and regular, I only marked these learner interactions and did not count them as LL interactions for the subsequent detailed analysis.

For example, in my notes from week 6 the interaction shown in Figure 3.2 below is marked LI 13, which exemplifies a learner-instructor interaction that was initiated by the learner. The number 13 indicates that this interaction was the 13th interaction in my notes for week 6. As shown in this example the interaction between the learner and the instructor was reciprocal. The learner's comment was followed by instructor's comment which was constructive in nature and guided the learner's knowledge construction. The learner's comment also revealed his knowledge and experience concerning the topic which was being

discussed (offshoring vs. outsourcing). This interaction therefore matched my constructed criteria and was selected for detailed analysis.

Learner:	Z, the company Z, clothing company
Instructor A:	oh, clothing
Learner:	they don't necessarily have like a bunch of super-secret technology but they only have one factory that's centralized somewhere in Europe but they don't allow any visitors and I think they said if you're on campus the people can shoot you
Instructor A:	no…that will be offshoring because they actually own that facility right? otherwise how can they shoot you?

Figure 3.2. Example of a learner-instructor interaction.

It is important to note that I counted individual course participants' reciprocal exchanges with other course participants as one interaction regardless of the number of actual exchanges, mainly for ease in coding. In the above example for instance, there are two distinct exchanges. However, because the instructor was interacting with the same learner I counted this reciprocal exchange as a single learner-instructor interaction. That is, the reciprocal exchanges had to have at least two actions that influenced one another to be marked as a reciprocal interaction. However, more than two actions with the same individual or group was considered as one interaction. I coded all LI and LL interactions this way. I have presented the above interaction in its entirety in Episode 5 in chapter four.

The second step in classroom observation analysis was to identify interactions that had significance in terms of their influence on learners' learning. In this second level of analysis, while watching the videos in real time, I first identified reciprocal exchanges that clearly exemplified the significance of live interactions in this engineering DE course. Those live interactions that best matched my constructed criteria were selected for examination of

their significance for influencing learners' learning. These interactions were either a clear example of purposeful and constructive exchanges valued by course participants or were exchanges that demonstrated course participants' skills, experiences, disciplinary knowledge, or cultural background (e.g., Figure 3.3).

Instructor A:	when X first started this they made the phone curved in the short dimension... let me ask you why you want to have the phone curved this way why do you want to do that...
1st Learner:	it'll be easier to store
Instructor A:	why?
1st Learner:	they make more compact in width and so maybe in some places it will be easier to store
Instructor A:	okay, yeah what would be the reason for
2nd Learner:	I think it's just to make it so it's easier for you to see the screen it will be more angled towards your eye sight since you hold in the middle of your face when you look to the edge of the screen it's more directly flat on the screen now since it's curved
Instructor A:	okay
3rd Learner:	before the phone didn't we see also I think it might have been X also with the TV that was curved as well but
Instructor A:	but the TV curve was along the long dimension here this they curve on the short dimension see, this is long, this is short
3rd Learner:	yeah, I was thinking for the future how you see the Y card board how it will be for VR in the future that's just kind of like the future
Instructor A:	okay, gives you more immersive view
4th Learner:	it's easier to hold in your hands
Instructor A:	very good, actually the main reason for X to try that is remember a phone of big size is not a one hand operation right, because it's pretty hard to have your thumb to navigate the whole phone because the distance here is too big, right so, imagine if you curve the phone it actually makes it a one hand operation...

Figure 3.3. Example of an episode of interaction.

After identifying these interactions I then constructed transcripts (Skukauskaite, 2012) of these identified interactions. Because while watching the videos I had identified the

content of the live synchronous discussions noting any shifts in topic, based upon these topic markers I identified the boundaries of a given interaction pertaining to a topic, i.e., an interaction event. For example, in Figure 3.3 I present an example of an interaction event bounded by Instructor A's dialogue. This example is one of the selected interaction events that I had transcribed for subsequent episode selection. This interaction event displays learners' engagement in dialogue with the instructor concerning a course concept (product design). This event was selected for transcription and served as an intermediate representation enabling the identifications of key events for presentation of findings. This example illustrates how the instructor engaged the learners in a dialogue guiding their knowledge construction through an application question. This instructor initiated dialogue encouraged discussion where learners' responses reflected their engagement with the topic.

After transcribing, from these bounded events I then selected episodes of live interaction for the presentation of my findings in chapter four. For example, in Figure 3.4 I show an example of an episode of interaction (Episode 5 in chapter four) that contains two learner initiated learner-instructor interactions. The learners in this episode were from University A. As shown in this episode, the boundaries are marked by instructor's dialogue about a course concept, i.e., topic (offshoring vs. outsourcing). Considering the limited space for the presentation of findings, I have not included instructor's entire dialogue. To mark the boundaries of the episode and show the nature of interaction, I have only presented instructor's last and initial utterances from his dialogue. This episode shows the reciprocal exchanges between course participants where one learner's comment influenced another learner's comment while the instructor's constructive feedback guided learners' construction of disciplinary knowledge. This episode was selected for examining the significance of live

Instructor A:	so most safest way is to outsource late when the technology becomes common technology it's just a matter of scaling up okay, yes?
1st Learner:	well just adding onto that I've actually been to X factory they use up a block -- to blocked up the entire area so
Instructor A:	oh yeah, yeah
1st Learner:	so that you don't see much and can't even get close to it and it's blocked up by like a glass as well
Instructor A:	oh yeah, you don't see that… this kind of Y outsourcing factory has almost become a mixed model of outsourcing/offshoring because yes, it is outsourced, on the other hand that little pocket they have created in a foreign land is still owned by them so that's offshoring…and they are very very careful about leaking the technology okay, any other questions, yes
2nd Learner:	I was just going to say it's not just trying to leak technology cause I know Z for example I don't think they have any
Instructor A:	what example?
2nd Learner:	Z, the company Z, clothing company
Instructor A:	oh, clothing
2nd Learner:	they don't necessarily have like a bunch of super-secret technology but they only have one factory that's centralized somewhere in Europe but they don't allow any visitors and I think they said if you're on campus the people can shoot you
Instructor A:	no…that will be offshoring because they actually own that facility right? otherwise how can they shoot you? …I'm going to make sure that you understand the difference between offshoring and outsourcing…

Figure 3.4. Example of an episode of interaction selected for presentation of findings.

interactions because it exemplified an instance where learners' mental representations were reflected in their dialogue during a purposeful and constructive live interaction. In this episode the second learner was also challenging instructor's comment by sharing his own knowledge (*it's not just trying to leak technology, cause I know Z for example…they don't*

necessarily have like a bunch of super-secret technology, but they only have one factory that's centralized somewhere in Europe). The learners' comment was followed by instructor's scaffolding in form of a correction of learner's understanding of the concept being discussed (*no…that will be offshoring because they actually own that facility, right? otherwise how can they shoot you?*). Therefore, this interaction event in matching different specified characteristics from my criteria was selected as an example that revealed the significance of live interactions.

For the purposes of this study, it is important to note the following considerations concerning my video analysis and the transcripts presented in the text of this research study for both video and audio recordings (audio recording for the interviews is explained in the subsequent sections). First, transcripts are a re-presentation of recorded events under investigation and are not value-neutral (Barron & Engle, 2007; Emerson, Fretz, & Shaw, 2011; Lapadat & Lindsay, 1999). That is, I selected segments that I thought were robust instances of the phenomenon under investigation. The event selection and the transcription of course participants' discussions then were selective.

Secondly, oral speech and written text are different mediums of communication, and reproducing the exact flavor of oral discourse in written format is not possible (Brenner, 2006). Accordingly, depending upon theoretical concerns or research interests, transcription constructions differ along several dimensions such as in style, detail presented, and features of speech included. For example, in discourse analysis and transcription construction, I did not consider contextualization cues, such as uses of pauses, stress and intonation patterns, changes in volume, and speed of delivery (Bloome, Carter, Christian, Otto, & Shuart-Faris, 2010) and edited the transcripts for ease in reading and public consumption (Barron & Engle, 2007). While the inclusion of contextualization cues provide details which are of value in

certain types of research, for instance in micro-ethnographic approach to discourse analysis (Bloome et al., 2010), due to the objective of my research, they were of less concern to me and were excluded. Also, I edited the transcripts of the interviews and the classroom interactions only for ease in reading, and the editing was done to an extent that preserved the speech flavor and the individuality of the speakers.

Finally, the video analysis and the transcription undertaken in this study, while presented in a linear manner, benefited from iterative cycles of examination and moving across different levels of analysis (Barron & Engle, 2007). That is, similar to ethnographic approaches, for examining the phenomenon under investigation, I applied a recursive and an iterative logic of inquiry (Agar, 2006). This cyclical process of data analysis, which entails returning to the data with a different viewpoint as new insights are developed (Brenner, 2006), was also used for the interviews, explained in the subsequent sections.

Artifact Analysis

Artifact analysis in this study consisted of examining a range of course products which were either made available to me by the University A instructor (e.g., course syllabus, lecture slides, 2015 fall engineering course website, papers and presentations concerning the DE program) or were publically accessible (e.g., the DE program website and blog). I did not have access to any learner products, other than the team project presentations captured in the recorded videos. The artifact analysis of the written texts informed the research investigation and especially guided the formulation of research questions and subsequent data collection and data analyses processes. The artifact analysis was also instrumental in revealing the pedagogy of the engineering course. Through the artifact analysis I found that the founder of the program, i.e., Instructor A, considered the DE program a "no-distance" learning program that promoted interactive learning across physical, institutional, and

cultural boundaries. The program was called no-distance because internet technologies were used to eliminate the interaction distance among course participants across the various geographical sites. This conceptualization of distance with regards to DE mirrored that explained by Moore (1993), in which the notion of distance is not limited to physical distance and can be reduced through interaction and dialogue. This line of thinking, whether directly or indirectly, influences the opportunities provided for interaction by the instructor and guides the course design. This preliminary finding in turn informed the investigation of the present study.

Survey

Qualitative case studies can benefit from quantitative evidence as well (Yin, 2013). To evaluate learners' experience in this DE course, especially in regards to their interactions with peers from all three campuses, I administered surveys during the last week of the engineering course, i.e., before the start of week 14, and made the surveys available for the learners to take until the end of their semester. The design of the survey was informed by the observations I had made throughout the semester and the preliminary analysis I had conducted from these observations.

The survey was administered online via Google Forms. I used an online survey because it enabled ease in formatting and presentation, as well as efficiency in administration and data collection, given the multi-site nature of the course. The link to the survey was sent to all learners at the three campuses by the TA of the course, in an email that included the consent form (Appendix B1), informing the participants that by taking the survey they were consenting to the terms described in the consent form. Of the 43 learners enrolled in the course, 30 learners took the survey, resulting in a response rate of 70%. The breakdown for the response rates for each participating university is given in Table 3.2. As shown in Table

3.2, University A had the highest number of respondents, with a response rate of 83% (n = 19). University C with 64% had a moderately high response rate (n = 9), and University B had a response rate of 33% (n = 2).

Table 3.2

Survey Response Rate Breakdown for Each Site

University	Response Rate	Respondents	Total Learners
University A	83%	19	23
University B	33%	2	6
University C	64%	9	14

Survey instrumentation. The unit of analysis for the survey was the learners and their experience regarding interactions with peers. The objective with administering the survey was to find out what in general were the learners' perceptions concerning their experience in this DE course, particularly with regards to their interactions with peers and their learning from the various instructional exchanges made available for them. Surveys are highly structured both in method and content, and are used for finding particular pieces of information and for determining frequency of diverse responses in preset categories (Brenner, 2006). Specifically, I wanted to examine the following outcomes from the learners about their interactions with peers across the three campuses: (a) to what extent they learned from peers and instructors through the different types of interactions provided for them during the live sessions, and (b) which types of interactions they found to be more helpful for their learning. The survey then while giving a general idea about learners' experience in this DE course, mainly served as a means to validate observations about the nature and significance of course participants' interactions and their influence on learners' learning, as well as to obtain preliminary data for the interviews.

It is important to note that although I did not compute elaborate statistical analysis carried out in most quantitative studies, for the purposes of this qualitative study, I present means and frequencies of survey participants' responses to show what in general were the learners' perceptions about their learning experience in this DE course, and how the survey data, by providing direct information from the majority of course participants, guided my subsequent qualitative interviews. To this end, Yin (2013) has explained that case study research is not limited to only qualitative evidence and can include quantitative evidence for depth of analysis.

The 12-item survey (Appendix A2) was comprised of three main sections, in order to provide adequate description for each question and for organization. The first portion of the survey consisted of background information, asking the learners to identify their university and major. Section A was comprised of two Likert-type scale (1-5) items, designed to measure to what extend learners thought they had learned from this course. These items were as follows:

A1. *I learned a great deal about principles/practices of global innovation from this course: (Strongly Agree, Agree, Somewhat Agree, Disagree, Strongly Disagree).*

A2. *I learned a great deal from the cross-cultural team projects: (Strongly Agree, Agree, Somewhat Agree, Disagree, Strongly Disagree).*

I asked these questions about learners' learning before inquiring about their interactions, in order to distinguish learning from the course in general, from learning from peers and instructors during the different types of interactions made available for them. While there were different learning activities, for this survey, in order to be specific, I chose the cross-cultural exercises as an example in question A2, mainly because the survey was administered prior to learners' presentations of their final team projects.

Section B, likewise, was comprised of two Likert-type scale (1-5) items, designed to measure to what extent learners thought they had learned from their interactions, and from which peers they had learned more, i.e., remote vs. in class. The objective with these items was to examine the significance of peer interactions and their influence on learners' learning in a DE environment where participants from different sites interacted. These items were as follows:

B1. *I learned a great deal from my interaction with my classmates across the three campuses: (Strongly Agree, Agree, Somewhat Agree, Disagree, Strongly Disagree).*

B2. *I learned more from interaction with classmates from my own campus than from classmates from the remote campuses: (Strongly Agree, Agree, Somewhat Agree, Disagree, Strongly Disagree).*

In Section C learners were asked to rank the resources made available for their learning in terms of what had been most helpful, with five being most helpful and one being least helpful. These resources were as follows: (a) reading material, (b) team discussions on Slack of posted material, (c) learners' presentations of cross-cultural team projects, (d) instructors' explanations and clarifications during the live sessions, and (e) learners' Q & A with instructors during the weekly live two-hour sessions. The objective here was again to examine the contribution of each type of interaction to learners' learning in terms of what the learners had found to be most helpful. Lastly, learners were asked if they would consider being interviewed for the present project. Of the 30 survey respondents, seven participated in the subsequent interviews, described in the interview section.

Survey analysis and coding. Because the survey was administered by Google Forms, I was able to generate an excel sheet of the survey responses directly from Google Forms. Following the coding method explained by Emerson et al. (2011), I then coded the

survey data not simply to discover what is in the data but to link specific observations to more general analytic issues and categories. I calculated mean and frequencies for survey participants' responses in order to obtain a clear sense of what in general were the learners' perceptions regarding their learning and interactions in this DE course. I compared the survey results with my classroom observations, and used the survey findings as preliminary data for the interviews to further explore and validate my findings regarding the nature and significance of course participants' interactions and their influence on learners' learning.

Interviews

To obtain a deeper understanding of the phenomenon under investigation, I conducted "open-ended" qualitative interviews (Brenner, 2006) with the instructor from University A, who was the founder of the DE program, and with select learners who agreed to participate in the follow-up interviews after taking the survey. The main objective for conducting these interviews was to gain an insider's perspective concerning the significance of course participants' interactions and their influence on learners' learning. In addition, the interviews enabled me to further take observations made from live interactions and preliminary survey results, and validate them with course participants. Interviews are a significant source for data collection, because they provide a space for the informants (i.e., interviewees) to express meaning in their own words and to direct the interview process (Brenner, 2006).

Learner interviews. Due to the low response rate of the follow-up interviews, I interviewed all learners who expressed interest in being interviewed. Those who participated in the follow-up interviews received a modest compensation in return for their time and contribution. Of the seven learners who participated in the follow-up interviews, four were from University A, whom I interviewed in person at University A's campus, on the last day

of their course scheduled session (12.07.15). Of these four learners, three were male and one was female. These interviewees were told that the interviews were meant to take about 20 minutes. The consent form for learner interviews was sent via email to the interviewees prior to the interviews (Appendix B2), and the interviewees gave their verbal consent before the start of the interviews. While I took notes during the interviews, I audio recorded all interviews, using a digital audio recorder and obtained permission from interviewees for the recording of the interviews. The recording enabled me to focus on the conversation with my interviewees, while obtaining a complete record of their words (Brenner, 2006). After conducting all in person interviews I then transcribed the interviews for coding and analysis. See Appendix A4 for the in person learner interview protocol.

The remaining three interviewees were all from University C in Taiwan. All three interviewees were female. These interviews were written interviews, which were made available for the participants on a Google Form. Again, I used Google Forms for ease and efficiency in presentation and data collection. Due to the difference in time zones, the ending of the course, and the low survey response rates, the written interview seemed a good and a practical approach for obtaining as many interviewees as possible from participants oversees. The interview questions were the same as the ones I used for the in person interviews, and the interviewees were told via email that the written interview was meant to take about 20 minutes of their time. The consent forms were sent to interviewees via email, informing them that participation in the interview meant they consented to the terms indicated on the form. After obtaining the written interviews, I reviewed the responses and asked follow-up questions for clarification via email. I received all written interviews prior to the last day of the course scheduled session, which allowed sufficient time for follow-up questions. See Appendix A3 for the remote learner interview forms.

Unfortunately, I did not have any interviewees from University B in China. After the last session of the course, I was notified by the TA from University A that the learners from China could not access the Google form. I provided the same survey in form of a word document. However, given that the course was officially over, I received two responses from University B learners for the surveys, with no volunteers for the follow-up interview. Not having enough participants from University B posed methodological limitations for the analysis of the data. Their contribution would have undoubtedly enriched the overall observations of my research and provided insider's perspective from one of the participating universities, which probably would differ to some extent from the other two universities.

However, the reviewing of all follow-up interviews showed that there was a great deal of consensus over the nature, significance, and the frequency of learners' interactions across the campuses during the live synchronous sessions, among University A and C interviewees. While it is possible that University B learners would have provided views contrary to that of University A and C learners, given that University B and C were similar in background and no major discrepancies were identified in the survey results, it is not highly probable that University B learners would have provided opposing views. To clarify, the views presented by interviewees from University A and C, while diverse complemented one another. To this end, the three sites are considered separately in the analysis of the findings. That is, the learners are not lumped together representing a single learner group, but are treated as distinct learners from their respective universities.

While in this study I distinguished between the three sites in order to examine any cultural and national differences, I did not distinguish between the genders of course participants. For instance, on the survey I did not ask for participants' gender. To this end, with the exception of those who participated in the follow-up interviews, the survey

responses are distinguished only by participating universities and not by participants' gender. This methodological decision was made based upon existing DE literature, which has consistently placed an emphasis on cultural differences in DE and their impact on learners' learning (e.g., Sterling, 2015; Uzuner, 2009; Zawacki-Ritcher et al., 2009) but not on learners' gender (e.g., Hart, 2012). Therefore, while for the follow-up interviews I did not have equal numbers of each gender from each participating site, for the purposes of this study this limitation though significant was not seen as a methodological flaw likely to limit findings. To this end, the analysis of the interviews was undertaken with attention to the participating sites and not interviewees' gender.

Learner interview instrumentation. Following the interviewing approach described by Patton (2002), for the follow-up in person open-ended qualitative interviews, I used a combination of "interview guide" and "standardized open-ended interview" approach to interviewing. Prior to the interviews, I listed the issues I wanted to explore with the interviewees; however, I also created a set of questions which were carefully worded and arranged in a specific order. I therefore took a deductive approach to open-ended qualitative interviewing (Brenner, 2006), given that I drew upon the theoretical conceptualizations and frameworks presented in chapter two to guide the structuring of the interview protocol and my main objective was to investigate my research questions. That is, while sensitive to how the interviewees framed their experiences in the course, through focused questions within the interview (Brenner, 2006) I explored my research questions.

I asked all interviewees the same eight main questions in almost the same order I had written. Based upon my interviewees' answers, I also asked follow-up questions or probed to obtain clarity. To this end, my interview protocol was semi-structured which afforded the advantage of asking all interviewees the same core questions with the freedom

to ask follow-up questions that built on received responses (Brenner, 2006).

To establish rapport and trust, I began the interviews with a general question about the nature of the DE engineering course and the interviewees' decision in enrolling in this course. This first question of the interview was both a "knowledge" and an "experience" question (Patton, 2002). Patton (2002) has suggested beginning interviews with descriptive questions that are relevant to interviewees' current expertise and experience, in order to ease interviewees into the interview and to create a positive climate. In addition, this question served as a "grand tour" question, which enabled me to collect "language sample" from my interviewees' responses (Werner & Schoepfle, 1987). The first question was as follows:

Question 1: How would you describe the difference between this course and other courses you have taken?

[probe: how did this difference effect your decision in enrolling in the course?]

Because the purpose of my research was to examine the nature and significance of live interactions in this multi-site engineering DE course, from the learner interviews I wanted to learn what the learners thought about their interactions with their peers and instructors, and what they considered to be helpful for their learning. To this end I asked questions two and three in order to gain insights specifically about course participants' interactions. These questions were "open-ended" questions in a sense that they did not limit interviewees' responses to presupposed dimensions of feeling or thought (Patton, 2002), and were asked in order to encourage interviewees to speak comprehensively on the topic (Brenner, 2006). These questions with their probes were as follows:

Question 2: In this course you had the opportunity of interacting with remote site students and presenting projects with them, please tell me about your interactions with your peers?

[probes: what you learned, how contributed to the understanding of the material, the discussions]

Question 3: What else did you find rewarding in your interactions with the remote campus students?

[probes: things you learned or appreciated, any social benefits]

Questions four to seven were "opinion" and "value" questions, aimed at understanding what interviewees thought about their experiences and the issues (Patton, 2002) they encountered in the DE course they took. These questions were also open-ended questions, framed in form of *what* questions that cued interviewees to provide their perspectives in their own words (Brenner, 2006). These questions were as follows with their corresponding probes:

Question 4: What did you learn from the cross-cultural experience?

Question 5: What did you find challenging in this course?

[probes: interaction with the remote site learners, work on projects or discussions]

Question 6: What was your favorite part about the course?

[probes: which exercises or presentations]

Question 7: What suggestions do you have about how your experience in this course and your interactions with your classmates could have been improved?

I finished the interviews by asking a final open-ended question that gave the interviewees the opportunity to express any comments about their experience in the DE course not inquired by me in the interview. This final question was as follows:

Question 8: Is there anything else that I haven't asked that you feel would be important to know?

These same interview questions were provided on the Google Form for the remote learners, in the same order but without the probes for the second and the sixth questions, in

order to not bias interviewees' responses. Follow-up questions that served as probes were asked via email after I reviewed the submitted interviews. Please see Appendix A3 and A4 for remote and in person learner interview protocols.

Instructor interview. For this project I only got to interview the instructor from University A. Given the schedule of the other instructors and the international classroom trip at the end of the semester, I was not able to conduct the instructor interviews immediately at the end of the semester. I got to interview the instructor from University A weeks after the semester was over, and by that time considering the other countries' academic calendars and the instructors' other duties, I was not able to conduct interviews with them. However, Instructor A had been teaching this engineering DE course since the DE program's inception at 2009, and his contributions and views reflect those of his colleagues.

I conducted a written interview with the instructor from University A, which was administered via a Google Form. Again, I used Google Forms for ease of delivery and data collection, considering the busy schedule and travels of the instructor. Please see Appendix A1 for instructor interview protocol.

Instructor interview instrumentation. I started the instructor interview with a question about the intended learning outcomes of the course. While through classroom observations I explored this topic in-depth, the interview provided an opportunity to validate these observations with the instructor. The first question which was a general knowledge question was as follows:

Question 1: What were some of the most important learning outcomes that you intended for your students to obtain in this course?

Given my objective in this study was to explore the nature and significance of course participants' interactions, I next inquired about the instructor's intended purposes for

providing interactive activities during the live synchronous sessions. My objective was to verify the purpose and significance of learners' interactions that occurred during the live sessions, and learn from the instructor which type of interactions he found to be more important in terms of influencing learners' learning. These questions, which were knowledge and experience questions respectively, were as follows:

Question 2: What were the intended purposes of interaction (both instructor-student and student-student interactions) during the live sessions (e.g., clarification of material, presentation of material, discussion of material)? Were these purposes realized as intended? Please explain.

Question 3: For your intended purposes, please explain which kind of interaction (instructor-student or student-student) was more important during the live sessions in order to help the students obtain the course objectives?

Next, I inquired about learners' interactions outside of the classroom time, which I did not get to observe. My objective was to learn from the instructor what his expectations and requirements were for these interactions that took place outside the live synchronous sessions in order to find out about their significance and influence on learners' learning. This question which was a knowledge/experience question was as follows:

Question 4: With regards to students' interactions outside of the scheduled classroom time, what were your requirements and/or what outcomes did you expect in terms of their contribution to students' learning of the material?

I ended the interview by asking a final open-ended question that provided the opportunity for the instructor to express any comments about the DE course and learners' experience not inquired by me in the interview. This final question was as follows:

Question 5: Is there anything else that I haven't asked about interactions in your

course that you feel would be important to know?

For both instructor and learner interviews I used the same analysis and coding procedures, explained next.

Interview analysis and coding. For interview analysis I coded the transcribed and written interviews, adapting the coding method for ethnographic fieldnotes explained by Emerson et al. (2011) to the analysis of my case study interview records. Although by drawing upon theoretical frameworks and conceptualizations I took a deductive approach for the structuring of the interview questions in order to investigate my research questions, for the analysis and coding of the interviews I did not start with fixed or pre-established analytic categories common in quantitative studies. Instead I proceeded inductively with the aim of first driving categories directly from the interviews that reflected the significant interaction events and research questions I was exploring. This approach resembles that of grounded theory (Emerson et al., 2011).

To do this, I first read through all the transcribed and written interviews to take in the entire interview record and refresh my memory. I combined this close reading with procedures that are used for analytically coding fieldnotes. Namely, following Emerson et al. (2011) coding procedures, I first "open coded" the interview records by reading through them line-by-line, identifying ideas, issues, and themes they suggested. Therefore, I first relied on the interview records to construct the interview data. After this initial open coding, I turned to "focused coding" by examining in detail the selected themes and by connecting the data to my classroom observations. Through this process of exploration and purposeful selection, I then interpreted my constructed data to provide meaning in relation to the observed events of the live classroom sessions.

TA interview. Beside the structured interviews, I also conducted an informal

interview with the TA from University A. The informal interview, also called unstructured or conversational interviewing, is a flexible and spontaneous way of obtaining information from informants depending upon what emerges from observing a given environment and the conversational flow of the interview (Patton, 2002). While during the informal interview with the TA I took notes, I did not record the interview. This informal interview however, was extremely helpful and enabled me to clarify observations and obtain answers to questions concerning those interactions of course participants that occurred outside of the live synchronous sessions.

Please refer to Appendices A1-A4 for a full copy of the survey and interview instruments.

Ethical Considerations

For the purposes of this study I did not obtain nor was given any private or personal information regarding course participants. For instance, I did not obtain a course roster from each participating site, which would have identified course participants' information such as their names, gender, and final grades. For those who participated in the survey, there was no way of matching their names with their responses, since on the survey they were not asked questions secondary to the main objective of the survey (Appendix A2). For those participants who were interviewed, prior to the interview, I explained the procedures of the study, ensuring the confidentiality of their contributions and the concealing of their identity in the final report of the published project, also explained in the consent form (Appendix B2). Following Brenner's (2006) outlining of items to be included in an informed consent, I made separate consent forms for the survey and the interviews specifying in each (a) the nature of my research, (b) the research procedures for the participants who participate, (c) a description of how their confidentiality will be protected, (d) my contact information where

questions and complaints could be directed, and (e) a description of possible risks and benefits of my research. See Appendices B1-B3 for a full copy of learner and instructor consent forms.

For the recorded videos, it is important to note that I did not record the live synchronous session videos myself, but that these sessions were recorded by the DE program and were made available for learners. I was given access to these videos by the founder of the DE program. However, video records are essentially non-anonymous, unless the images of the participants are masked or filtered (Derry, Hickey, & Koschmann, 2007). Given that these videos were made for course participants, the images could not have been filtered. Therefore, following Derry et al.'s (2007) suggestions, I took all necessary actions to protect the confidentiality of course participants' identities. To this end, I restricted access to the videos and used pseudonyms in this research report for both the course participants, whose interactions I transcribed and included in the text of this report, and the participating universities.

Validity and Reliability

Construct validity. To insure that construct validity was not threatened, drawing on significant DE literature and educational theories and conceptualizations of interaction, I first defined interaction in great detail in terms of specific concepts and related them to the objectives of this present study. I also provided an operationalized definition of interaction in order to clarify what is considered interaction in this present study. In addition, I constructed a detailed criteria based upon the literature review for the purposes of identifying interactive events that occurred during the live two-hour sessions. Please refer to chapter two for a detailed reading of concepts related to interaction.

External validity. Because the main objective of this case study was to explore and

describe the nature and significance of live interactions among course participants in a multi-site DE course, my aim was to ensure threats to analytic generalizability and not statistical generalizability (Yin, 2013). The limited potential of case studies for generalization to larger populations is a known fact in empirical research (Ashley, 2012). Due to my methodological approach then, my objective was not to ensure the generalizability of the findings to other populations. To this end, I made sure that my literature review was comprehensive enough in order to show how the criteria for identifying interactive events and episodes for the present study was derived, and how the findings would fit with existing research concerning interaction in DE.

Reliability. To reduce threats to reliability and thereby minimizing bias and error (Yin, 2013) in the present study, I documented my work thoroughly. For example, I made time-indexed fieldnotes indicating the sequence of events and subevents. The time-indexed fieldnotes included a content log which enabled the identification of discussion topics during the live synchronous sessions for subsequent episode selection. In my notes I also marked all learner-learner and learner-instructor interactions from which the interaction episodes were selected. In a different notebook, I also documented my observations, thoughts, research planning, and the steps that I was taking during the data collection and data analysis phases of this research.

Trustworthiness and Research Quality

The role of a researcher. Qualitative research and especially qualitative interviewing is based upon a personal interaction**,** where who the researcher is and how she or he is viewed by the study participants can potentially influence the information received (Brenner, 2006). As explained earlier, I observed and interviewed undergraduate learners and was introduced to them as a researcher from UCSB. Given the existing power

differentials between me and my interviewees, such as age, race, and gender (Brenner, 2006), the research and the interviews were carried out smoothly. For example, while all interviewees were of a different ethnic background than mine (i.e., not Armenian), this did not seem to impede the flow of the interviews and the depth of the interviewees' contributions, probably due to the age difference and the similarity of my appearance to theirs. Being a young graduate learner, my interviewees recognized the small age difference and some asked about my research and knew that I was a graduate learner. This in some ways benefited my research, in that my interviewees seemed to feel comfortable and spoke more than I did during the interviews, which is a characteristic of a good interview (Brenner, 2006).

While, I did not have personal interaction with remote learners and those who did not participate in the follow-up interviews, because I attended five of the sessions in person, I was captured in the recorded lectures, always sitting in the same location at the end of the class. Again, it is highly probable that my age and the similarity of my appearance with those of learners, visible from the recorded videos, reduced the effect of the power differentials and contributed to high rates of survey participation.

Member checking and researcher bias. Establishing the trustworthiness of research in the qualitative tradition is a way of ensuring the quality of the research (Brenner, 2006). Following Brenner's (2006) suggestions for ensuring research quality and reducing researcher bias, I engaged reliable sources for member checking and for reviewing and examining my constructed data and analysis. For learner interviews I conducted member checking to confirm my interpretations of meaning with interviewees' perceptions. To do this, I presented the outcome of my analysis to the TA of the course and one of the interviewees from University A (Sarah) to review my written report of learner interviews and

see if my interpretations were correct. Based on their comments and feedback I made corrections to my interview report and elaborated on my descriptions to provide a more accurate account of the interviews.

To reduce researcher bias, I also discussed every step of my research process with a researcher from UCSB and pre-tested my survey questionnaire and the interview protocol with the same researcher to ensure that I had structured good questions for obtaining maximum information from the interviewees that could be used for answering my research questions. In addition, I presented my constructed data for review to other UCSB scholars and applied their recommendations and feedback.

Chapter Summary

This case study research sought to explore and describe in-depth the nature and significance of live interactions among course participants in a multi-site engineering DE course, where learners across geographical distances engaged in interactive learning during live synchronous sessions. Classroom observations and artifact analysis enabled me to explore the research questions and investigate the significance of live interactions that influenced learners' learning. I also conducted survey and interviews in order to take observations and ideas from the live interactions and validate and explore them with course participants. This triangulation of methods and sources was particularly helpful for confirming emerging findings and contradictions, discussed in the following chapters.

CHAPTER FOUR

FINDINGS

With the availability of advanced internet technologies, new approaches to teaching and learning have become possible, especially in DE. While educators are experimenting with different instructional designs and possibilities, fewer studies have examined live synchronous interaction in DE in-depth in order to inform practice and instructional design. This study examined the nature and significance of instructional interactions among course participants in a multi-site engineering DE course with the intent to provide insights concerning new possibilities for instructional design in DE. To explore how the nature of course participants' interactions reflected the course design and instructors' intentions for learning outcomes as well as the significance of these interactions that influenced learners' learning, I first observed the classroom live sessions and investigated the instructors' intent in providing opportunities for interaction. Then I examined interaction events in greater detail in order to find out their significance.

I examined the following research questions:

1. How does the nature of interactions among course participants reflect the course design and instructors' intentions for learning outcomes?
2. What are the significance of course participants' interactions during live synchronous sessions that influence learning?

To investigate these questions, I observed the live synchronous sessions of the course, which took place over a period of 15 weeks. Of the 15 weeks I made only five observations in person at one of the participating universities (University A). My observations of these scheduled synchronous sessions were done by watching the course recorded videos (28 h of

video record). To examine in-depth the nature and significance of course participants' interactions I conducted video analyses. Artifact analysis of available course material throughout the research process guided and informed my investigation. In addition to observations and artifact analysis, I surveyed the learners and conducted follow-up interviews of select learners and one of the instructors. Surveys and interviews complemented the observations and enabled me to validate my observations and ideas with course participants. Of the 43 potential participants, 30 learners responded to the surveys, resulting in a response rate of 70%. Of the 30 learners who took the survey, seven participated in the follow-up interviews. I only interviewed the instructor from University A, who was the founder of the DE program. This triangulation of methods in turn contributed to a deeper understanding of the phenomenon under investigation.

Classroom Observations and Artifact Analysis Findings

In the following sections I present findings from classroom observations of participants' live synchronous sessions. I present these findings in conjunction with artifact analysis findings especially when discussing the nature of course participants' interactions. It is important to note here that I present survey and interview findings separately and triangulate results from survey and interview findings with classroom observations and artifact analysis findings at the end of this chapter. To this end, for the purposes of this research study I mainly relied on classroom observations and used the survey and interview data in a complementary way to validate observations and triangulate findings.

Nature of Course Participants' Interactions that Reflected Course Design and Instructor's Intentions for Learning Outcomes (Research Question 1)

Classroom observations of course participants' interactions and artifact analysis were the main methods I used for examining the nature of course participants' interactions. For

classroom observations I could only observe the live synchronous sessions. I did not have access to course participants' interactions that either occurred outside the classroom time or on Slack, the virtual platform that was used for peer discussions especially during the live synchronous sessions. However, I had 28 hours of video record of the live synchronous sessions, which I observed and took detailed notes. In addition to the recorded videos, the five observations that I made in person at University A enabled me to get a sense of how the live interactions were carried out in the actual classrooms. The in person observations complemented the video analysis and provided a different opportunity for analyzing the nature of interactions. The artifact analysis also complemented classroom observations and was especially helpful for revealing the DE program's pedagogy and therefore illuminating the nature of interactions that reflected the course design. While for artifact analysis I used all available resources, such as course lecture slides, course website, and the DE program's blog, in particular the course syllabus which in great detail described the DE program's pedagogy, the DE program's website, and some papers and presentations of the DE program were the instrumental resources for this analysis.

To examine the nature of interactions, while watching the recorded videos I made time-indexed fieldnotes that contained a content log of classroom interactions for each week. The content log consisted of a brief description of the content of course participants' live discussions. I noted discussion topics and main points from course participants' dialogue next to the column where I recorded the time for main discussion topics and sub-topics. I also identified all learner-instructor (LI) and learner-learner (LL) reciprocal exchanges for subsequent analysis of the significance of these live interactions. The topic markers enabled me to identify the boundaries of interaction events from which episodes of interaction were selected for presentation in the text of this research study. From the time-indexed fieldnotes

and content logs I made event maps for each week's live synchronous session. These event maps succinctly reflected the overall classroom instructional activities and exchanges in a chronological order. Because the event maps showed the flow of instructional exchanges they were instrumental in the analysis of how the nature of interactions reflected the course design.

As stated previously, this DE course was selected because interaction for learning was emphasized in this course and was purposefully incorporated into the design of the course. The identification of reciprocal exchanges and the construction of event maps served as preliminary analysis for examining whether and to what extent the different types of instructional exchanges occurred in this DE course during the live sessions. Below I first discuss the overall distribution of the live reciprocal exchanges for the entire course (Table 4.1) and the frequency of reciprocal exchanges from each participating university (Table 4.2), which gives a general idea of the frequency and the nature of the live interactions over the 15 week period. Then I discuss the instructional exchanges of three live sessions in greater detail. For these three live sessions I present the event maps I had constructed which in detail show the flow of instructional exchanges during these live sessions. The first event map is from the live session that occurred on week six (10.05.15) and is representative of live sessions led by Instructor A (Table 4.3). The second event map is from the live session that occurred on week 14 (11.30.15) and is representative of live sessions led by Instructor B (Table 4.4). The third event map is from the live session that occurred on week 13 (11.23.15) and is representative of learners' team presentations led by Instructor C (Table 4.5).

Table 4.1

Outline of Learners' Reciprocal Exchanges during Live Synchronous Sessions

Live Synchronous Sessions' Week and Date	Number of Different Types of Reciprocal Group Interactions	Reciprocal Interactions Total
Week 1 (8.31.15) – Instructor A	1 LI (learner initiated)	1
Week 2 (9.7.15) – No Class	---	---
Week 3 (9.14.2015) – Conference	3 LI (instructor initiated) 4 LI (learner initiated)	7
Week 4 (9.21.2015) – Discussion led by TA from University A	9 LI (instructor initiated) 1 LLm (10 LL) 1 Ld	19
Week 5 (9.28.15) – Instructor A	1 LI (instructor initiated) 12 LI (learner initiated) 2 LLm (3 LL) 2 Ld	16
Week 6 (10.05.15) – Instructor A	2 LI (instructor initiated) 18 LI (learner initiated) 2 LLm (6 LL) 2 Ld	26
Week 7 (10.12.15) – Instructor A	5 LI (instructor initiated) 14 LI (learner initiated) 2 LLm (9 LL) 1 Ld	28
Week 8 (10.19.15) – Instructor A	9 LI (instructor initiated) 11 LI (learner initiated) 1 LLm (3 LL) 1 Ld	23
Week 9 (10.26.15) – Instructor B	8 LI (instructor initiated) 2 LLm (5 LL) 2 Ld	13
Week 10 (11.2.15) – Instructor C – Cross-cultural Exercise 1	1 LLm (7 LL) 1 Ld 7 LLp (0 LL)	7
Week 11 (11.09.15) – Instructor B	4 LI (instructor initiated) 2 LI (learner initiated) 10 LLp (2 LL)	8
Week 12 (11.16.15) – Instructor B	19 LI (instructor initiated) 5 LI (learner initiated) 1 LLm (4 LL) 1 Ld	28
Week 13 (11.23.15) – Instructor C – Cross-cultural Exercise 2	7 LLp (26 LL)	26
Week 14 (11.30.15) – Instructor B	11 LI (instructor initiated) 3 LI (learner initiated) 1 LLm (9 LL) 1 Ld	23
Week 15 (12.7.15) – Final Project Presentations	6 LLp (3LL)	3

*Learner-instructor interaction (LI) Learner-learner interaction (LL)
Learner-learner mediated (LLm) Learner presentation (LLp)
Learner discussion in groups (Ld)
Reciprocal Interactions → LI & LL

As stated previously, I first examined the reciprocal exchanges that occurred during the live synchronous sessions. Reciprocal exchanges included at least two individuals and two actions, such as a comment or a question and a corresponding reply, thereby affecting an influence (Anderson, 2008). In Table 4.1 I present an outline of these live reciprocal exchanges showing their distribution. This outline reflects some characteristics of the live sessions and reveals the nature of interactions in this DE course.

There were a total of 228 reciprocal exchanges during the live synchronous sessions. Of these 228 reciprocal exchanges 141 (about 62%) were learner-instructor interactions and 87 (about 38%) were learner-learner interactions. Of the 141 learner-instructor interactions 70 were learner initiated and 71 were instructor initiated. As shown in Table 4.1, with the exception of week eight, the number of reciprocal exchanges increased with each week during the first half of the course where Instructor A was leading the live sessions. This could mean that either the learners felt more at ease to communicate or they could contribute more to discussions as the course progressed. The same pattern occurred with Instructor B. There was an initial drop in the number of reciprocal exchanges when he first started leading the live sessions. However, the last sessions led by Instructor B have the same number of reciprocal exchanges as Instructor A's last sessions. This preliminary analysis then revealed that interaction among course participants occurred consistently each week and the number of these interactions increased with each instructor.

It is important to note here that I did not count individual exchanges of learners' presentations. While presentations were a form of group interaction, for the purposes of this study I counted and examined those reciprocal exchanges that had an immediate reply within the reciprocal exchange. For example, on week 13, which was a learner presentation day, there were seven presentations. However in Table 4.1 I have noted 26 learner-learner

interactions. That is, I did not count the presenters' dialogue but only counted the reciprocal exchanges during presentations that followed the operationalized definition of interaction constructed for this study. Conversely, the live synchronous sessions included guided activities which are identified as LLm in Table 4.1. These activities were facilitated by instructors or the TA. However, because learners' exchanges during these guided activities were addressed to other learners and not to instructors, I have counted these interactions as learner-learner and not learner-instructor interactions.

The number of the reciprocal exchanges during live sessions also showed another pattern. Whereas with Instructor A most learner-instructor interactions were initiated by learners, with Instructor B most learner-instructor interactions were initiated by Instructor B. Video analysis of live session interactions revealed that instructor initiated interactions seemed particularly significant in the context of this multi-site DE course, given that remote learners (from the session leading instructor's stand-point) in general did not regularly participate in live sessions in order to contribute to discussions. To this end, it was at times necessary for instructors to actively direct questions to remote sites in order to engage them in the live discussions. However classroom observations revealed that University A learners participated more often in the live discussions in comparison to University B and C learners. Most of the reciprocal exchanges that occurred during the live synchronous sessions were with University A learners. In Table 4.2 I present a breakdown of these reciprocal exchanges showing the frequency of these exchanges from each participating university. For each week while watching the recorded live sessions I identified the reciprocal exchanges, noting the university of learners who made the comments or the questions. For example, when a learner from University A made a comment in my notes I wrote "comment from University A learner." This way I was able to then count the number of reciprocal exchanges from each

participating university which I have presented in Table 4.2.

Table 4.2

Frequency of Reciprocal Interactions from Each Participating University

Participating University	Frequency of Reciprocal Interactions
University A	147
University B	34
University C	47

As shown in Table 4.2, of the 228 interactions 147 were with University A learners (about 65%), 34 were with University B learners (about 15%), and 47 were with University C learners (about 21%). That is, University A learners were regular contributors to the live discussions and actively commented and asked questions during the live two-hour sessions. This contrast between the universities was notable, and I explored this issue further in the learner interviews, presented in the following sections. Conversely, it is possible that given Instructor A led the first five synchronous sessions, University A learners, being in the same site as Instructor A, felt more comfortable to communicate and interact and therefore adapted faster to the multi-site nature of the course. In particular, they initiated more learner-instructor interactions and continued their active participation in the second half of the course when Instructor B was leading the sessions.

To show the flow of instructional exchanges during the live synchronous sessions I next present three event maps constructed from the live sessions. These three instructional days each were led by one of the instructors. The two live sessions led by Instructors A and B are representative of their session leading weeks. While these instructors had different styles of presentation, the classroom observations revealed that in general their approach to leading the live sessions were similar. To this end, while each event map is representative of

that instructor's teaching style, the two event maps are also representative of live synchronous sessions where the instructors led the sessions. Similarly, the event map of learners' presentation week is representative of the other two presentation weeks led by Instructor C.

Classroom observations revealed that Instructors A and B did not lecture during the live synchronous sessions but engaged in dialogue with learners and led guided activities with regards to course concepts. As shown in Tables 4.3 and 4.4, both instructors started the live sessions with announcements and feedback concerning learners' out of classroom interactions and assignments. Then, the instructors led the live sessions by reviewing concepts the learners were supposed to have learned during the week prior to the start of the live session. Learners' learning of the material and their engagement with other learners on exercises prior to the live synchronous sessions then was crucial to the live discussions because it enabled the learners to be informed and to regularly contribute to the discussions. However, there was a minor difference in the way Instructors A and B incorporated guided activities. Whereas Instructor A presented questions for learners to discuss in groups on Slack and had them report their group discussions to the class, Instructor B had learners discuss their upcoming projects and analysis reports in their groups and report their progress to the class mainly addressing the instructor himself and receiving feedback from him.

Finally, Table 4.5 shows the flow of learners' live interactions on one of learner team presentation weeks (week 13). Of the thirteen live sessions where instructional activity occurred, three sessions were presentation days where the instructional activity consisted of only learner team presentations. On these weeks learners presented their team projects and after each team presentation learners posed discussion questions for their peers across the three campuses. The nature of learners' interactions on this presentation week is

representative of the other two learner team presentation weeks (weeks 10 & 15).

Table 4.3

Event Map of Instructional Activity on Week Six (10.05.15) Led by Instructor A

Time	Instructional Activity	Content Log
00:15:09	Instructor A starting session	*Announcements and feedback -Cross campus exercise on software -Campus participations, percentage from each campus, University A highest and overall of 69% -Participation in peer discussion and pain index
00:31:08	Presentation on how to change profile and login on Slack	*Learner and TA explaining different features of Slack LI 1 (learner initiated) LI 2 (learner initiated) LI 3 (learner initiated)
00:47:55	Instructor A continuing live session	*Going over course concepts discussed previously -Second phase of S curve, explaining life cycle -Dominant design -Product performance -Hyper competition -Segment Zero LI 4 (learner initiated) LI 5 (learner initiated) -Mainstream market in 3 stages LI 6 (instructor initiated) LI 7 (instructor initiated) LI 8 (learner initiated) LI 9 (learner initiated) LI 10 (learner initiated) -Outsourcing LI 11 (learner initiated)
01:05:23	In class group exercise 1	*Instructor A explaining the exercise on mainstream market -Learners getting in groups on Slack to discuss the exercise questions (LLd) -TA explaining Slack features LLd
01:16:15	Instructor A going over the exercise with the different teams (LLm)	*Learner discussion responses (LL) -Learner from University A responding on smart phone (LL 1) -Learner from University C responding (LL 2) -Learner from University A responding on 3D printing (LL 3) -Learner from University C responding on Facebook (LL 4) -Learner from University A responding

		(LL5) -Learner from University C responding on Coca-Cola (LL 6) -Instructor A's comments in between learner responses -LI 12 (learner initiated)
01:25:55	Instructor A continuing	*Explaining reason for exercise 1 -Segment zero -LI 13 (learner initiated) -LI 14 (learner initiated) -LI 15 (learner initiated) -LI 16 (learner initiated) -LI 17 (learner initiated) -LI 18 (learner initiated) -LI 19 (learner initiated) -LI 20 (learner initiated)
02:00:50	In class group exercise 2	*Instructor A explaining the exercise - Learners are placed in groups to discuss 4 questions on Slack -TA explaining link for the exercise -No time for discussion of responses Instructor explaining the process of learning
02:10:30	End of session	

Table 4.4

Event Map of Instructional Activity on Week 14 (11.30.15) Led by Instructor B

Time	**Instructional Activity**	**Content Log**
00:11:49	Instructor A starting session	*Announcements and feedback -TA announcing UCSB survey
00:14:15	Instructor B starting live session discussion	*Going over assignments -Industry analysis report -Discussing provided videos -Going over last week's discussion, explaining patent laws, big data and artificial intelligence -Example of self-driving car LI 1 (instructor initiated)
00:33:00	Instructor B continuing	*Instructor B discussing a new topic -S curve -Talking about computers predicting human behavior
00:37:42	Showing video 1	*Discussing technology prediction and identifying trends from video LI 2 (instructor initiated) LI 3 (instructor initiated)

00:50:05	Instructor B continuing	*Discussing big data -S curve application to different fields LI 4 (instructor initiated) LI 5 (instructor initiated) LI 6 (instructor initiated) LI 7 (instructor initiated) LI 8 (instructor initiated) -Going over examples of industry report in biology
01:26:00	Showing video 2	*Discussing becoming a different species from video LI 9 (instructor initiated) LI 10 (instructor initiated) -Explaining the analysis report LI 11 (instructor initiated)
01:32:10	In class group exercise 1	*Telling learners to do an exercise with their groups and report in 5minutes -Learners getting in groups to discuss the exercise questions (LLd)
01:44:00	Instructor B going over the exercise with the different teams (LLm)	*Learner discussion responses (LL) -Learner from University C responding (LL1) -Different learner from University C responding (LL2) -Different learner from University C responding (LL3) -Different learner from University C responding (LL4) -Learner from University A responding (LL5) -Different learner from University A responding (LL6) -LI 12 (learner initiated) -Different learner from University C responding (LL7) -Different learner from University A responding (LL8) -LI 13 (learner initiated) -LI 14 (learner initiated) -Different learner from University A responding (LL9) -Instructor B comments in between learners' responses -Instructor B presenting final comments
02:13:34	End of session	

Table 4.5

*Event Map of Instructional Activity on Week 13 (*11.23.15*) Led by Instructor C*

Time	Instructional Activity	Content Log
0:05:00	University C team A1 presenting	*6 learners presenting on the status of TPP (the Trans-Pacific Partnership) -Presenting discussion question LL 1
0:22:00	University A team A1 presenting	*4 learners presenting on China one child policy law -Presenting discussion questions LL 2, LL3, & LL4
0:37:00	University A team A2 presenting	*4 learners presenting on China and Taiwan relations -Video Presentation -Presenting discussion questions LL5, LL6, & LL7
0:54:00	University B team presenting	*2 learners presenting on TPP (the Trans-Pacific Partnership) -Showing a video before presentation -Presenting discussion questions LL8, LL9, LL10, LL11, LL12, LL13, & LL14
1:13:00	University C team A2 presenting	*2 learners presenting on Immigration -Presenting discussion questions LL15, LL16, LL17, LL18, LL19, LL20, & LL21
1:31:00	University A team B1 presenting	* 2 learners presenting on China one child policy -Presenting Discussion question LL22, LL23, LL24, & LL25
1:49:00	University A team B2 presenting	*6 learners presenting on textbook controversy and protest in Taiwan -Presenting Discussion questions LL 26
2:02:00	Instructor C commenting and finishing session	*Giving feedback on presentations -Commenting on how the discussions need to be more interactive and stimulating -Instructor A commenting on lack of discussion, how there were similar projects which learners could have arranged for a debate to show the different side of the story

In Tables 4.3, 4.4, and 4.5, I have shown the distribution of the live reciprocal exchanges that I briefly presented in Table 4.1. In the following sections I present the

transcripts of some of the live reciprocal exchanges which in greater detail show the nature of these live interactions. However, these event maps which represent the instructional flow of the live synchronous sessions show that in this DE course the live synchronous sessions were not utilized for delivery of subject content but mainly served as an instructional space for course participants' live discussions of subject content.

To further explore the nature of course participants' interactions and triangulate findings, I sought to learn from course participants - mainly the instructors - the significance they ascribed to the live interactions. The artifact analysis revealed that the instructor from University A, who was also the founder of the DE program, held a social constructivist view of learning, where knowledge is seen to be a social construct and learning an interactive process. While acknowledging the importance of different types of interaction, such as learner-instructor, learner-computer, and learner-learner (peer-learning) - all of which correspond with Moore's (1989) model of instructional exchange - for the purposes of his DE program, Instructor A emphasized peer-learning and provided opportunities for learners across the different geographical sites to engage in interactive and collaborative activities, as shown in Tables 4.3, 4.4, and 4.5.

From Instructor A's perspective interactive peer-learning was important because it generated "contextual understanding" of course concepts. Instructor A during one of the live sessions explained the importance of contextual understanding by noting that "in the global environment [learners] need to have more knowledge about the things around the content subject," i.e., context (See Appendix C1 for complete transcript of this discourse). Artifact analysis further illuminated the DE program's pedagogy by revealing that whereas subject content can be learned *from* instructors, contextual understanding is developed *with* peers. In addition, because this DE program's pedagogy held that learning depended upon whom

the learners learned with, interactive and international learning was emphasized and promoted, based upon the belief that diversity increased learning opportunity for all course participants. Learners' contributions to discussions and projects influenced by their diverse backgrounds then in this course enabled contextual understanding of the subject content (i.e., principles and practices of global innovation), which cannot be gained from content knowledge only. In order for learners to acquire contextual understanding however, after learning the course content prior to the live sessions, learners in this course engaged in collaborative and interactive activities with peers to co-construct contextual understanding of subject content.

Throughout the semester all three instructors emphasized the importance of interaction for learning and encouraged the learners to engage in more interaction with one another. In particular, Instructor A explained the importance of interaction for the purposes of his DE program by engaging in a meta-discourse regarding interaction. Through this meta-discourse, Instructor A continuously explained the significance of interaction for learning, especially in the context of his engineering course. This meta-discourse revealed the instructors' intentions for learning outcomes as well as the significance of peer interactions for learners' learning. This meta-discourse also influenced learners' thinking and was taken up by learners, as shown in the interview responses of some of the learners presented in the subsequent sections.

In particular, this meta-discourse clarified what the nature and purpose of the DE program was, in turn illuminating possibilities in DE, in general, and the new purposes DE can serve given available advance internet technologies. In what follows I present a segment of the meta-discourse used by Instructor A regarding the significance and purposes of interaction in this multi-site engineering DE course. This meta-discourse occurred during a

review session on week 11 (11.09.15). This review session did not occur during the two-hour synchronous sessions for the three participating universities but was made available for learners on the course website. What was said in this review session was previously said during the course live sessions. However, because this meta-discourse was comprehensive I present a segment of this discourse as opposed to a brief version of the same discourse from the two-hour live synchronous sessions. Please refer to Appendix E for the transcription guide to all transcribed dialogues presented in the text of this research study report.

Episode 1: Instructor A's meta-discourse about interaction from week 11

Line #	Speaker	Discourse
1	Instructor A:	if you view knowledge as a social construct
2		then learning becomes an interaction process
3		so learning is not a transmission process…
4		there are many different ways to interact
5		however there is a very important kind of interaction which we focus here
6		that is called the peer interaction
7		when a student interacts with a student
8		this is really what we are focusing on in this class
9		so if you look at the peer interaction
10		there are also different types…
11		we want to experiment something very different
12		we want to be able to learn from the difference
13		in other words we purposely put students
14		who think very differently on the same subject together
15		because our purpose is not to enhance content understanding
16		but rather try to enhance their contextual understanding of each other

Lines 1-2, illustrate Instructor A's social construction view of knowledge, where learning is equated with the interaction process itself, signifying the importance of interaction not only from the perspective of constructivism, but also for the instructor with regards to his intended learning outcomes (lines 11-16). He emphasized the importance of peer interactions (lines 5-8), explaining that the purpose of interaction was to enhance

learners' contextual understanding of course concepts (lines15-16). Because peer interaction was crucial for the intended learning outcomes of this course, Instructor A's meta-discourse served to provide understanding for learners concerning the nature and the purposes of peer interactions in order to encourage and facilitate these interactions. (See Appendix C2 for complete transcript of this discourse).

After exploring the instructors' intentions for providing opportunities for peer interaction along with their purposes for intended learning outcomes, I then further examined the nature of these peer interactions to investigate how they reflected the course design. During the live synchronous sessions, Instructor A explained for learners the "Learning Cycle" of the course in which they were to engage in weekly. That is, apart from the live synchronous sessions, throughout the week, the learners in this course interacted with one another for their collaborative projects and exercises outside the scheduled classroom sessions. The explanation of the Learning Cycle clarified the extent and the nature of these peer interactions, which was designed to support the intended learning outcomes of the course.

The Learning Cycle consisted of five phases that mainly occurred during the week, outside the scheduled synchronous sessions. Most of these peer interactions occurred either on *Slack*, a virtual platform made available for course participants, or via email. The peer interactions outside scheduled synchronous sessions then occurred through both synchronous and asynchronous technologies. The interactions on *Slack* were not recorded and consequently were not available for research observations. While I did not observe any peer interactions - both synchronous and asynchronous - that occurred during the Learning Cycle, here I present Instructor A's explanation of the Learning Cycle, which clarifies the intended nature of course participants' interactions outside of the scheduled synchronous sessions.

Figure 4.1 displays an image of this Learning Cycle, obtained from the course lecture slides, which was also published on the DE program's website.

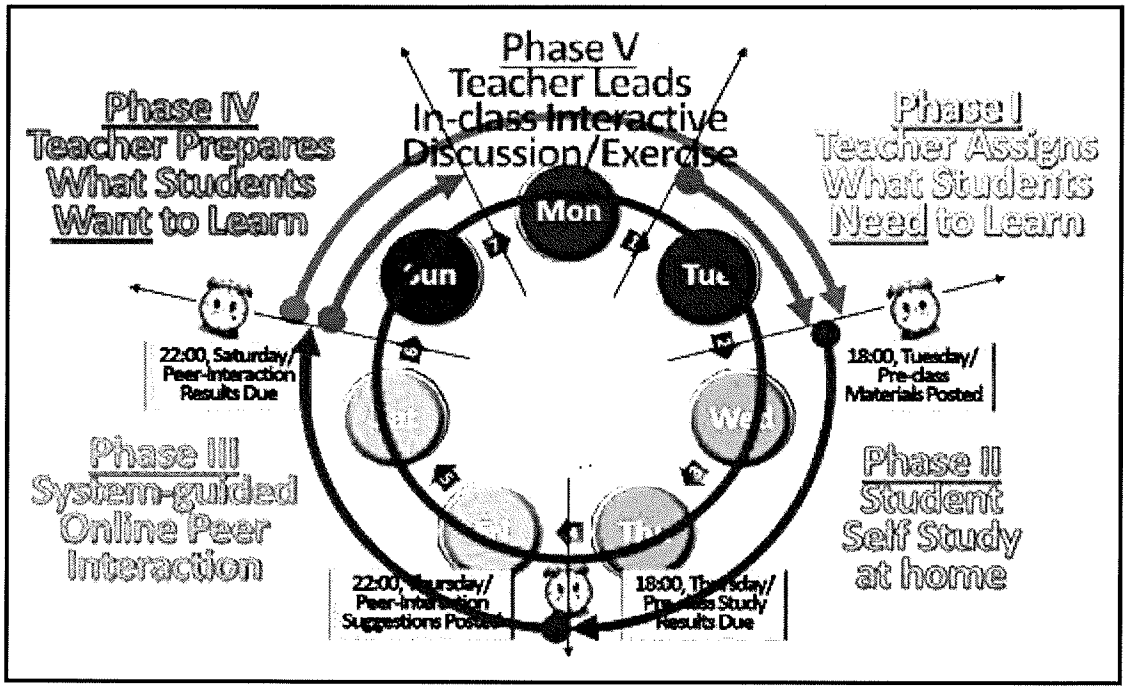

Figure 4.1. Learning Cycle for peer interactions, obtained from Instructor A's lecture slides.

According to Instructor A's explanations given on week 1(08.31.15), Phase 1 of the Learning Cycle was marked by instructors' assigning of what the learners needed to learn on the course website. After the end of each synchronous session, which in this course was on Monday, the instructors posted reading materials, online lectures (including relevant MOOC materials), and slides pertaining to the topic of discussion. During Phase 2, the learners were to study the posted material on their own in order to acquire the content knowledge with regards to course concepts. By the end of Phase 2 (about 2 ½ days), learners were to enter their individual feedback into the course system, responding to questions about the posted material. Learners were then grouped based upon their answers, where learners with different answers and understanding of the posted material were placed in the same small groups for discussion with peers. This peer matching marked the beginning of Phase 3,

where peer interactions in groups occurred. This peer matching enabled learners to revise their understanding of the posted material and to discuss and explain difficult concepts. In Phase 4, the instructors reviewed responses of peer interactions posted on the course system. Based upon feedback from learners' peer interactions, the instructors prepared what the learners needed to learn next, and led the in-class interactive discussion sessions accordingly, marked by Phase 5.

Instructor A explained that to engage in the Learning Cycle with international classmates, learners had to be prepared by learning the material on their own, in order to be able to contribute to each other's (contextual) understanding of the course concepts. The Learning Cycle then represented a form of inverted or flipped[4] learning, where learners' direct engagement with subject content occurred outside the live synchronous sessions. To this end, Instructor A, in a different meta-discourse about interaction, which occurred at the beginning of the semester (08.31.15), explained the objective of the course by pointing out the importance of peer interactions for co-constructing contextual understanding of subject content. "This class is not supposed to really give you pages after pages of power point, but rather to provide an environment where you can work together with people who are very different from you." While, the peer interactions during the Learning Cycle did not always clarify the difficulty of the course concepts, they were still viewed as being crucial in fostering in-depth contextual understanding of these concepts. To this end, the TA from University A, in an informal interview (Patton, 2002) concerning peer interactions during the Learning Cycle observed the following: "sometimes they [learners] end up more confused, but on the whole, there are big increases in student understanding." This observation was

[4] In literature inverted and flipped learning are used interchangeably referring to the same learning approach. In the text of this study I mainly use the term inverted in relation to this learning approach, especially because this term was used by the founder of the DE program.

made based upon evaluations of learners' weekly feedback.

Further artifact analysis revealed that apart from the objective of having learners co-construct contextual understanding with peers from different universities and backgrounds, the instructors also intended for learners to learn from different instructors with various academic and cultural backgrounds. Instructor A in one of his meta-discourses about interaction noted that learning from different instructors can expand learners' knowledge and can add to their experience. The excerpt below is taken from Instructor A's meta-discourse given on week 7 (10.12.15). In this episode Instructor A explained that learning from instructors with diverse backgrounds and teaching styles can increase learning opportunities for learners.

Episode 2: Instructor A's meta-discourse on learning from different instructors from week 7

Line #	Speaker	Discourse
17	Instructor A:	starting from phase two
18		you can tell from the schedule both session A and session B[5]
19		will be led by a different faculty
20		and this is a new experiment that we started several years ago
21		not only we want you to learn with students from different campuses
22		we also want you to learn from faculty from different campuses
23		because faculty have a different kind of teaching style
24		they have different kind of expertise
25		it will be fun for you to get use to this kind of different style
26		and then you can also try to learn from the differences

Given for the obtaining of the intended learning outcomes of the course, peer interactions were emphasized both during live sessions and outside classroom time, learners' live session attendance while not mandatory was highly encouraged. Classroom observations revealed that learners regularly attended the live sessions. That is, classroom

[5] This research project was conducted in the session B course. Session A was the same course taught in the morning with learners from different campuses.

observations via the recorded videos did not show any significant amount of absentees and classroom images showed the same learners present at each site. In person observations at University A also verified these findings. Conversely, artifact analysis revealed that a significant portion of learners' final course grade depended upon learners' active participation in the live discussions and their interactions with peers especially during the lives sessions. This in turn ensured live session attendance.

Research Question 1 Summary

In summary, based upon classroom observations and artifact analysis the nature of interactions in this multi-site DE course reflected a course design that relied on and utilized peer interactions for the obtaining of the course intended learning outcomes. To this end, the live synchronous sessions were not used for the delivery of subject content but were used as an instructional space for course participants' discussions and guided interactions. To enable more productive synchronous sessions learners engaged in guided virtual discussions during the week and learned the subject content prior to the synchronous sessions.

Specifically, peer interactions with diverse and international learners both during synchronous sessions and outside the classroom time (i.e., nature of interactions) were meant to enable the intended learning outcomes of this multi-site engineering DE course by enabling learners to co-construct contextual understanding of course concepts. Based on the pedagogy of this course, contextual understanding did not come from content knowledge only. Rather it was realized through interaction with peers who were from different academic and cultural backgrounds, where their contributions to peer and synchronous session discussions arising from their differences would enhance the learning of their peers. It was to this end that opportunities for peer interactions were provided both during the live synchronous sessions and outside the classroom time. This way, course participants from the

three campuses could benefit from the contributions of their peers during guided activities and their peer discussions that occurred during the week.

However, to enable contextual understanding of course concepts, learners were to learn the subject content on their own during the week prior to their live synchronous sessions. This learning of course concepts prior to the synchronous sessions reflected a course design that entailed an inverted approach to learning. The inverted approach to learning in turn allowed for more informed contributions based on learned material. Therefore, learners' learning of course concepts prior to the live sessions and their engagement in different peer interactions, both during the week and the live synchronous sessions, reflected a course design that relied on peer interactions for the obtaining of the intended learning outcomes of the course which the inverted approach to learning made possible.

Finally, the live synchronous sessions also provided an opportunity for the learners to learn from different instructors, who in turn brought different academic backgrounds and teaching styles to the learning environment. This provided yet another opportunity for the learners to learn from the differences. Therefore, interaction with instructors and learners from different academic and cultural backgrounds reflected a course design that emphasized diversity and intercultural interaction for the obtaining of the intended learning outcomes of the course, i.e., the acquiring of contextual understanding of course concepts.

Significance of Course Participants' Interactions that Influenced Learning during Live Synchronous Sessions (Research Question 2)

After investigating the nature of course participants' interactions that reflected course design and instructors' intentions for learning outcomes, I then examined the significance of the live synchronous interactions that influenced learning in order to then explore new

possibilities for instructional design in DE. By analyzing participants' interactions during the live synchronous sessions, I wanted to understand the ways in which the live interactions contributed to knowledge construction among course participants and thereby influencing learners' learning, as well as the immediate effect of instructors' providing of guidance, constructive feedback, and scaffolding on learners' learning of the course concepts. Viewing course participants' interactions through a social construction of knowledge lens, I explored course participants' live synchronous interactions and offer my interpretations with regards to the significance of these interactions.

To examine the significance of live synchronous interactions that influenced learning based on the same criteria constructed for identifying reciprocal exchanges, I then selected those interactions that more clearly illustrated the significance of the live interactions. That is, for a more detailed analysis, presented below, I selected reciprocal exchanges that seemed purposeful and constructive and which promoted a meaningful learning experience. Briefly, these reciprocal exchanges were interactions that had the following characteristics: (a) pertained to course concepts or the objectives of the course, (b) revealed engagement with subject content, (c) contributed to learners' construction of disciplinary knowledge accompanied by instructors' guidance or scaffolding, (d) encouraged discussion and reflection with subject content, (e) revealed course participants' skills, experiences, disciplinary knowledge, or cultural background (i.e., mental representations). I further noted in my criteria that these exchanges may include the challenging of ideas, may be informative in nature revealing new perspectives, or may involve negotiation, social sharing, or creation of group meanings. It is important to note that in my constructed criteria I specified these distinctions for clarity. That is, there is an overlap among these characteristics which I separated for research quality and ease in identification of representative interactions.

Classroom observations revealed that the live synchronous two-hour sessions were mainly designed and utilized for the following purposes: (a) to discuss course concepts based upon weekly feedback obtained during the Learning Cycle, (b) to engage in interactive dialogue with learners to clarify or explain course concepts, and (c) to have learners present team projects and engage in in-class group exercises. In what follows I present specific examples (episodes) of course participants' interactions selected based upon the constructed criteria, to show the significance of the live synchronous interactions. With these episodes I describe and show how through interaction participants co-constructed disciplinary knowledge that facilitated their contextual understanding of the course concepts. These live synchronous interactions were in form of learner-instructor and learner-learner instructional exchanges (Moore, 1989) that supported both face-to-face and computer mediated collaborative learning between two or more participants (Dillenbourd, 1999). I present these learner-instructor and learner-learner interactions separately.

Learner-instructor interactions. The live synchronous sessions provided an opportunity for the instructors and learners to engage in live interactive dialogue, where all participants could benefit from the outcome of these live instructional exchanges. Due to advanced internet technologies that enabled the live interactions across the three sites, the learner-instructor exchanges were similar to those occurring in traditional classrooms. These learner-instructor exchanges were either initiated by instructors or by learners. For an interaction to have been considered as a learner-instructor interaction there had to be a comment or a question that was followed by a corresponding reply. For instance, in the following episode which occurred on week 7 (10.12.15), after explaining a concept, Instructor A engaged the learners in a dialogue in order to guide the learners in constructing the new knowledge they were acquiring in the course. This episode was selected because it

exemplified interactions where the instructor by providing his scaffolding and guidance contributed to learners' construction of disciplinary knowledge and the reciprocal exchange pertained to course concepts. This episode contains two instructor initiated learner-instructor interactions.

Episode 3: Instructor initiated dialogue featuring Instructor A from week 7

Line #	Speaker	Discourse
27	Instructor A:	now the mainstream market is not something that starts right away
28		any innovation has to go through the early period
29		and has to achieve a certain stage
30		in order for us to call that mainstream market
31		so the second question is where when and how do you start a mainstream market? …
32		let me move this question to University B
33		anyone from University B can tell me what would be the starting point
34		that you can say you've entered a mainstream market?
35		yes, please
36	Learner B_1:	when the whole industry finds a common standard for the innovation
37	Instructor A:	okay, very good
38		what do you call that common standard?
39	Learner B_1:	I forgot the professional term
40	Instructor A:	you forgot the term
41		okay, anyone from University C know the term of that standard
42		what is that standard?
43		yes
44	Learner C_1:	dominant design
45	Instructor A:	good, very good
46		so what happens is you need to agree upon a dominant design
47		dominant design means that…

In Episode 3, after explaining the concept of *mainstream market* (lines 27-30), Instructor A asked the learners a question about that concept (line 31). To engage the remote learners in the live dialogue, in this episode, Instructor A directed the question to learners at University B (Lines 32-34). While a correct response was given from University B (line 36), Instructor A probed the learner further to elicit clarification (lines 37-38). When the learner

from University B was not able to provide the engineering term for the concept under discussion (line 39), Instructor A directed the question to University C (lines 41-42), where the correct term was given by one of the learners from University C (line 44). As shown in this episode, Instructor A purposefully directed his questions towards remote site learners in order to engage them in the live interactive dialogue. This episode illustrates how during synchronous live sessions Instructor A engaged in dialogue with learners and examined their understanding of course concepts.

As stated previously, this purposeful engaging of remote site learners by instructors was often necessary, given that remote site learners, considering from any live session leading instructor's stand point, did not actively participate in the live dialogues. This was especially true for learners from Universities B and C, who compared to University A learners participated less in the live discussions and asked fewer questions. This episode then illustrates the importance of instructors' engaging of learners in dialogue during the live sessions, which given the multi-site nature of the engineering DE course was crucial in supporting interactive learning across the different sites. In addition, the live sessions enabled instructors to scaffold learners' learning of the new course concepts in a space where all learners could benefit from these guidance and scaffolding of instructors.

Episode 3 was representative of learner-instructor interactions where instructors engaged the learners in dialogue thereby supporting and guiding their constructions of disciplinary knowledge. Next, I present a different episode from a different instructional week in which Instructor B engaged the learners in dialogue from the different sites. This episode also contains two instructor initiated learner-instructor interactions. The similarity of instructors' engaging of learners in dialogue during the live sessions illustrated in these two episodes, shows the similarity of their style in leading of the live sessions discussed earlier,

in turn demonstrating the representative characteristic of these episodes.

Episode 4: Instructor initiated dialogue featuring Instructor B from week 12

Line #	Speaker	Discourse
48	Instructor B:	I want to switch over to University C…
49		in the innovation market place
50		do you think people should explicitly claim their rights in their publications or not?
51		a yes no question
52	Learner C_2:	I think people should claim the right of their publication
53		but I think the right should be limited
54		because some of the publication right will block others' innovations
55		so I think that maybe some rights we'll have but some will be limited
56		yes
57	Instructor B:	good, so I believe that you watched the video
58		that they talked about creative license
59		unlike copy-right licenses, is all rights reserved
60		but it's so called some rights reserved in the video…
61		okay, let's switch over to University A
62		… so now answer the question
63		do you prefer to mark your creations with some kind of explicit labels
64		claiming your rights or not
65		yes no question
66	Learner A_1:	I think yes…
67		you can argue it from both sides
68		because on one hand it's like if you're going to define all these things into rights
69		and make it like very linear in that way
70		you might be discouraging people to innovate
71		just for the pure sake of innovation
72		or for something bigger than just having the rights to something
73		or owning the rights to something
74		but at the same time
75		it is a good incentive because if you don't do that
76		then other people might just take your ideas
78		and you might not feel like you're getting the credit that is due
79	Instructor B:	good, so let me ask another stronger question

As shown in Episode 4 which occurred on week 12 (11.16.15), Instructor B similar to Instructor A directed his questions pertaining to a course concept being discussed (claims to licensing for innovation products) to different remote sites in order to engage the remote

learners in the live discussions (lines 48 & 61). Similar to Instructor A, Instructor B in between his reciprocal exchanges with learners discussed the course concepts and provided his insights or explanations. For instance, Instructor A elaborated on the concept of mainstream market (lines 27-30) and then directed his question concerning that topic to learners. Similarly, Instructor B after the first learner's response (lines 52-56), elaborated on the concept of copy-right licenses and provided his explanations (lines 57-60), which is not presented in its entirety here. These two episodes also illustrate how the instructors expected the learners to know the course concepts and utilized the live sessions to guide and scaffold the learners' learning. For instance Instructor A asked about the technical engineering term for the common standard (line 38), and Instructor B examined learners' understanding of claims to licensing (lines 50 & 63-64) and clarified what was discussed in the video for the learners (lines 58-60). These two episodes then show in greater detail the nature of instructor-learner interactions during the live synchronous sessions, where instructors instead of lecturing the course concepts, based upon received feedback from learners' outside classroom exercises clarified and explained course concepts and engaged in discussion with learners in order to examine their understanding of these concepts.

As stated earlier, because the pedagogy and design of this DE program emphasized interactive and international learning, following the axiom of "what you learn depends on with whom you learn," during the live sessions, the instructors actively sought to engage the learners from the different sites in dialogue, in order to enable contextual understanding of course concepts. Learners' responses during these interactions in turn showed how learners' cultural diversity enriched the learning events and provided significant opportunities for the contextual understanding of course concepts. For instance, in Episode 4, Instructor B engaged two learners from different sites in a dialogue concerning the same topic. These

learners' responses made visible their underlying collectivist and individualistic thinking arising from different cultural (mental) representations (Uzuner, 2009), which they brought to the learning environment. In particular, this episode was selected because it exemplified an interaction episode where learners' cultural background and disciplinary knowledge was reflected in their comments, in turn showing the significance of live interactions for increasing opportunities for learners to express their thoughts and insights on course concepts in a learning space where all learners could benefit from these insights and perspectives.

In this episode, Instructor B after explaining the importance of licensing for claiming innovation rights, first picked a learner from University C and then a second learner from University A, and questioned them as to their rationale for whether people should claim their innovation rights or not. Instructor B asked these learners from Universities C and A respectively, the same question regarding claims to licensing (lines 49-51 & 61-65). Learner C_2's response (lines 52-56) reflected an underlying collectivist viewpoint, where his rational for licensing took into account the possible hindering of other people's innovations, therefore indicating a thinking where the innovation was considered in light of what was beneficial for the collective good (*because some of the publication right will block others' innovations*). Conversely, Learner A_1's response (lines 66-78) made visible a more individualistic thinking (*if you don't do that, then other people might just take your ideas, and you might not feel like you're getting the credit that is due*) arising from a viewpoint that denotes more closely that of capitalism (*if you're going to define all these things into rights…you might be discouraging people to innovate, just for the pure sake of innovation, or for something bigger than just having the rights to something*).

This brief episode then shows how learners' responses, which indicated their mental representations, can be traced to their national cultures and international differences. It is

important to note that while learner A_1 was Asian American, her viewpoint represented that of an individualistic culture prevalent in the American society, thereby showing that in this instance the difference in learners' thinking could be attributed to national and not ethnic influences. Contributions such as the ones presented in Episode 4, could be highly instructive for all course participants, in that learners' differing viewpoints has the potential to expand all course participants' contextual understanding of the course concepts. This episode then illustrated how live synchronous sessions provided an opportunity for instructors to engage the learners in discussions where learners' informed perspectives about course concepts could contribute to their peers' learning.

As stated previously half of the learner-instructor interactions were initiated by learners (i.e., 70 learner initiated interactions out of 141 learner-instructor interactions). In these interactions learners either asked a question or made a comment that was followed by a corresponding reply from the instructor. The following episode which contains two reciprocal interactions represents learner initiated interactions. This episode exemplifies how learners from University A initiated comments and questions concerning concepts Instructor A was discussing. I noted earlier that University A learners participated more in the live discussions and thereby regularly contributed to co-construction of engineering knowledge in this course. Of the 70 learner initiated interactions, 62 (about 89%) were by University A learners and 5 of the 8 remaining learner initiated comments by University B and C learners were from week 3 which was a conference day and not a regular synchronous session. To this end, because the majority of learner initiated comments were from University A learners, I selected an episode that was representative of the majority of learner initiated interactions. In addition to being representative of learner initiated interactions this episode also exemplified an interaction in which learners' skills and experiences were reflected in their

discussions. Moreover, learners' comments revealed their engagement with the course concept being discussed as well as their understanding of the concept. This episode also illustrates another example of instructors' scaffolding and guiding of learners' learning during the live sessions. In this interaction the instructor from learners' comments realized how the concept could be misunderstood and using the learners' own examples clarified the meaning of the concept. This episode occurred on week 6 (10.12.15).

Episode 5: Learner initiated dialogue from week 6

Line #	Speaker	Discourse
80	Instructor A:	so most safest way is to outsource late when the technology becomes common technology
81		it's just a matter of scaling up
82		okay, yes?
83	Learner A_2:	well just adding onto that
84		I've actually been to X factory
85		they use up a block -- to blocked up the entire area so
86	Instructor A:	oh yeah, yeah
87	Learner A_2:	so that you don't see much
88		and can't even get close to it
89		and it's blocked up by like a glass as well
90	Instructor A:	oh yeah, you don't see that…
91		this kind of Y outsourcing factory has almost become a mixed model of outsourcing/offshoring
92		because yes, it is outsourced, on the other hand
93		that little pocket they have created in a foreign land is still owned by them
94		so that's offshoring…and they are very very careful about leaking the technology
95		okay, any other questions, yes
96	Learner A_3:	I was just going to say it's not just trying to leak technology
97		cause I know Z for example
98		I don't think they have any
99	Instructor A:	what example?
100	Learner A_3:	Z, the company Z, clothing company
101	Instructor A:	oh, clothing
102	Learner A_3:	they don't necessarily have like a bunch of super-secret technology
103		but they only have one factory that's centralized somewhere in Europe
104		but they don't allow any visitors
105		and I think they said if you're on campus the people can shoot you
106	Instructor A:	no…that will be offshoring because they actually own that facility

107	right?
108	otherwise how can they shoot you?
109	…I'm going to make sure that you understand the difference between offshoring and outsourcing…

As shown in Episode 5, a learner from University A initiated a comment concerning the concept of *outsourcing* (lines 83-85 & 87-89) which Instructor A was discussing (lines 80-81). Instructor A elaborated on this learners' comment (lines 90-94), in turn eliciting a different comment from a different learner again from University A (lines 96-98 & 102-105). The significance of this interactive dialogue and its contribution to learners' understanding of subject content is made visible when Instructor A from learner A_3's comments (*they don't necessarily have like a bunch of super-secret technology, but they only have one factory that's centralized somewhere in Europe, but they don't allow any visitors, and I think they said if you're on campus the people can shoot you*) realized how the two terms of *outsourcing* and *offshoring* could be confused (lines 106-109). The instructor was then able to clarify these two concepts using the learner's own example (*that will be offshoring because they actually own that facility, right? otherwise how can they shoot you?*). Both these learners' comments also illustrated how learners A_2 and A_3 were incorporating and applying the new knowledge they were acquiring into what they already knew about different industries. Notably, the comments of these two learners showed their contextual understanding of the subject content, where by presenting their informative comments they in turn contributed to other learners' knowledge and contextual understanding.

This episode then illustrates how during synchronous sessions learners had the opportunity to discuss course concepts and share their insights and experiences while instructors' feedback and scaffolding guided their construction of disciplinary knowledge. In particular, this episode illustrates how what was discussed was not the subject content per se

but was about the contextual understanding of the concept. This discussion then provided an opportunity for learners to acquire contextual understanding of the concepts of offshoring and outsourcing because learners A_2 and A_3 discussed their own knowledge and experiences and applied the concepts to what they already knew. In addition, this episode also shows how during synchronous sessions course participants' comments influenced the live discussions by eliciting other comments from other course participants and thereby increased learning opportunities.

As shown in the above three episodes (3, 4, & 5) the two types of learner-instructor interactions (i.e., learner initiated vs. instructor initiated) were similar in nature in that they contained a comment or a question that was followed by a corresponding reply. The only difference in these interactions was the source of the comment or question initiator. These learner-instructor interactions occurred during instructors' explanations or discussions of course concepts. That is, while discussing a course concept either the instructors or the learners asked a question which was followed by a reply. These three episodes, containing six interactions, then are representative of learner-instructor interactions which were more frequent than learner-learner interactions (62% vs. 38% respectively), not including learners' presentations. To this end, due to limited space for the presentation of findings I have presented only three episodes from three different weeks to illustrate the significance of learner-instructor interactions.

Learner-learner interactions. Because in this course interactive and collaborative peer-learning was emphasized, different opportunities were provided by instructors for the learners to engage with each other in guided collaborative activities in order to co-construct contextual understanding of course concepts. In particular, the following collaborative activities were designed for learners to support peer-learning: (a) two cross-cultural

exercises, (b) the final innovation team project, and (c) in-class cross campus exercises on *Slack*. For the first two collaborative projects (a & b), learners in designated teams worked together outside of scheduled classroom time and presented these projects during the live synchronous sessions. For the in-class exercises, learners were placed in different teams each week and worked on *Slack* during the live sessions, and for the most part had a representative presenting their responses to the whole class. With the exception of the cross-cultural exercises, in most collaborative activities each team consisted of learners from different campuses. Because the first two collaborative activities (a & b) were similar in nature, from these categories, I present here two examples from the cross-cultural exercises, which illustrates the nature of learner-learner interactions and shows how the learners co-constructed knowledge from these presented projects during the live sessions. I did not select an episode of learner-learner interaction from the final innovation project presentations because as shown in Table 4.1 there were only three learner-learner interactions on this day due to the length of the presentations. Therefore, here I present two episodes from the second cross-cultural exercise presentations from week 13 (11.23.15), when Instructor C was leading the live sessions. On this presentation day there were 26 learner-learner interactions. These two episodes are from two different presentation groups, one from University A and one from University C.

In the first learner-learner interaction episode (Episode 6) learners from University A presented on the topic of the one child policy law in China. In their presentation, the learners talked about the history of the one child policy law and presented an analysis of why it occurred along with a discussion of how this law was represented by the American government and media. I selected this episode because it exemplified an instance where learners' reciprocal exchanges reflected their cultural background and experience (mental

representations) while their engagement with the discussion topic revealed their differing perspectives.

Episode 6: University A learners' presentation of cross-cultural exercise from week 13

Line #	Speaker	Discourse
110	Presenter A_4:	so we have some questions here
111		which one would you guys actually like to talk about
112		any personal views
113		how about
114		do you think there was any other solution to the possibly dangerous population increase
115	Learner B_2:	hello this is University B
116		well, I feel like this is a topic that directly affects us
117		so I felt like I should say something about what people here in China
118		the majority feels
119		cause we are in our early twenties
120		and I guess question two is what I'm trying to tackle
121		I think for our generation the biggest problem is that a lot of people
122		are saying that we are the only generation that has to help look after the elderly
123		and also children
124		which puts a lot of pressure on this generation to earn money
125		and then I guess in some way it will affect how our personality
126		and also the entire culture of our generation
127		maybe will grow to become more aggressive
128		and also I guess maybe in a few years mental illness will be a big problem here in China
129		or something like that, yeah
130		so that's I think in long term
131		maybe that's one of the things that we'll see in the social field
132		yeah, thank you
133	Presenter A_4:	thank you
134	Learner A_5:	also going along with the second part of the second question
135		I think the one child policy is actually canceled already
136		it's now two children policy or something
137		cause they encourage people to have two kids
138		not too much, which is two kids
139		and I think that basically says
140		that in long term one child policy is not going to affect China anymore
141		given that's already canceled
142		that's what I have

In this episode, after the team from University A presented their cross-cultural exercise, the presenters posed questions for all learners in order to engage them in a discussion on this topic (lines 110-114). A learner from China (University B) responded to one of the presenting team's questions (lines 115-132), and because of her background and her immediate experience (*I felt like I should say something about what people here in China, the majority feels*) she provided an in-depth explanation considering the economic, social, and psychological effects of the policy (*we are the only generation that has to help look after the elderly… which puts a lot of pressure on this generation to earn money…in some way it will affect how our personality… will grow to become more aggressive… and also I guess maybe in a few years mental illness will be a big problem here in China*). This learner's response which reflected her knowledge and experience, provided contextual understanding about the topic, which contrasted with another learner's response from University A (lines 134-142), whose response reflected an informative but a remote understanding of the topic (*I think the one child policy is actually canceled already, it's now two children policy… I think that basically says that in long term one child policy is not going to affect China anymore, given that's already canceled*). The responses of these two learners revealed their dissimilar cultural experiences, reflecting their cultural backgrounds and mental representations. In particular, learner B_2's response exemplified that learners' diverse backgrounds and cultural experience can be a learning resource, adding to other learners' knowledge about a given topic. This episode illustrated how learners' guided activities during the live synchronous sessions increased opportunities for learners to engage in discussion and through interaction learn from the differences that arises either from their cultural backgrounds or diverse experiences.

The next episode is similar to Episode 6 in that it also illustrates learners' engagement

in a discussion where their cultural knowledge and experience arising from their different cultural backgrounds became a learning resource for their peers. In this episode learners from University C presented on the topic of immigration, discussing European and American migration along with reasons for immigration.

Episode 7: University C learners' presentation of cross-cultural exercise from week 13

Line #	Speaker	Discourse
143	Presenter C_3:	do you think it will effect U.S society if you accept these refugees
144		because maybe they are the terrorist coming
145		or because some refugees want to seek much more safe place
146		rather than the war place in their country
147	Learner A_6:	…I think the biggest concern with accepting refugees in most countries is
148		that they feel that the crime rate might go up
149		but if you count all the immigrants that come in and see how many
150		and measure the percentage of people who commit crimes
151		what's the percentage of Americans who commit crimes
152		I don't think there will be a huge discrepancy there
153		so I think it's okay for us to accept refugees
154	Presenter C_3:	thank you, thank you
155		and how about University B students
156		if refugees seek for a safe place to China
157	Learner B_3:	I don't think that I can speak for China
158		but personally I'd say that I'm all for accepting refugees from different countries
159		but then again for China it will pose a problem in terms of the population
160		because you know we have such huge amount of population
161		and to be honest a lot of people from the country side
162		are actually having a really hard time just getting by their daily life
163		so I don't know how the central government
164		they're going to be able to provide protection and food and daily necessities
165		when they can't really afford to you know help the people from the country side
166		but then there is also a question that I would like to ask…

In Episode 7, after learners from University C presented on the topic of immigration, two learners, one from each remote site, responded to the presenter from University C who similar to the presenter from University A in Episode 6 (lines 110-114 & 133) directed the

discussion after their presentation (lines 143-146 & 154-156). Again, this episode shows how learners from different countries and cultures had different views and responses about the topic of discussion. While learner A_6's response was positive in regard to his country (*I think it's okay for us to accept refugees*), Learner B_3 expressed concerns about accepting refugees in her country (*for China it will pose a problem in terms of the population*). Also, the responses of these learners reflected different social issues in each country showing the learners' knowledge of their country's distinct problems, in turn contributing to their peers' knowledge. For instance, while learner A_6 discussed the issue of immigration from a crime rate perspective (*I think the biggest concern with accepting refugees in most countries is that they feel that the crime rate might go up, but if you count all the immigrants that come in… and measure the percentage of people who commit crimes, what's the percentage of Americans who commit crimes, I don't think there will be a huge discrepancy there*), Learner B_3 discussed the issue from a population growth perspective and its social implications (*we have such huge amount of population… a lot of people from the country side are actually having a really hard time just getting by their daily life… I don't know how the central government, they're going to be able to provide protection and food and daily necessities*). In particular, this episode reflected learners' diverse perspectives, again arising from their different cultural and social backgrounds. Both these comments were informative in nature and reflected the learners' knowledge about global issues from their countries' standpoint.

These two episodes which represented learner-learner interactions showed the nature of these interactions during learner presentations. As shown in these episodes, the presenters posed their questions for discussion and learners from different sites responded. Because the presentation topics were regarding different global issues, learners from the different countries had diverse and at times opposing responses and views. To this end, these learner-

learner interactions demonstrated that learners' guided interactions during live synchronous sessions increased opportunities for learning by enabling learners to share their diverse perspectives, experiences, and knowledge about different global topics where these discussions became a learning resource for their peers.

On the other hand, learner-learner interactions on Slack provided a different opportunity for learners to engage with course concepts during the live synchronous sessions, and through guided activities co-construct knowledge and gain contextual understanding of subject content. In this next episode I present the learners' in-class presentations after their discussions on Slack. The presentation in this episode was guided by the TA who facilitated the learners' discussions and with his comments directed the live peer interactions. While during in-class group exercises, the TA or the instructors facilitated the learner discussions, because learners' comments were addressed to their peers as opposed to the instructors, I considered these interactions as learner-learner interactions or rather mediated learner-learner interactions (LLm). The following episode occurred on week 8 (10.19.15), when Instructor A was leading the live session. This episode was selected because it represented learner-learner mediated group interactions where learners' guided and purposeful discussions pertained to course concepts and illustrated their construction of disciplinary knowledge.

Episode 8: Learners' in-class presentation after peer discussions on Slack from week 8

Line #	Speaker	Discourse
167	TA	okay, so do we have someone who wants to volunteer
168		to talk about the basic feature, performance feature, or an excitement feature
169		from one of these three phones
170		or if that excitement feature is creating a new market
171		or a life style meaning that drives from one of these products
172	Learner A_7	so, for the basic features of these phones
173		we were talking about how if they didn't have calling or texting
174		people would be really upset
175		but also things like the selfie camera

176		that's something that's kind of expected now
177		so if a phone doesn't have it
178		it's not going to be good
179	TA	awesome, yeah, I agree
180		so in regards to the basic features we would say
181		I think of a calling function
182		but nowadays any phone is going to have that…
183		do we have someone from another campus
184		who might want to add a basic feature, a performance feature, or an excitement feature for one of these three phones
185		anyone from University B or University C willing to speak
186		awesome, go for it
187	Learner C_4	I want to talk about the performance features
188		screen size, memory capacity, camera, and computing speed
189		and also the operating system
190	TA	I think those are all really great ones
191		in regards to the memory that you're talking about on the iPhone
192		the lowest capability right now is still 16 gigabytes…
193		so great
194		maybe one of you guys from University B can talk about
195		do you think the excitement features presented here actually are initiating a new market
196		but whatever you want to discuss
197	Learner B_4	hi everyone
198		we have talked about the detached screen
199		we have seen that some products have two side screens
200		we think about maybe the side screen can bring some benefit
201		but actually many people will attach the wrong part
202		and maybe it can bring many mistakes when they use the phone
203		so we think that maybe it is really hard to imagine that some people think
204		that maybe one day all of the place of the phone may be screen
205		we think that is it hard to achieve
206		that's all
207	TA	great
208		that brings up an interesting point
209		maybe some of these new excitement features might not be liked by the public
210		people might have issues with them
211		they might not have function as people intended
212		so that's something to take into consideration
213		but these things that might seem exciting at first
214		end up not being very practical

As shown in Episode 8, the learners during this live session engaged in an interactive

exercise and presented their results from their group discussions to the entire class. This particular exercise occurred at the end of the two-hour live session, and the discussion teams consisted of learners from the same campus. Each presenter then in this episode is presenting their own campus's discussion results. The pronoun "we" in the presenters A_7 and B_4's responses indicates their reporting of their team's discussions respectively (*we were talking about how if they didn't have calling or texting, people would be really upset; we think about maybe the side screen can bring some benefit, but actually many people will attach the wrong part*).

In this episode, the learners were given a set of questions about a technological product (three different phones) and were asked to apply course concepts (basic, performance, and excitement features of innovative products) to these products explaining their implications. Each campus in this episode presented their discussion and opinions on one of the concepts, thereby jointly contributing to knowledge co-construction. For example, learner A_7 commented on the basic features of the phones (lines172-178), explaining how this feature was expected by consumers (*things like the selfie camera, that's something that's kind of expected now, so if a phone doesn't have it, it's not going to be good*). Learner C_4 named different performance features of one of the phones (lines 187-189), and learner B_4 presented their opinion on a new excitement feature (lines 197-206) explaining how an excitement feature may fail (*we have seen that some products have two side screens… maybe it can bring many mistakes when they use the phone, so we think that maybe it is really hard to imagine…that maybe one day all of the place of the phone may be screen*). This live peer interaction is one event that exemplified how during live synchronous sessions learners from the different campuses engaged in interactive activities and discussed the course concepts by applying them to everyday life examples and thereby constructed disciplinary knowledge.

These learner-learner mediated interactions were mostly application exercises where learners in their groups applied the course concepts to different technological products or phenomenon. To this end, these leaner-learner interactions provided an opportunity for learners to interact with their peers and construct disciplinary knowledge with the guidance of a more knowledgeable person.

This live interaction across the campuses however was facilitated by the TA, who was a former learner in this engineering course. As shown in this episode, his directing of the interactions was crucial for enabling the learners to present their comments and contribute to each other's learning. After each learner's presentation, the TA provided his own informed comment on the concept (*I think of a calling function but nowadays any phone is going to have that*), directed the cross campus interactions (*do we have someone from another campus who might want to add a basic feature, a performance feature, or an excitement feature for one of these three phones*), and elicited critical thinking and reasoning (*maybe some of these new excitement features might not be liked by the public… they might not have function as people intended, so that's something to take into consideration*). The TA's directing of the cross campus interactive exercise made visible the importance of a facilitator for the guided activities during the live synchronous sessions. Similar to instructors' engaging of remote learners (Episodes 3 & 4), the TA actively guided the discussions from one campus to another in order to enable the peer interactions. To this end, the TA's interaction with learners was similar to instructors' leading of the live sessions in that he directed the live discussions and gave feedback after each presenter. Given this similarity and the limited space, I have presented only one learner-learner mediated interaction.

Research Question 2 Summary

In summary, during the live synchronous sessions two main types of interactions were prevalent: (a) learner-instructor, and (b) learner-learner. Learner-content and learner-interface interactions on the other hand, occurred outside of the scheduled live sessions, where learners engaged with the subject content on their own. These two types of interactions (a & b) were collaborative in nature, in that they involved two or more course participants who through group interaction constructed knowledge together (Dillenbourd, 1999; Prokofieva, 2013).

Classroom observations revealed that course participants' interactions during the live synchronous sessions increased opportunities for learning by enabling learners to engage in discussion and share their perspectives and insights in regards to course concepts while at the same time receiving guidance from instructors or the TA who were leading the live synchronous sessions. In particular, the instructors used the live synchronous sessions to explain or elaborate on course concepts which learners were expected to have learned prior to these live sessions. By engaging the learners in discussion during the synchronous sessions instructors examined learners' understanding of course concepts and asked and answered questions. Conversely, during live synchronous sessions opportunities for learner-learner interactions were provided either in form of mediated group discussions or project presentations that enabled learners to engage in dialogue with one another across the different sites. During these guided activities learners who were from diverse cultural backgrounds shared their perspectives and insights concerning the various discussion topics and thereby though their contributions to the live synchronous discussions increased opportunities for their peers' learning.

Within learner-instructor interactions there were two sub-types: (a) instructor initiated interactions, and (b) learner initiated interactions. Instructor initiated interactions seemed

particularly significant because they encouraged learners to participate in the live synchronous discussions and share their insights. To this end, it was at times necessary for instructors to actively direct questions to remote sites in order to engage them in these live discussions (e.g., Episodes 3 & 4). The live synchronous sessions also provided the opportunity for learners to interact with instructors and clarify any misunderstandings or ask questions. Therefore, learners too initiated comments or questions during these live sessions. Half of learner-instructor interactions were initiated by learners. Because these learner-instructor interactions occurred during the live synchronous sessions all course participants could benefit from these reciprocal exchanges. However, as noted above, classroom observations revealed that University A learners being more interactive during the live synchronous sessions initiated more interactions with the instructors (e.g., Episode 5).

Finally, learner-learner interactions consisted of two main sub-types: (a) learners' presentations of projects during the live synchronous sessions and their engagement in Q & A with peers concerning these presentations, and (b) learners' guided discussions and interactions on *Slack* during the live synchronous sessions. With regards to learners' interactions during the project presentations, learners after presenting their projects posed project related questions to course participants at all sites. During this open discussion time, learners across the different campuses responded to the presenting teams' questions or commented on the discussion topic, sharing their perspectives and insights which considering their different cultural backgrounds were varied and informative (e.g., Episode 6 & 7). This in turn increased opportunities for learners to co-construct contextual understanding of course concepts.

On the other hand, during most of the live synchronous sessions, especially when Instructor A was leading the sessions, learners were given in-class exercises that they worked

with their discussion teams on *Slack*, and had representatives from each team presenting their results to the whole class. These sessions were led either by the instructors or the TA of the course (e.g., Episode 8). These exercises provided another opportunity for learners to present their comments on course concepts and interact with their peers and construct disciplinary knowledge with them.

In short, the design of the course enabled different opportunities for interaction during the live synchronous sessions which were crucial for enabling co-construction of disciplinary knowledge and contextual understanding of subject content. The live synchronous sessions were particularly significant in enabling course participants to engage in discussions in a learning space where all course participants could benefit from the outcome of these live interactions. During these live sessions the instructors guided learners' learning and explained and clarified course concepts, while learners shared their insights and perspectives which given their diverse backgrounds were wide-ranging and informative in nature.

Survey Findings

I conducted surveys in order to find out in general what the learners' perceptions were regarding their experience in this DE course, especially their experience with regards to their interactions with peers and their learning from the variety of instructional exchanges. I then used the survey results to validate my findings and analysis from classroom observations and artifact analysis, presented earlier. Within the survey questionnaire, participants were not asked for any demographic information. However, they were asked to identify their participating university and to indicate their majors. This way, participants' identity was protected, given survey responses were not linked to their names.

Learning from peers and instructors. The survey results showed that on average

learners had learned a great deal about the principles and practices of global innovation and from their interactions with their peers in this multi-site DE course. In Appendix D1, I present means and frequencies for survey participants' responses, for questions that measured these outcomes (A & B). The calculated means for questions that measured learners' perceptions of their learning from peers and instructors showed that on average learners agreed that they had learned from their peers and instructors. The overall mean for these measures was 3.7 (between "3. Somewhat Agree" and "4. Agree") on a Likert-type scale of 1-5, 5 being Strongly Agree (M = 3.7). Most participants (93%) reported levels of 3-5 ("Somewhat Agree" to "Strongly Agree") regarding their learning of the principles and practices of global innovation (A1). Only one participant (3%) reported level 2 ("Disagree") indicating not having learned a great deal.

With regards to the second item (A2), which measured learners' learning from the cross-cultural exercises, again most participants (86%) reported levels of 3-5 ("Somewhat Agree" to "Strongly Agree") with regards to their learning from cross-cultural team projects, and three of the participants (9%) reported levels of 1-2 ("Strongly Disagree" to "Disagree"). However with this question, almost half of survey participants (40%) reported level 3 ("Somewhat Agree") concerning their learning from cross-cultural team projects. This level 3 report was significantly higher in frequency in comparison to the level 3 reports from the other three questions (A1, B1, B2), which seemed to be an important point that I explored further in the qualitative interviews. Please refer to Figure 4.2, for the percentages of reported levels of 3-5 ("Somewhat Agree" to "Strongly Agree") for sections A and B questions.

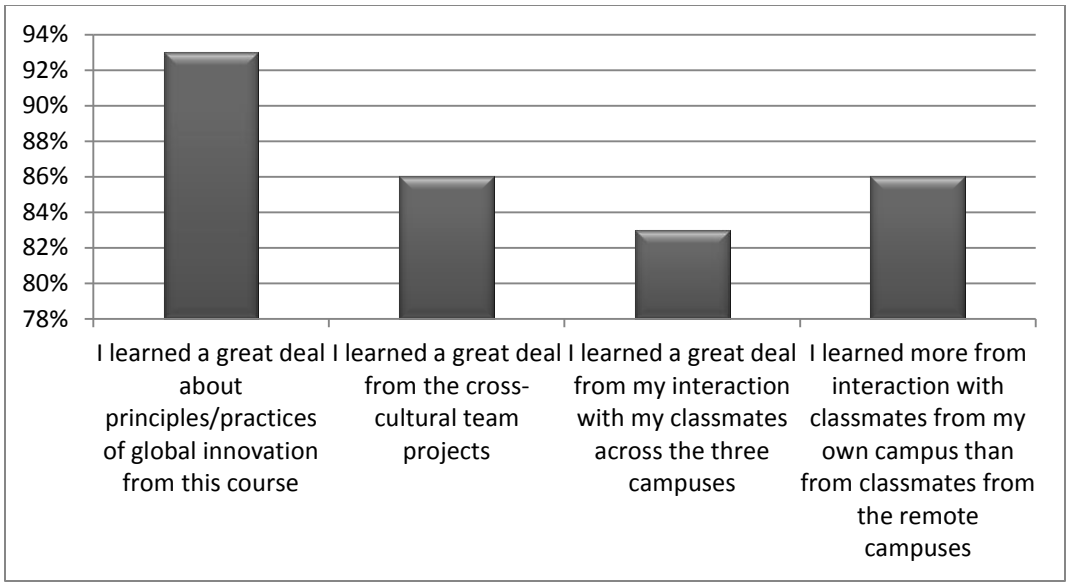

Figure 4.2. Percentages for combined reported levels of 3-5 ("Somewhat Agree" to "Strongly Agree") for section A and B questions.

With regards to Section B, while most participants (84%) reported levels of 3-5 ("Somewhat Agree" to "Strongly Agree") concerning their learning from interactions with classmates across the three campuses (B1), slightly higher number of participants (87%) reported that their learning from interactions occurred more with classmates from their own campus than from remote classmates (B2). Given the objective of this multi-site DE course was to create a learning environment where learners across distances could interact and learn from each other, this was an interesting finding that I explored further in the qualitative interviews.

Conversely, a significant number of survey participants (17%) reported level 2 ("Disagree") regarding their learning from interactions with peers (B1). This was significantly a high number of participants who reported negatively with regards to their learning from peer interactions, which again seemed to be an important issue that I further explored in the interviews. However, a few of the participants (13%) reported level 1-2 ("Strongly Disagree" to "Disagree") on question B2, indicating they had learned more from

remote classmates. Three of these participants were from University A and one was from University B. To this end, in the interviews I explored in what ways and under what conditions, from the perspective of the interviewees, the remote learners seemed to be contributing to their classmates learning. For details regarding the reported results of Sections A and B questions please refer to Appendix D1.

Learning from the variety of instructional exchanges. The learners' reports also showed that on average they had found all instructional resources made available for their learning helpful. The overall mean for this measure was 3.46, ranking on a scale of 1-5, 5 being most helpful (M = 3.46). See Appendix D2 for the means for all resources. Given that the means for all resources were within the same range, a close examination of the individual rankings did not reveal any patterns. Some participants had ranked the resources in order, giving each category one of the ranks of 1-5, while others had rank each category from 1-5 and not in a ranking order, such that they had given the same rank to more than one category. This could be due to the wording of the question, which could have been misleading or not clear.

However, I counted the frequency of the responses, which still gave an indication of which resources on average were given higher rankings (see Appendix D2 for frequencies of the rankings). To do this, I only considered the highest ranks (rankings 4 & 5) in each category. The combination of the frequencies for the two highest ranks in each category then gave me an indication of which resources were considered to be most helpful. As shown in Figure 4.3, the cross-cultural team exercises (with a frequency of 20 for the combined rankings of 4 & 5), followed by the instructor's explanations and clarifications during the live sessions (with a frequency of 19 for the combined rankings of 4 & 5), had the highest frequencies respectively.

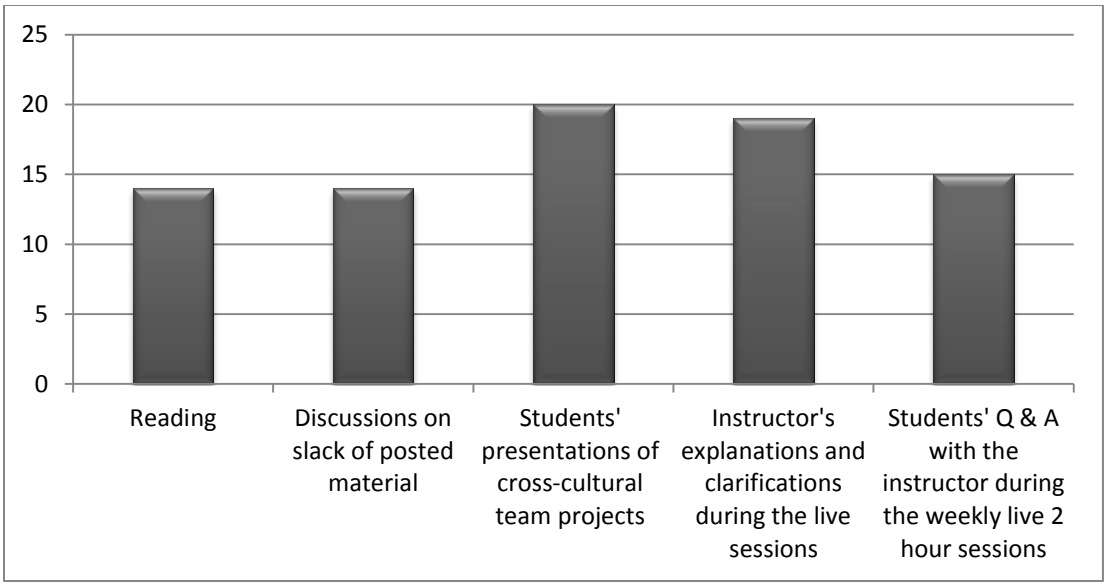

Figure 4.3. Combination of frequencies of rankings 4 & 5 of learners' responses with regards to most helpful resources for learning of course concepts.

These results validated classroom observations of learner-instructor and learner-learner interactions presented earlier. That is, survey reports showed that learners found interactions with peers and instructors during the live synchronous sessions helpful. However, as discussed above, the survey results from Section A2 showed that a higher number of participants (40%) reported level 3 ("Somewhat Agree") regarding their learning from the cross-cultural team project. This finding contrasted with the high ranks given to the learning from the presentations of cross-cultural team projects in Section C. Noting this discrepancy, I explored the opportunity of learning from the cross-cultural exercises and peers during the live synchronous sessions in the follow-up interviews.

Survey Summary

Most survey participants reported having learned a great deal about the principles and practices of global innovation (M = 3.86) and from their interactions with peers in this multi-site DE course (M = 3.7). Concerning learning from interactions with peers however, 17% of the survey participants (n = 5) reported not having learned a great deal from interactions

with their peers, and 87% of survey respondents (n = 26) reported having learned more from their own classmates as opposed to from remote learners. Given the objectives of this multi-site DE course and the instructors' emphasis on peer learning, these findings regarding peer interactions were significant and served as preliminary data for the follow-up interviews to explore the factors that hindered or enhanced peer interactions across the different sites during the live synchronous sessions.

Most participants also reported finding all instructional resources helpful for their learning of the course concepts (M = 3.46). However, a discrepancy in the results surfaced. Most learners gave higher ranks to learning from "Students' presentations of cross-cultural team projects," followed by learning from "Instructor's explanations and clarifications during the live sessions," indicating they had found these instructional resources most helpful. However, when asked "I learned a great deal from the cross-cultural team project," in question A2, 40% of respondents (n = 12) reported "Somewhat Agree," which was a significantly high number of respondents reporting level 3 in comparison to level 3 reports on questions A1, B2, and B3. To this end, in the follow-up interviews I explored under what conditions peer interactions were perceived to be greatly contributing to the learners' learning.

The survey reports provided a general sense of learners' perceptions about their experience in this multi-site DE course. The discrepancy in the survey results could be attributed to the highly structured form of the surveys that did not allow for explanations or elaborations on the survey items. To this end, the surveys mainly served as preliminary data and were helpful in guiding the follow-up learner interviews, presented next. It is important to note that while there were less survey participants from University Band significantly more participants from University A, because the survey reports from the three universities

were comparable and low and high reported levels were not concentrated in one site, I did not lump the survey reports from the three universities and considered each site separately.

Learner Interview Findings

Reasons for enrolling in the DE course. I started the interviews by asking interviewees[6] about their decision in enrolling in this multi-site DE course. Given this multi-site DE course differed in design from other regular DE courses, the responses revealed learners' thinking and expectations, which can inform research in DE, considering the affordances advanced technologies enable in today's 21st century world. Interest in course topic and the opportunity of a cultural and international experience, that can enrich learning by enabling the exchange of thought and knowledge, were the main reasons reported by interviewees for enrolling in this DE course. Interviewees found taking a course simultaneously with learners from different parts of the world intriguing. "I think having interactions with students from different countries is very cool," said Willow from University C. This desire to learn with learners from different countries was expressed uniformly by interviewees, especially given the distinct nature of this multi-site DE course. "I wanted to learn about how people are in their own culture, in their own environment," explained Eric, an Asian American learner from University A.

These responses reflected the objectives of the course and the instructors' intentions in providing opportunities for interaction among learners across the different geographical sites. I then explored the theme of interaction in interviewees' responses, to examine what the learners found to be challenging and rewarding in their interactions with peers, and what suggestions they had for improving these peer interactions.

[6] Pseudonyms are used for all interviewees.

Challenges in interactions with peers. All interviewees pointed out that the different time zones across the continents posed challenges for communicating and completing assignments and projects with peers across the different sites. Time management appeared to be a big issue that in turn impacted project management. This is especially an important issue that can impact learning in innovative DE environments. For example, Eric expanded upon the problem of time difference and its impact upon project management.

> We receive our assignment probably on Wednesday or Thursday. We have a day to read, we have a day to respond, and then we have a day to actually communicate. That was the main problem, because of the time difference. When it's our daytime it's their night time, and when it's our night time it's their day time. So, the time lag creates a little difficulty in terms of communicating and completing the results in time. But other than that, for our project, for instance, we have sufficient amount of time. So, even though we can't really respond immediately from time to time, we would be able to actually respond and learn from each other throughout this entire project.

While the time difference is a given in international learning environments, as expressed by some of the interviewees, others suggested having easier reading material and a lighter academic load as a means of lessening some of the issues arising from time and project management. For example, Alice from University C reflected that "the loading is too heavy to absorb," and wished that the instructors would spend more time to explain the new knowledge. Other interviewees likewise noted that instructors' explanations during the live synchronous sessions clarified their questions with regards to their projects and assignments. This in turn pointed out the importance of instructors' guidance and contribution in supporting the learners' learning. Eric, on the other hand, suggested that an adjustment in the timing of the weekly assignments and discussions during the Learning Cycle might enable them to better utilize their time outside of the classroom. However, not all comments about the course load were negative. For example, Willow noted that Instructor A's pre-studies' reading material gave her "another understanding toward innovation."

A second suggestion in this regard was given by another interviewee, who recommended having scheduled and guided one-hour discussion sections with a TA or an instructor during the week, similar to the synchronous two-hour sessions. John, a White American learner from University A, explained that these scheduled live sessions would lessen issues arising from the time difference and in turn enable more face-to-face interaction with remote learners, which he felt to be important in contributing to their learning. He noted that this face-to-face interaction would add to his learning experience.

> If there was like a discussion section for the class, where it was another designated time, where you met up with your groups, and you had face-to-face interactions, then I would get a lot more out of being in project groups with people from different universities.

John's response further made visible his underlying expectations concerning his enrollment in this DE course and his interactions with learners from different universities. On a different note, another challenge that was pointed out by interviewees, from both Universities A and C, was the issue of language barrier, given that two of the participating universities (Universities B & C) were not native English speakers. However, Sarah, an Asian American learner from University A, reflected that the language barrier did not seem to impede the learners' learning from each other's contributions.

> Even though sometimes the presentation of the information wasn't as conscience from the foreign students, a lot of them had some really insightful things to say and made really great contributions to our projects. So, I think the biggest limitation is just that language barrier.

Alice's comment with regards to the issue of language barrier paralleled Sarah's response, and pointed out the issue from the perspective of those for whom language was a barrier. "Language, [I found challenging] I think, because sometimes I missed what the teacher and the classmates said, which made me confused to do the next part [of the assignments]." To this end, some of the interviewees suggested having clearer instructions

for the projects, which could have in turn eased issues with regards to projects and time management. For instance, Sarah noted:

> I liked all the elements of the course. I think they were all helpful, having all those resources available to us. I think just needed to be organized before the class started, or more clearly communicated to the students.

Rewards in interactions with peers. Apart from these challenges, which are inherent in most multi-site DE courses, interviewees found their interactions with peers rewarding and expressed that they learned from their peer interactions. Interviewees attributed their rewarding experience to both relational and academic factors. Relational factors included making friends with peers from different academic and national backgrounds and building relationships with individual learners while working on projects. Due to the design of this course and the way projects were done with remote learners, learners had to interact with their peers across the different sites in order to accomplish their projects. This interaction for some became a means of making friends and building relationships. For example, Sarah reflected:

> I think it was kind of cool to be able to actually develop [relationships]. For example, there was one girl that was in my group for like many different projects, and it was really cool. I kind of got to build a relationship, and develop a friendship with these students. And it was just interesting, because a lot of the times these students were from, even thought they were taking the class from Taiwan or China, they were like from Germany or they lived in all these different places.

Similarly, Levi, a Latino American learner from University A, noted that he had a positive experience in interacting with his peers across the different sites and expanded upon his relationship with a remote learner, explaining in detail the nature of their interactions, given the time differences, and how he benefited from this type of interaction:

> I got sort of close with a student from University C…Whenever we had an assignment together, we found out the best way was to come one day together where we could sort of talk what we have to do, and we would work on it [their project] separately. And the thing I liked was that she would work on it when I was asleep

> and I would work on my side when she was asleep. So, she would work on it and if she had any questions or things she wanted me to look at, she would send it to me before she went to bed. And, when I woke up, I would read it, work on it, and we sort of went back and forth. So, it's sort of nice knowing someone is working on the project when you're asleep. That's something I really liked.

Although some of the interviewees benefited from their peer interactions with remote learners and built relationships with them, others noted the difficulty in building relationships with remote learners and not connecting with them. John, for example explained that a lot of his interactions with peers outside of the live synchronous sessions were through messaging and with his team members he did not have many face-to-face interactions. He felt that this lack of face-to-face interaction was "kind of a hindrance on the overall experience." Similarly, Eric noted that connecting with remote learners and building strong relationships with them was difficult, due to the time zone difference and "given that you don't really see them, you don't really get to spend time with them," except through various technologies such as social media. Along the same lines, Alice reflected that while "in the beginning it was inconvenient to interact with remote learners," after using a common platform called *Slack* this problem was solved. Sarah in a follow-up interview explained that *Slack* enabled peer communication and interaction, especially during the live synchronous sessions. "Slack was introduced as a way for us to communicate within our small innovation team groups during allotted discussion times." Willow expanded upon this issue by explaining that while initially difficulties existed, over the course of the semester their interactions with remote learners improved.

> I think at first it was kind of difficult, since we didn't know each other and we have different times zones, which means it's really hard for us to interact with other classmates, and to set up a very suitable time. But after knowing each other for a period of time, I think things got better, because we have this platform and we have projects we did together, therefore we must have interactions.

To this end, Eric suggested that meeting prior to the start of the class could help the

learners get to know each other and make personal connections before taking the class remotely. He reflected that while this was challenging, it would enable the learners to make connections which then could be developed throughout the semester. He attributed this to developing trust. "I feel like face-to-face interaction is what develops trusts more. I think with that trust it's easier to connect later on through social media." From other interviewees' comments it appeared that this initial interaction with remote learners did not necessarily have to be in person or face-to-face. Jasmine, a learner from University C, for example, explained that at the beginning of the semester her classmates commented that they liked sending e-mails to remote learners because they found out "how different their lives are from each other." This novelty of having classmates from different countries and backgrounds in turn made their interactions and communication more interesting.

On the other hand, the main academic factor that made learners' interactions rewarding was noted to be learning from their peers' perspectives, insights, and ideas. Interviewees from each site viewed remote learners' contributions positively and saw them as being more knowledgeable and resourceful. "University A students have lots of ideas and it seems that they focus on international issues often," stated Alice. Likewise, Levi noted that University B and C learners knew "more about global problems and global issues" than they did, and reflected that "I feel the students in Taiwan and China, they just know more about what's happening in the world than us here." These comments made visible the impact of learners' contributions upon each other's learning and perceptions of their global classmates.

However, as shown in the survey results, the survey participants reported that they had learned more from their own classmates than from remote learners. When asked what they thought contributed to their learning more from their own classmates, most interviewees

attributed this outcome to having more opportunities for face-to-face interactions with their own classmates. For example, Willow in a follow-up interview explained that the two cross-cultural exercises, which were made of teams with learners from the same campus, provided more occasions for them to have face-to-face interactions, thereby contributing to more learning from their own peers. "We have more interactions in cross-cultural experience projects in our own campus, and we can meet up face-to-face to talk about some cultural issues together instead of using Slack as a material only." Alice while pointing out the physical distance with remote learners and its impact on a sense of dis-connectivity, added that her classmates had different academic backgrounds from her, which provided an opportunity for her to learn from their ideas, given she had more face-to-face interactions with them.

> I'm studying economics and most of my classmates from my own campus are graduate students studying engineering. I got so many different ideas from them. What's more, I could only interact with classmates from other campuses via camera or internet, which left me still feel far from them.

As noted earlier, other interviewees also pointed out the sense of dis-connectivity with remote learners due to less face-to-face interactions with them. From the interviews it appeared that face-to-face interactions with peers increased opportunities for learning possibly because learners could communicate and interact more comfortably and with ease in person.

Besides less face-to-face interactions with remote peers, other interviewees noted that they learned more from peers who interacted more during the live synchronous sessions, because more interactions enabled them to hear these peers' insights and ideas. To this end, some interviewees noted that University A learners interacted more during the discussions and thereby contributed more to their peers' learning. When asked why they thought

University A learners contributed more to discussions, most interviewees attributed this outcome to personality and cultural factors, namely shyness, on the part of University B and C learners. "The cultural difference is so notable when we are supposed to discuss [the projects]. Western people are more open to discussion, meanwhile Asian people are more conservative or shy that they don't want to discuss any topic," explained Jasmine. Other interviewees from University C seconded the issue of shyness. For example, Willow noted that from her interactions with University A learners she had learned to "speak up more often." Similarly, Alice explained that she had learned from University A learners to express herself freely.

> University A students affected me a lot. In the past, I was afraid to raise my hand and ask questions during the class, because I didn't want to use other people's time. University A students always expressed their ideas when things confused them. Gradually, I felt more confident to say something during the class. Not only in this class, but also some other classes.

Eric, from University A, expanded upon the cultural difference among the learners from the different sites:

> My classmates here in University A, they are more interactive. So, we talk and they respond faster and they respond with their ideas. People from other places [Universities B & C] respond with their good ideas as well, but then usually, I guess most of the time, they don't respond as much or as fast as students from here. It could be cultural difference, because, I don't know, they might not just talk as much as we do or they're just shy.

Eric later emphasized the importance of interaction for learning, especially in the context of this multi-site DE course, and noted that learning from interactions in this course not only "depends on how much you put in [contribute]" but "it also depends on how much others put in." He reflected that "I think to learn, it really comes out to interaction. So, someone else has to put in their effort, to communicate with you, to share their ideas with you too, to make this class the most beneficial." Eric's response made visible how the meta-

discourse given by Instructor A was taken up by him and had framed his thinking about learning in this course and in general.

However, from interviewees' responses it appeared that while learning depended upon interaction with other learners, it also depended upon interacting with knowledgeable classmates or classmates who had similar interests that could make for a more satisfying learning experience. For example, Sarah, from University A, noted that she learned more from her own classmates because she felt the "business acumen was sharper with University A students," and because she could easily understand them. Conversely, John, reminiscing on one of his interactions with remote learners during the first weeks of the course, expressed why he found this interaction with remote learners rewarding:

> All three of us [team members] had interest in 3D printing and we talked about 'what companies are big out there,' and 'what have you done with 3D printers,' 'O I've built my own 3D printers.' It was cool because we had something in common.

John then added that being in teams with remote learners who have common interests in turn can make the learners to "want to talk to each other more." Having common interests then appeared to be an important factor that generated more interactions, which is essential for promoting knowledge co-construction. These responses reflected the axiom of "what you learn depends on with whom you learn," indicating that interaction can be most beneficial and satisfactory when the co-construction of knowledge is done with learners who are knowledgeable and who have common interests. Although the interviewees uniformly reported that they learned more when there was more interaction with peers, especially when contributing to discussions, Eric explained that the point in interaction was not more talking.

> You hear more ideas [when learners talk]. I don't necessarily believe that talking more is anything, but talking more does let you hear what they are trying to say. People from other schools might have great ideas too, but if you don't hear it you don't know them.

Again, Eric's comment showed how his thinking corresponded with a social constructivist viewpoint, where participants' contribution in learning environments is crucial for knowledge co-construction. From interviewees' responses other important themes emerged that I present next. While I have presented these themes in distinct categories, this distinction does not imply that the themes do not overlap.

Factors that promoted peer interaction. For improving peer interactions, some interviewees suggested making time for interactions during the live two-hour sessions. For example, Jasmine strongly felt that they needed to have more interactions with remote peers during these synchronous sessions. "Because, otherwise it's hard to get input from all the class." Similarly, Levi noted that he found especially helpful when previously learned concepts were discussed in teams with peers during the live synchronous sessions. "I feel that helped a lot. Cause you know, you sort of are talking about the stuff you have read, the stuff the professor just spoke about, and you work together to learn." In this regard, Levi also noted a difference in the instructors' leading of the live synchronous sessions. He reflected that Instructor A made the synchronous sessions more interactive by providing the learners "little tasks between classes or during class to … interact with other students." He found these tasks helpful and felt that other instructors didn't really take advantage of that sort of interaction, and instead had them work on homework together without providing interactive activities. Levi's comment reflected classroom observations which had revealed a difference in the way Instructors A and B conducted guided activities during the live synchronous sessions. Sarah, on the other hand, suggested incorporating live chat during the synchronous sessions.

> I actually liked the idea of having to discuss the material of the course with the students. I think they could have incorporated more discussion during the class. I

> think if they had like maybe a live chat, that maybe people could talk on and discuss while the professor was lecturing, I think that would be cool.

Jasmine, similarly suggested dedicating one or half an hour of the live sessions to online chat, where the instructors asked questions and the learners responded.

> In that way, everyone will give their own input. Also, they can meet through there and be aware of some cultural differences. This will be a good exercise for everyone, because everyone will pay attention to the chat instead of being on other webpages.

Conversely, Eric noted that they did have a sort of a live chat during the synchronous sessions on *Slack*. However, from the interviews it appeared that not all learners were aware that besides collaborating on exercises on *Slack* during the synchronous sessions, some of their peers were consistently on this chat during these two-hour synchronous sessions. To this end, in a follow-up interview, the TA noted that they had a formal introduction to *Slack* in one of the earlier weeks of the course, during which they showcased to all learners the chat feature of *Slack*. He explained the learners were told that the chat feature "could be used to discuss with the whole class or their individual project teams during the live sessions." He then added that "Perhaps we should have further emphasized this functionality besides during that one lecture."

Eric further explained that the learners on this platform communicated back and forth with each other when the professor was instructing. He noted that this interaction on *Slack* was especially convenient during the lives synchronous sessions, given that their questions might not have applied to everyone and they did not interrupt the instructor, but received answers concerning their questions from peers.

> Through Slack, since we are not really interrupting anyone when we type, we can type our questions and wait for responses from others. We have 60 people on Slack that can respond to you at any given time, so it's helpful for people to spit out ideas as fast as they could or even any ideas in general, whereas for the professor when he is talking, it just feels not right to interrupt him.

Interviewees reported that in general the interactions during the live synchronous sessions enabled them to hear their peers' perspectives and insights and in turn contributed to their learning. For example, Willow appreciated "that students in different countries tended to exchange their ideas" during the synchronous sessions while Instructor A explained the course concepts. Sarah also noted that she found remote learners' perspectives on various global issues instructive:

> You actually get the perspective on these issues that we see on the news and all the time, but from somebody that actually lives there. I heard about the one child policy in China my whole life, but I never got to hear from someone who lives in China, and like how that affects them and how like they might not have siblings.

On the other hand, for improving interactions within the project teams, the interviewees suggested having smaller teams for effective communication among the team members. For instance, Levi reflected that "it was hard to get on that same page once the group got bigger…I felt it got more difficult, communicating between six people, that was hard, because you have six different schedules to manage." Levi later added that having one permanent team and weekly teams that changed seemed to work well in this course and enabled effective interactions among peers, considering the drop-outs.

Although difficulties existed in communicating for projects within the teams, it appeared that overall the interviewees benefited from their peer interactions within their various designated teams. For example, while Jasmine reported that "sometimes my peers didn't contribute as I did," Eric reflected that "we [team members] actually really communicated a lot and we had all sorts of ideas and perspectives put into this project [final project]." However, Jasmine added that she liked working in groups with "random people" because this enabled her to "understand different styles" of interacting. Similarly, Sarah expressed liking the weekly discussion groups that were randomly paired, except she

suggested having a better technology.

Peer interactions through internet technologies. For interactions outside of classroom time the learners used a variety of internet technologies and social media to interact weekly with peers and work on projects. Some interviewees reported using Facebook as their primary communication tool. However, Sarah noted that they ran into complications while using Facebook, given that some learners did not have access to Facebook, due to bans on Facebook in their country. *Slack*, on the other hand, which learners started to use couple of weeks into the semester, was uniformly reported to be both a convenient and a great tool for interacting with peers and for having discussions. "Slack is definitely the best discussion tool that we have, because it makes it easy to talk to all the other students," explained Sarah. Willow on the other hand, while noting that *Slack* was "a very good way to communicate" and "to gather information," expressed that it did not provide "the opportunity to communicate with each other visually." To this end, John noted that while their reliance on messaging enabled them to get their projects done, lack of a face-to-face component in their interactions impacted their overall learning experience. However, the TA in a follow-up interview explained that *Slack* did have a feature that enabled the learners to enter a video chat room with team members, and that "students at any point during the lecture could open a chat room to visually interact with their peers." He then added that they should have further emphasized the importance of this feature and reminded learners to take advantage of it.

Levi however, noted that *Slack* was a dynamic tool that enabled the tracing of the messages, which he found to be beneficial for their discussions. He explained that learners used *Slack* during the week to clarify questions and concepts before turning in their weekly assignments.

> Before that grading time, a lot of the students were on Slack and were asking bunch of questions. Someone would ask 'you know I don't understand this chart can someone explain it'…Since I sort of read the material late, I had the Slack open and I was reading the material, and whenever I had a question, I looked if someone asked it. Most of the time someone did so…and you would have three to four students who replied and answered it. So it was really nice…Sometimes…I would message them directly…I guess it's much less intimidating asking another student that seems to know what they're doing versus a professor, because they're busy and they may not get back to you as quick.

From interviewees' responses it appeared that *Slack* conveniently supported peer interactions both outside of the classroom time and during the synchronous sessions, enabling the learners to view their peers' public discussions, and to reply to questions or to make comments, and that without interrupting the instructors. Although most interviewees did not have reservations about using any particular technology or platform, they preferred having one platform. Sarah, for example, noted the importance of having just "one platform for communicating" and one place where the "information and assignments get uploaded and submitted." She further added that *Slack* seemed "more like a messaging service," and she felt there was a need for a better portal for uploading slides and other course material. While Levi also reflected that instructors' teaching style could be different, he felt "the technology has to be consistent."

Learning from interaction with different instructors. Due to the pedagogy and the learning objectives of this course, the two-hour live synchronous sessions were led by two instructors from Universities A and B. Instructor A led the live discussions during the first half of the semester, while Instructor B led the discussions during the second half of the semester. The interviewees had differing views about learning from different instructors. For example, John preferred having only one instructor. "I feel like the continuity would be a lot better." He expressed that he learned more when Instructor A was leading the discussions, and he favored his teaching style, explaining that the organization of the course

changed when Instructor B started leading the live sessions. Other interviewees reported similar views. For example, Jasmine noted that "the explanations of Instructor A were clear and easy to understand." Willow also noted that Instructor A's explanations were "always very concise and understandable," and expressed that Instructor B's discussions were "quite difficult" to understand. However, she added that she learned from Instructor B's interactions with learners during the live synchronous sessions. "When I listen to someone asking questions from him [Instructor B], I feel that he is really good at conveying his ideas to others, and every time when people ask questions I learn more from him." This comment exemplifies another instance where course participants' interactions during the synchronous sessions contributed to learners' learning of course concepts.

On the other hand, some interviewees reported more positively with regards to having different instructors. However, they uniformly noted the importance of a more organized and structured system. For example, while Sarah felt that the class organization could have been better, for her, learning with an instructor from a different university was a positive experience.

> I actually kind of loved having the multiple professors. I think maybe the class organization and the transition of those things could have been done better. I think the biggest problem with when the foreign professor took over was just that the instructions were not as clearly communicated, and we would have less time to work on our projects, because they would email us about it later. But, I think having a different professor was a cool experience, to get to learn from someone from a different university. I just think the organization needs to be handled a little better to make the transition a little easier for us.

Eric recognized advantages in having instructors from different universities. "It's kind of like you're taking a class physically where they are too." He likewise appreciated the different teaching styles and found the experience beneficial.

> We have University A's culture, in terms of the teaching style and everything, whereas in a different campus and a different school or even a different country, they

> have a different style of teaching as well. So, you really get to learn more about how each college life would be, how each college professor would be in a different region. So, I think that part is beneficial.

As noted earlier, Levi pointed out that Instructor A's teaching style markedly differed from Instructor B. For example, he explained that Instructor A's teaching style was "very straight forward," and that he provided opportunities for learners to interact during each synchronous session, which he appreciated. He reflected that he did not mind having instructors jointly teaching the same course with different teaching styles. He added that he did not know what the preferred teaching style was, but he emphasized "it would be helpful having a defined one." In a similar vein, some interviewees expressed that the transition from one instructor to another was challenging. To this end, Eric explained that having two instructors with different teaching styles was challenging because the learners had two different adaption periods for getting used to the instructors' teaching styles.

> For any professor, when we take their class we have like a week or two before we get used to this professor. Whereas, for our class we only meet once every week, and there is two professors in one semester. So, there is really two adaption periods, which makes the learning kind of slower than otherwise would be. But granted, I still think having two professors really expands my views on what the life would be and what the instructors could teach.

Learning from the cross-cultural experience. Overall the interviewees reported positively about their cross-cultural experience and the opportunity of learning with peers from different universities. Interviewees from both sites found their remote learners similar to themselves and reported learning from the cultural differences. "We found each other much more similar than I expected, given there are differences in race and color," noted Willow. Jasmine's reflection on what she learned from the differences exemplified the experience of having interactions with peers from different backgrounds and universities in a guided learning environment.

> I learned that the world is so diverse, and there is not a correct answer for everything. This is helping to open more my vision for my current and future life, since now I'm aware of the other cultures and lives in our big world.

Learner Interview Summary

Overall interviewees reported having learned from their peer interactions across the three campuses and benefited from remote learners' contributions during the live synchronous sessions. Most interviewees also reported learning from learner-instructor interactions during the live synchronous sessions and found the instructors' guidance and explanations during these sessions helpful. Interacting with remote learners and collaborating on projects however was not without challenges in this multi-site DE course. Notably, interviewees reported that the different time zones across the three countries and the language barrier hindered peer interactions and posed challenges for completing assignments.

Given these challenges, interviewees suggested having a lighter load and clear instructions for the assignments, as well as an adjustment in the timing of the weekly assignments. Other interviewees recommended having opportunities for scheduled discussions, where learners could interact with their teams and work on projects. They expressed that this would in turn lessen time difference issues and enable face-to-face interactions, which they felt enhanced their overall learning experience. While some interviewees reported that language barrier at times affected their understanding of course participants' discussions, others noted that the language barrier did not impede their learning from each other's contributions. On the contrary, the insightful comments of those learners with language barrier greatly contributed to their peers' learning.

Of course, the abovementioned challenges are present in most international DE courses, and do not define learners' overall experience. Interviewees, for instance, reported

finding their interactions with remote peers rewarding and expressed that they had benefited from these cross-cultural interactions. This rewarding experience was attributed to both relational and academic factors. In particular, for some interviewees making friends with peers from different academic and cultural backgrounds was a rewarding experience they greatly appreciated. They expressed that doing projects with remote learners enabled them to build relationships with individual learners from their teams. Peer interactions with remote learners further enabled course participants to learn from their peers' insights, perspectives, and ideas, which they felt it greatly added to their learning experience. For instance, interviewees from both University A and C reported finding their remote peers more knowledgeable and resourceful, especially in regards to global and international issues.

However, some interviewees noted the difficulty in building relationships with remote peers and reported not connecting with them. Lack of a face-to-face interaction was seen as a main contributor to the dis-connectivity experienced by learners. On the other hand, some interviewees explained that although initially difficulties existed in interacting with remote peers, gradually their interactions with remote learners improved, especially after using a common platform called *Slack*. To this end, some interviewees suggested having some kind of an opportunity prior to the start of the class, whether in person or through various internet technologies, in order to get to know their remote peers.

As noted earlier in the survey results, most learners reported having learned more from their own classmates than from remote peers. When asked what in their opinion contributed to this outcome, most interviewees pointed out that having more occasions for face-to-face interactions with peers from their own campus increased opportunities for peer contributions, in turn enabling them to learn more from their own peers' insights and perspectives. In addition, some interviewees reported learning more from University A

learners, given that they interacted more, especially during the live synchronous sessions, and thereby contributed more to discussions. The interviewees attributed this outcome to cultural and personality factors on the part of University B and C learners. To this end, some University C interviewees reported that they had learned from University A learners' comfort in expressing their ideas and overtime had become more confident to express their opinions in class.

The lower contributions from University B and C learners were seen to be an important factor that impacted the learning experience of some University A learners. For instance, it was noted that more interaction enabled to hear course participants' perspectives and ideas on course concepts, which could be beneficial only if these insights are communicated. On the other hand, from the interviewees' reports it also appeared that it was interacting with knowledgeable peers or peers with similar interests that made for a more satisfying learning experience. To improve peer interactions, interviewees suggested incorporating some form of a live chat and having more little exercises with small teams across the campuses during the two-hour synchronous sessions. However, interviewee reports showed that some learners were engaged in live chat on *Slack* during the synchronous sessions.

While most interviewees did not have reservations about using any form of technology or platform for their interactions with peers, most found *Slack* to be efficient for their learning purposes. Some interviewees however, not being aware that *Slack* had a visual component, did not take advantage of this feature, which could have in turn contributed to a more engaging learning experience. Although the type of technology did not matter, interviewees emphasized the importance of using the same technology throughout the semester.

Finally, while some interviewees preferred having one instructor for continuity, others liked having more than one instructor and felt their differing teaching styles and backgrounds added to their learning experience. Some interviewees further reported benefiting more from an interactive teaching style, and expressed that instructors' different teaching styles can greatly expand their learning if they are more defined in order to ease the learners' transition from one instructor to another.

Instructor Interview Findings

Instructor A reported that the most important learning outcome intended for learners in this multi-site engineering DE course was the "contextual understanding of subject content" and "mutual understanding of each other." These objectives paralleled the classroom observations, and were made visible in learners' interactions, previously described. Concerning different types of interactions, Instructor A considered peer-to-peer interactions to be the most important type of interaction during the live synchronous sessions, and explained that guided peer interactions are the most effective way for learners to co-construct knowledge and learn from each other.

> Peer-to-peer interactions within small cohorts and interconnected classrooms, when properly guided and systematically directed based on participants' diversity of background, are the most effective way for students to understand each other's different perspectives toward a subject. They can also co-construct new perspectives which were unknown to anyone previously.

For peer interactions outside of the scheduled classroom time, learners were not given strict guidelines with regards to their approach to their interactions. They were however "required to discuss with members of their learning cohort" the "pre-class self-study feedback of course contents." Instructor A explained that learners were assigned to these learning cohorts by the DE program computer system, that automatically "based on the diversity" of learners' responses placed them in teams for discussion.

Finally, Instructor A considered peer interactions with diverse learners an important factor for contributing to learners' learning, especially in today's 21st century world. He ended the interview by expressing that "learning from diversity is a new frontier of education which needs a new pedagogy to guide its realization."

Instructor Interview Summary

Instructor A's interview report validated classroom observations and artifact analysis. In particular, peer interactions were noted to be of great importance that enabled contextual understanding of course concepts. In addition, these peer interactions were seen to be most effective when carried out in a guided learning environment. Learners' engagement with subject content and peers with diverse backgrounds outside the scheduled classroom time further provided an opportunity for the learners to co-construct new perspectives.

Chapter Summary

Classroom observations and artifact analysis revealed that for the intended learning outcomes of this multi-site engineering DE course peer interactions were emphasized and different opportunities for peer interaction were provided and incorporated into the design of the course. The nature of interactions revealed that the live synchronous sessions were not used for delivery of subject content. Instead these live sessions served as an instructional space where course participants engaged in discussions concerning course concepts. To this end, an inverted approach to learning was incorporated into the design of the course where learners learned the course concepts during the week and engaged with their peers in guided discussions prior to the live synchronous sessions. This in turn allowed for more informed contributions during the synchronous sessions and peer interactions.

In particular, instructors utilized these synchronous sessions to clarify and explain course concepts, and by engaging the learners in discussions they examined learners'

understanding of course concepts. Learner-learner interactions on the other hand provided opportunities for learners to share their insights and perspectives concerning course concepts and discussion topics. Given learners were from diverse cultural backgrounds their contributions were varied. This in turn increased opportunities for learners to learn from the differences, which was instructors' intention in designing the course. Survey and interview reports also validated these observations. Learners reported having learned from their peers' insights and differing perspectives and found instructors' guidance and explanations helpful especially during the live synchronous sessions.

Therefore, course participants' interactions during the live synchronous sessions were significant in that they enabled learners to benefit from instructors' guidance and their peers' contributions in an instructional space where all learners across the three campuses could interact and learn from each other. Peer interactions were emphasized because they increased opportunities for learners from diverse backgrounds to co-construct disciplinary knowledge and contextual understanding of subject content. To this end, interviewees reported that they learned more when there were more guided peer interactions, both during the synchronous sessions and outside of the classroom time. Interviewees also noted learning more from knowledgeable peers and from peers who contributed more to the discussions.

The main types of interactions during the live sessions were learner-instructor and learner-learner interactions that were collaborative in nature. The survey reports also showed that learners found these instructional exchanges the most helpful of resources for their learning. In addition, classroom observations made visible how learner-instructor and learner-learner interactions during live sessions, by providing an occasion for course participants to co-construct knowledge, increased learning opportunities. These interactions

also revealed more participation from University A learners. Interviewees attributed University B and C learners' lower participation rates to cultural and personality factors. Notably, survey and interview participants reported having learned more from their own campus peers than from remote peers, explaining that face-to-face interaction with their campus classmates increased opportunities for interaction and contributions to discussions. On average however, participants reported having learned from their cross-cultural experience and benefited from remote peers' insights and contributions especially during the live synchronous sessions.

CHAPTER FIVE

DISCUSSION OF FINDINGS AND LIMITATIONS

Due to advances in internet technologies that enable interaction across geographical distances, educators are testing new approaches to teaching and learning especially in various DE environments. Notably, synchronous technologies in the past decades have made live interaction across distances possible. This in turn has given rise to new instructional designs. However, qualitative studies that describe what is actually occurring in these new learning environments are scant. In particular, there are few qualitative studies that investigate the nature and significance of course participants' interactions for the purposes of informing course design. Most studies that have examined interaction in learning environments that utilize synchronous technologies are quantitative in nature and do not provide a description of what is occurring in these environments in order to inform new possibilities for instructional design.

This study investigated the nature and significance of course participants' interactions in a multi-site engineering DE course. To explore course participants' interactions a case study methodology was employed that allowed for an in-depth examination of these interactions, which occurred across three campuses located in different countries (USA, China, and Taiwan). In exploring the nature and significance of course participants' interactions, this study sought to first examine an existing DE course in order to describe what is actually occurring in a current DE course that utilizes advanced synchronous technologies, and how course participants' interactions reflected the course design and instructors' intentions for learning outcomes. This in-depth investigation then enabled to explore new possibilities for instructional design which is discussed in chapter six of this

research report. In this chapter, I first present a discussion of findings, relating the findings to previous research. Then, I discuss study's limitations along with opportunities for future research.

Major Findings

Classroom observations, artifact analysis, survey results and course participants' interviews revealed a course design that emphasized peer interactions for the obtaining of the intended learning outcomes of the course, namely contextual understanding of subject content via peer interactions. To this end, live synchronous sessions were used as an instructional space where course participants engaged in discussions and guided activities. That is, in this case study the course was intentionally designed to promote interaction among learners. To enable this, an inverted approach to learning was incorporated into the design of the course that allowed for more informed contributions during the live sessions.

In regards to the significance of learners' interactions, the findings revealed that instructors utilized the live sessions to clarify course concepts and examine learners' understanding by engaging them in discussions. On the other hand, learner-learner interactions enabled learners to share their diverse insights and perspectives. Interviewees reported learning more from guided peer interactions and from peers who were knowledgeable or contributed more to the live discussions. However, classroom observations revealed more participation from University A learners. Interviewees attributed University B and C learners' lower participation to cultural factors. Notably, most learners reported having learned more from their own campus peers than remote learners and emphasized the importance of face-to-face interactions.

Nature of Course Participants' Interactions that Reflected Course Design and Instructor's Intentions for Learning Outcomes (Research Question 1)

The examination of the nature of course participants' interactions revealed that for the intended learning outcomes of this multi-site engineering DE course different opportunities for peer interaction were provided for learners, both during live synchronous sessions and outside the classroom time, in order to enable the learners to co-construct disciplinary knowledge and obtain contextual understanding of course concepts. To this end, the live synchronous sessions were not utilized for delivery of content and served as an instructional space for course participants' discussions and guided interactions.

In particular, classroom observations and artifact analysis revealed that peer interactions were considered to be an important factor in enabling contextual understanding of course concepts. Based on the pedagogy of this course, contextual understanding, that is "knowledge about the things around the content subject" (Instructor A's dialogue presented in Appendix C1), did not occur from content knowledge only but was realized through interaction with peers and instructors from different cultural and academic backgrounds. This view of learning that emphasized interaction, reflected the social constructivist view of learning where learning is seen to occur through dialogue and collaborative activities for both individuals and groups (Oliver et al., 2006). It was to this end, that is, co-construction of contextual understanding of subject content, that different opportunities for interaction were provided for learners especially during the live synchronous sessions.

However, this co-construction of contextual understanding of course concepts depended upon learners' advance learning of subject content prior to the live sessions. This advance preparation reflected a form of inverted learning, where learners' direct engagement with subject content occurred outside the synchronous sessions, reserving classroom time for interactive activities and discussions. The inverted method of instruction along with course participants' cultural diversity enabled the co-construction of contextual understanding of

course concepts as well as more informed discussions, by shaping learners' mental or cultural representations that they brought to the learning environment (Uzuner, 2009). The interactions during live sessions made these mental representations visible and thereby increased opportunities for learners to hear their peers' perspectives and ideas and to become acquainted with other cultures and ways of thinking. Learner survey and interview reports validated these observations and revealed that learners learned from their peers' insightful contributions during the synchronous discussions. Therefore, in this multi-site DE course interaction among course participants from different academic and cultural backgrounds was the means by which (contextual) learning of principles and practices of global innovation occurred.

Course participants' interactions during the live synchronous sessions were considered to be especially important because they provided a face-to-face opportunity for learners to engage in collaborative activities and discussions, which in turn increased opportunities for contextual understanding of course concepts. Researchers have noted the importance of a face-to-face component in DE (Zhao et al., 2005). In particular, previous research in DE has shown that instruction that combined face-to-face and online elements was found to be more advantages than purely online instruction (U.S. Department of Education, 2010). In this present study, survey and interview reports also showed the importance of face-to-face interaction for learning. For instance, learners reported benefiting more from face-to-face interactions.

In the context of DE, synchronous internet technologies by enabling instant feedback and face-to-face interaction (Mattheos et al., 2001; Hrastinski et al., 2010) create environments that are closer to traditional classrooms (Karal et al., 2011). Therefore, live interaction through synchronous technologies by reducing the sense of distance (Moore,

1993), has made new ways of teaching and learning across distances possible. This in turn has implications for educational practice, where synchronous technologies by allowing interaction across distances can enable new course designs and instructional approaches in DE, for both individual learners and actual classrooms.

The findings of this study revealed that the course design plays a significant role in allowing for more productive live synchronous sessions. To enable discussion and meaningful interaction among course participants, especially in courses where live synchronous sessions are utilized, it is crucial for learners to either learn or to be familiar with course material prior to synchronous sessions. This requires a form of inverted approach to learning which in turn reserves classroom time for meaningful interaction. Given that interaction among distance learners is less frequent and instructors' effort is necessary for promoting interaction among learners, a course design that incorporates an inverted approach to learning can enable more productive synchronous sessions.

Significance of Course Participants' Interactions that Influenced Learning during Live Synchronous Sessions (Research Question 2)

Classroom observations showed that learner-instructor and learner-learner interactions were the two prevalent types of interactions during the live synchronous sessions. These interactions were encouraged by course instructors, and different opportunities were provided during the live sessions in order to facilitate these instructional exchanges. For effectiveness in DE, research has pointed out the importance of promoting learner-instructor and learner-learner interactions, and instructors' participation in discussions and their providing of guidance and feedback has been emphasized (Lou et al., 2006; Ng, 2007; Tallent-Runnels et al., 2006). In particular, instructors' opinion has been noted to be especially important for encouraging learner-learner interactions (Prokofieva,

2013). Also, these instructional exchanges have been shown to significantly contribute to learner satisfaction (Sterling, 2015; Swan, 2001), where interaction with course participants and receiving of feedback has been correlated with learner persistence in DE programs (Hart, 2012).

This present study's findings were consistent with the abovementioned research in DE, reviewed in chapter two. Given the inverted learning approach of this engineering course, the live synchronous sessions were especially important for providing an instructional space for course participants' discussions. During these synchronous sessions, instructors clarified and explained course concepts and engaged the learners in discussions by asking them questions in order to examine learners' understanding of course concepts and guide their learning. Learners also initiated comments or questions during these sessions and shared their insights and diverse perspectives concerning course concepts during discussions. Learner survey and interviews also showed that course participants greatly valued these interactions and found them helpful for their learning. For instance, interviewees reported that these live interactions contributed to their learning by enabling them to hear their peers' insights and perspectives. Learners also reported having benefited from instructors' explanations and guidance during the synchronous sessions.

Concerning learner-instructor interactions, classroom observations revealed differences in the teaching style of the instructors, which was also noted by the interviewees. Significantly, interviewees preferred a more interactive style of teaching that incorporated guided activities enabling the learners to interact with peers and learn from them. This interactive style of teaching reportedly promoted constructive and meaningful interactions. This finding was consistent with Moradini's (2007), where learners preferred interactive sessions with the instructor. To this end, DE courses that intend to engage learners across

distances in interactive learning will benefit from a course design that incorporates guided activities where learners engage in discussions or projects with their peers across the different sites.

In a similar vein, researchers have emphasized that while interaction is important in DE it should be purposeful (Simonson et al., 2011). That is, purposeful interaction and not more interaction seems to be the key to effective learning in DE. Likewise, from a social constructivist view of learning (e.g., Vygotsky, 1978), it is interaction with a more knowledgeable instructor or a peer that contributes to a learning environment that fosters deeper understanding. The findings of this present study were also consistent with these observations. Notably, interviewees reported learning more when there were more guided and purposeful interactions with peers. Having common interests with team members also appeared to be a crucial factor that generated more interactions. Interestingly, some interviewees expressed that simply more interaction was not the key to more learning. While more interactions enabled to hear peers' insights and perspectives, it was interacting with more knowledgeable learners that appeared to be contributing significantly to learners' learning. The findings of this study then suggest that to ensure meaningful interactions during live sessions, it is crucial to ensure that learner interactions are informed and guided. Based on the findings of this study again the course design plays an important role in the realization of this objective.

Classroom observations also revealed that these learner-instructor and learner-learner interactions during the live synchronous sessions were collaborative (Dillenbourd, 1999) in nature, where through group interaction course participants constructed disciplinary knowledge together (Prokofieva, 2013). This collaborative learning which was incorporated into the design of the course promoted discussion and reflection with course concepts

(Laurillard, 2000). Given the collaborative nature of the course and assignments, some interviewees still experienced a sense of dis-connectivity with remote learners and reported not building strong relationships with them, due to the physical distance and less face-to-face interactions. These findings were consistent with research in DE that has reported learners' feelings of dis-connectivity with remote learners (Fox et al., 2011; Park and Bonk, 2007b; Stewart et al., 2011). However, some interviewees reported that working on projects and engaging in small tasks regarding course concepts during the live synchronous sessions enabled them to build relationships with individual learners and promoted more interaction among course participants, in turn contributing to their learning. This finding relates to Park and Bonk's (2007b) study where instructors' involving of learners jointly in task-oriented and meaningful group interactions greatly reduced complaints on dis-connectivity in a course taught with both regular and distance learners.

Conversely, video analysis made visible how these collaborative interactions during the live synchronous sessions increased opportunities for course participants to engage in discussion and to co-construct disciplinary knowledge. In particular, instructors played an important role in supporting collaborative interactions. Research has shown that active engagement of remote learners increases their contributions to discussions during live synchronous sessions (Stewart et al., 201; Szeto, 2015), which was observed in this present study. Because remote learners, considering from any instructors' stand point, participated less in discussions during the synchronous sessions, instructors actively engaged the remote learners in discussions by directing questions toward them. This in turn increased remote learners' contributions to the synchronous discussions.

However, there were significantly more interactions from one of the participating sites (University A) which hosted more instructor leading sessions. Learners from this site

asked more questions and participated more in the live discussions. This finding was consistent with prior studies that have reported limited or lack of interaction from remote learners in multi-site learning environments with both regular in-class and distance learners (Fox et al., 2011; Moradini, 2007; Muuro et al. 2014; Pukkaew, 2013; Szeto, 2015; Teng et al., 2012). On the other hand, interviewees attributed University A (USA) learners' more participation in discussions in comparison to University B (China) and C (Taiwan) learners' participation to cultural factors, such as shyness, on the part of University B and C learners. This finding was consistent with Uzuner's (2009) report that noted learners from less individualistic cultures had a more passive presence online, asked fewer questions, and held back their thoughts.

In addition, most survey participants (87%) reported having learned more from their own classmates as opposed to remote learners. When asked what contributed to this outcome, interviewees explained that having more opportunities for face-to-face interactions with their own classmates provided more occasions for peer contributions and discussions, in turn enabling them to learn more from their own classmates' insights and perspectives. This finding while consistent with Szeto's (2015) study, that reported group discussions, knowledge exchange, and sharing were more explicit among face-to-face learners, contrasted with that reported by Stewart et al. (2011), in which learners reported having learned as much or more from remote classmates. In Stewart et al.'s study however, the participants were graduate learners. Their advanced educational level could have played a role in the rate of their contributions. Conversely, it is possible that the wording of survey questions in this present study, not being clear, contributed to this finding. However, given the interviewees' explanations in this present study concerning why more learning occurred with peers from their own campus, and considering that this finding being consistent with Szeto's (2015)

report contributed significantly to the implications of this study presented in the next chapter, this discrepancy can be further investigated in future studies.

Learning more from face-to-face interactions however suggests that in the context of DE, given the availability of new internet technologies, distance learning accompanied by local learning not only has become possible but it appears to be more advantages, depending upon the objectives and the nature of a given course. That is, the findings of this study not only emphasize the importance of a mediated face-to-face interaction among distributed distance learners but suggest the importance of a face-to-face component within a regular classroom in DE.

Moreover, learner-learner interactions during live sessions consisted of learners' presentations of their projects and their engagement in Q & A with peers concerning these presentations, as well as learners' discussions and interactive exercises on *Slack*, a platform that enabled live interactions. These collaborative interactions enabled learners to co-construct contextual understanding of course concepts which became visible in classroom observations, presented earlier. Interviewees also noted that these learner-learner interactions contributed to their learning by enabling them to hear their remote peers' perspectives and ideas, which at times differed from their own. This finding was consistent with other studies that have reported the possibility of engaging learners in complex discussions and interactive activities in multi-site distance learning environments (Holliman & Scanlon, 2006; Mattheos et al. 2001).

However, collaborative activities during live synchronous sessions were guided and facilitated by instructors or the TA of the course. Consistent with previous research findings, the guided natures of peer interactions during the live synchronous sessions were crucial in ensuring learner contributions from all participating universities (Tallent-Runnels et al.,

2006). For instance, the instructors and the TA during these interactive activities provided their own comments, directed the cross campus interactions, and elicited critical reasoning and thinking. These instructor and facilitator actions contributed to effective moderation of discussions, similar to those reported by Asterhan and Schwars (2010), which in turn promoted participation from remote sites.

While research has emphasized the incorporation of interactive learning that fosters collaboration, such as problem-based or project-based learning, many DE courses do not have collaborative assignments or activities built into their course design (e.g., Fox et al., 2011; Moradini, 2007; Pukkaew, 2013; Teng et al., 2012). Given the unfamiliarity of most educators with holding online synchronous sessions (Teng et al., 2012), descriptive qualitative studies that examine interaction during live sessions can inform practice by showing different possibilities for interaction among course participants across different geographical sites, which this present study intended to do. The findings of this study revealed that course design plays an important role in the way synchronous sessions are held, and a course that emphasizes meaningful interaction can benefit from a course design that incorporates guided activities and an inverted approach to learning.

On a different note, in this course *Slack* was the main technological platform used by course participants for interactions both outside of classroom time and during synchronous sessions. Learners were not restricted to use this platform outside of classroom time and could utilize any software that enabled communication across distances. While interviewees did not have reservations regarding using any particular platform or technology for their interactions with peers, they expressed the importance of having one platform for their interactions where all course assignments and information could be viewed and submitted there. In the DE literature reviewed in chapter two, various technological platforms were

used for synchronous interaction, such as Interwise (Kuo et al., 2014), Horizon Wimba (Martin et al., 2012), VClass learning management system (VClass LMS) (Pukkaew, 2013), videoconferencing (Szeto, 2015), and Synchronous Cyber Classroom (SCC) (Teng et al., 2012). While, different instructors utilize the kind of software that is appropriate for the purposes of their DE course, researchers have advised for the usage of technology and pedagogy in DE that supports learner-instructor and learner-learner interactions, as opposed to technology and pedagogy that is directed toward learner-content and learner-interface interactions (Lou et al., 2006). Artifact analysis and learner interviews revealed that in the engineering multi-site DE course investigated in this present study the technology and pedagogy was intentionally chosen to support interaction among course participants and served instructors' purposes for obtaining course objectives.

Limitations

This case study examined the nature and significance of course participants' live interactions in a multi-site DE course. There are several possible limitations to this study. This study was limited to examination of course participants' interactions during one semester of a multi-site engineering DE course. Therefore, findings are not generalizable to populations. Interviews and surveys were conducted from learners of this one course. A study that examines two or more courses, that is, a multi-site case study, may yield different or more comprehensive results.

In addition, learner interviews were conducted with participants from two of the participating universities (Universities A & C). This posed a methodological problem. However, given that survey results of University B learners did not significantly differ from the other two sites, and that University B learners were similar in background with University C learners (China & Taiwan), I did not lump all learners together and considered

each site separately for analysis. Nevertheless, interviews from University B learners could have greatly increased the strength of the results. Similarly, only one instructor was interviewed in this study, due to the timing of the course and instructors' international travel with course participants. Interviews with instructors from Universities B and C could have contributed greatly to the findings and may have provided further insights.

Another limitation of the interviews was the unequal number of male and female participants from each university. Moreover, there were only female participants from University C. While research in DE has emphasized the importance of learners' culture and has focused on cultural differences in interaction, gender and its impact has not been widely specified. To this end, while the unequal number of male and female interviewees did not lessen the importance of interviewees' contributions, having equal or close to equal male and female interviewees could have expanded the results. However, there was consensus among male and female interviewees' comments, indicating that interviewees' gender did not impact their views concerning their experience in this multi-site DE course.

Moreover, not all interviews were conducted face-to-face. Because interviews were administered during the last week of the course, it was more convenient to interview the University A learners in person. For remote learners, to ensure participation and given the time zone difference, written interviews on Google Forms were conducted. While follow-up questions were asked of interviewees from both written and in person interviews, it is possible that in person interviews via skype with remote learners could have yielded more contributions from them. Likewise, the instructor interview was a written interview administered via Google Forms. Considering Instructor A's travels both during the semester and at the end of the semester for their international trip, participating in a written interview was more feasible and convenient for him. Again, it is possible that an in person interview

would have generated more contributions.

Because interviewees volunteered for the interviews, it is possible that there could have been a significant difference between those who were interviewed and those who only participated in the survey. For instance, interviewees could have been the more active learners who had a more positive experience in the course. However, interviewees' survey responses did not significantly differ from those who only participated in the survey. In fact, interviewees' survey responses were representative of survey participants' responses from their own campus. While this present study was a qualitative case study and representation was not an issue, still more interviewees from each site could have strengthen the findings.

Furthermore, most classroom observations were done through recorded videos. Given the multi-site nature of this course I was only able to attend University A in person for selected classroom observations. A different study can engage more researchers from all participating sites in order to record the in person experience of all participating universities and more comprehensively represent learners' DE experience or the nuances of participating in a multi-site DE course.

Finally, it is important to note that the main findings of this present study are based upon observations of the live synchronous sessions. During the week outside the classroom time, learners in assigned peer groups engaged in interaction with their peers from the different sites, discussing the weekly assigned readings, videos, or exercises. These interactions, which occurred both synchronously and asynchronously, were not recorded and were not available for research observations. Therefore, while a brief description of the nature of learners' interactions outside the live classroom sessions is given, this present study does not completely capture all interactions of learners and their significance for learning. Some interviewees however commented on the significance of these interactions and their

contribution to their learning. To this end, the investigation of these peer interactions outside the classroom time in DE courses that utilize synchronous technologies, can further increase our understanding in regards to the impact of peer interactions on learning and reveal other possibilities for course design.

Opportunities for Future Research

The findings of this study revealed that purposeful and constructive interactions with peers and course instructors increased opportunities for learning. Specifically, it was guided interactions with more knowledgeable others that was seen to be contributing to learners' learning, especially during the live synchronous sessions. By analyzing course participants' discussions during synchronous sessions I showed how during these sessions course participants interacted and constructed knowledge together. The analysis of the nature and significance of interactions in turn revealed in what ways the design of the multi-site engineering course provided opportunities for live interaction. Considering how DE is becoming more common and synchronous technologies increasingly are being incorporated in DE programs to enable live interaction, there is a need for more research in order to illuminate more effective ways of utilizing live synchronous sessions that yield desired learning outcomes.

The limitations of this study suggest several possible directions and opportunities for future research. For instance, future research can carry out multiple case studies which in turn can yield more robust results, the principles of which may be generalizable to other populations. Secondly, a case study with researchers in all the participating sites may provide a different opportunity to capture the experience of all remote learners and to more thoroughly present the nuances of participating in a multi-site DE course. Certainly, more interviews in future qualitative studies with equal number of male and female participants

from all participating sites can further enhance our understanding of the dynamics of engaging in interactive distance learning with peers from different cultural and academic backgrounds.

In addition, future research can further explore cultural issues in DE and their impact on learning. In this present study, there were significant differences in frequencies of course participants' contributions from the different participating universities to the live synchronous session discussions, which were attributed to cultural factors and differences. Given increasingly more educators are engaging in global instruction with learners from diverse cultural and national backgrounds, the explorations of cultural issues that impact learning can inform instructional practice and design.

Finally, future research can further investigate learning from both remote and regular learners. The findings of this present study showed that most learners reported having learned more from peers from their own campus as opposed to remote learners. This finding while consistent with one of the reviewed studies' findings (Szeto, 2015), contrasted with another (Stewart et al., 2011) which reported learners learned as much or more from remote learners. Future research can explore under what conditions these findings seem to be true. Future research can also replicate or explore these same questions, which can further inform research and course design in DE.

CHAPTER SIX

IMPLICATIONS FOR DESIGN IN DE AND HIGHER EDUCATION

In this chapter I present the implications of this study concerning new possibilities for instructional design in DE. Given my objective in this present study was to examine a DE course in order to then explore new possibilities for course design, the implications being more elaborate are presented in a separate chapter.

Conclusions from Design of the Multi-site Engineering Course

In this study I explored the nature of course participants' interactions that reflected course design and instructors' intentions for learning outcomes as well as the significance of interactions during the live synchronous sessions that influenced learning. My investigation revealed that live synchronous sessions were not used for content delivery but served as an instructional space for course participants' discussions and guided activities. An inverted approach to learning made this form of course design possible. The live synchronous sessions were especially significant in that during these sessions instructors engaged the learners in discussions in order to examine their understanding of course concepts and guide their learning by explaining or clarifying course concepts. In particular, during the synchronous sessions different opportunities were provided for learners to interact with one another and by sharing their diverse perspectives and insights co-construct disciplinary knowledge and obtain contextual understanding of course concepts. In what follows I first present the main technological and pedagogical design features of the engineering course and explain the nature and utility of these features. Then, I discuss implications for instructional design in DE which are derived directly from the explanation of the nature and utility of these technological and pedagogical features. These features are as follows: (a) inverted

learning, (b) recorded lecture videos, (c) textbook free, (d) different course entrance times, (e) global learning locally, and (f) institutional global learning.

Inverted learning. The case study presented in this research report showed the necessity for some form of inverted learning in synchronous DE, especially if live synchronous sessions are meant to be used for interaction and collaborative activities among course participants. This way, learners' contributions are informed and therefore opportunities for learning increase during interactions with peers.

Recorded lecture videos. In the multi-site engineering course under investigation in this present study, in addition to weekly videos and other learning materials provided for learners prior to the synchronous sessions, learners had access to all recorded live sessions throughout the semester. Access to and usage of recorded lectures or recorded videos of live synchronous sessions, made possible by advanced internet technologies, is an unprecedented approach to learning in the educational landscape which has greatly enhanced learning opportunities for learners of all ages and backgrounds. For instance, some university instructors have been using MOOC videos for content delivery outside of classroom, reserving class time for interactive projects and discussions (Gerber, 2014). The usage of recorded videos is a crucial element in enabling more productive live synchronous sessions by transferring the delivery of content to outside of classroom time and reserving class time for interactive and collaborative activities and discussions.

Textbook free. In the multi-site engineering course in this present study the instructors did not utilize any textbooks for delivery of subject content. For content delivery either videos were provided outside classroom time or slides and different readings about course concepts were made available for learners. With the advent of internet technologies**,** textbook free classrooms have increasingly become common in the past decades, not only in

online and distance learning but also in regular classrooms. Most courses nowadays have a course website where reading and course material is provided there electronically for learners. This feature is closely associated with inverted learning and recorded lecture videos in terms of enabling distance and online learning, and is both cost-effective and efficient. Textbook free classrooms fit well within a world that is becoming more and more paperless, and have significantly contributed to the shift from a lecture based model of instruction to a more interactive and collaborative learning.

Different course entrance times. In the multi-site engineering DE course under investigation in this present study, learners from the different participating universities entered the course at different times during the semester. Two of the sites (Universities B and C), due to their universities' academic calendars, joined the course two weeks after University A learners did. While the two weeks does not seem a long period, in a different session of the same course (Session A), where learners were from more professional and advanced academic backgrounds, one of the participating universities (Germany) joined the course on week eight. While distance learning has been known to support anytime, anyplace, and anywhere learning, this opportunity of flexible entrance further expands possibilities with distance and especially global distance learning for both individuals and groups. For instance, depending upon the purposes of an instructor (or an individual) an actual class can have a different entrance time into a multi-site learning environment and still engage in interactive and collaborative activities with learners from different geographical locations.

Research on different entrance times for participating schools or universities in multi-site learning environments is scant or rather nonexistent. I have not come across studies on multi-site learning environments that had this feature, which was incorporated into the design

of the multi-site engineering course under investigation in this study. Current distance learning programs, such as MOOCs and edX, enable individual learners to enter the course within a certain period of time. However, for most of these courses assessments close after their due dates. In other words, in current DE programs it is not common to enter a DE course half way through the course. Thus, this feature of the multi-site engineering course in the present study made visible new possibilities for global or national DE learning, where DE learning for both groups and individuals can become even more individualized.

Global learning locally. In the multi-site engineering course in this present study, the learners engaged in global learning while situated in their local educational institutions. Each participating site was an actual classroom with learners who had face-to-face interactions with their own classmates. The face-to-face interaction was an important contributor to learners' learning and survey and interview participants in this present study reported having learned more from peers from their own institution due to more face-to-face interactions with them which in turn promoted more discussions. Conversely, learning with remote peers added to learners learning experience. While learners from all participating sites expressed that less face-to-face interaction with remote learners contributed to a sense of distance and that the distance and the different time zones were issues that impacted their interactions, nevertheless learners from all three sites expressed having learned from their remote peers' contributions and thinking which differed at times from their own. Notably, working on projects with remote learners contributed to learners' learning and was reported to be a positive learning experience. Therefore, the local and the global nature of the course increased opportunities for learning with diverse learners without lessening the benefits of face-to-face learning in a traditional classroom sense.

It is important to note here that the founder of the DE program (Instructor A)

considered global learning a new frontier of education that requires a new pedagogy to guide its realization. Instructor A's vision for his multi-site DE program was expressed as "learning together for a better world," through "connected classrooms." In a meta-discourse about the importance of interaction in his engineering course given during the first live synchronous session (08.31.15), Instructor A explained that "everything that matters[in today's world] is interconnected…imagine where every classroom in the world is interconnected like the internet." Given, the ubiquity of educational subject content in today's technologically advanced world, where information and knowledge has become a commodity (Oliver et al., 2006) and is easily accessible by masses, Instructor A observed that learners will no longer be going to college for textbooks or lectures. Learning rather will become centered on contextual understanding of subject content which occurs through interaction with peers and other knowledgeable persons.

Classrooms then turn into environments where instead of receiving lectures learners work together and engage in guided learning activities. This requires some form of a face-to-face local learning where instructors' or more knowledgeable others' guidance and scaffolding can support the learning process. The idea of connected classrooms by adding the global factor to interactive learning greatly increases opportunities for contextual and mutual understanding, which in todays interconnected world has become a necessity for advancing knowledge and promoting good international relations.

Institutional global learning. Finally, a last design feature of the engineering course in this study was institutional global learning, which is closely associated with global learning locally. This feature was not unique to this course. As noted in the literature review presented in chapter two, educators are teaching courses with learners from other countries or institutions. This feature however differs from the kind of global learning that MOOCs and

other distance learning platforms enable and this difference is significant enough to note separately.

In the engineering course in the present study the global learning was institutionally supported. This means that by completing this course learners obtained credit toward their college degree. Currently this is not the case with global learning platforms such as MOOCs, which have high drop-out/non-completion and low participation rates. Therefore, universities or educational institutions engaging in global learning can yield better results in terms of learning outcomes and completion rates, because the degree granting institutional structure enforces higher learner retention rates, which can be especially important when interaction among learners with diverse backgrounds is the intention. For example, in the engineering course in this study, the learners from the three participating universities were undergraduate learners who were working towards their bachelor's degree. Considering the different challenges that existed in this multi-site engineering course (presented in chapter four) most learners completed the course and reported having a positive global learning experience. In addition, interviewees' emphasis on the importance of face-to-face interaction showed the necessity for actual classrooms in the kind of global learning that is to yield desired learning outcomes, particularly in a world that is becoming more interconnected and can benefit from a more knowledgeable public.

In summary, the presentation of main design features of the engineering course in this study revealed that technological advances have turned distance and online learning into a global phenomenon, without impacting its individualized anytime anyplace nature of learning while at the same time enabling interactive and collaborative learning at a larger scale. The usage of recorded videos and live synchronous sessions in particular have made the providing of instruction across distances possible and have given rise to new approaches

of instruction not feasible in the past decades. In addition, textbook free classrooms make global learning both more feasible and economical.

Implications for Instructional Design in DE and Higher Education in General

Based upon the exploration of the multi-site engineering DE course in this study, I here present implications for instructional design in DE and also higher education in general. While my initial intention in this study was to explore new possibilities for design in DE, the findings of the present study pointed to new possibilities for instruction in general applicable to traditional classrooms. To this end, I discuss implications for instructional design in traditional or regular classrooms, which is connected to DE and the trajectory DE is taking.

First, it is important to note that these are informed suggestions and do not contain a step by step order for design. Also, these suggestions are not meant to imply a possibility for a uniform or a unified educational instructional design. An assessment of the educational landscape shows the existence of different kinds of educational institutions with their own instructional purposes. For instance, in California higher education institutions fit under the state's tripartite structure of multi-campus network of research universities (the University of California (UC)), regionally based universities (the California State Universities (CSU)), and local community colleges (the California Community Colleges) (Douglass, 2010). These different institution types all have their distinct purposes and even select types of learners. Similarly, instructional design in higher education, considering the variety of advanced internet technologies that enable synchronous and asynchronous interaction across distances, can and ought to be varied in order to meet different learner needs and learning objectives.

Secondly, I present these suggestions in light of what I consider to be pedagogical and technological "givens," based upon this present study's findings and considering the rapid integration of advanced internet technologies into almost every aspect of our social

lives. The first educational given is that higher educational institutions for training future scientists and researchers need to have some form of a face-to-face component in their instructional design. While there are institutions that are purely online and there is a place for them on the educational landscape, for training the next generation of educators, scientists, and technicians, etc. a form of face-to-face interaction is necessary to insure the kind of interactive learning that is both more satisfying for learners and yields the desired learning outcomes. Second, advances in technologies have contributed to inevitable changes in content delivery, especially in DE, that sooner or later arguably could become ubiquitous. Considering these givens, I next present the implications for instructional design.

Provision of instruction through recorded videos. The advances in internet technologies and their subsequent impact upon instructional methods, seem to be shaping the way for provision of instruction through recorded videos. Instructors who teach the same courses, especially in lower division, have been providing the same material for years often in form of lectures to learners. The existence of a virtual space and the ability to record lectures and make them available for learners, now renders this repetitive ways of instruction obsolete. While research advances and knowledge changes, the introductory courses for most majors are both foundational and essential for acquiring the disciplinary knowledge. These introductory courses that need to be presented to each cohort of learners can be presented in purely modulated video formats. This in turn opens up class time for interactive activities and learning. This in a way may lead to the elimination of big lower division lectures. Instead a heavy reliance on sections that take place once or twice a week with TAs or facilitators may become the norm. Classes then automatically become smaller, which research has shown to be effective in terms of learning outcomes and their contribution to learner engagement, success, and satisfaction (e.g., Horning, 2007).

It is important to note here that in mid 1800s, a movement in higher education started, influenced specifically by leaders in various universities, to emulate the German university model, which separated the early years of college from the later rigorous years (Monroe, 1972). Lower division preparation in universities was viewed as a burden (Jurgens, 2010) and some leaders believed that providing general education to learners was a hindrance to advancing research (Monroe, 1972). While the German model was not exclusively adopted, due to tradition and the purpose undergraduate studies served in universities, junior colleges (community colleges) were established in increasing number, which in fact eventually did provide transferable courses for the first two years of college in higher education (Monroe, 1972). Community colleges in fact partly were created to carry this function of providing lower division college courses. It seems now that the virtual world, by becoming a means for providing lower division courses, can take the same role community colleges have played since the early 1900s. That is, instead of having instructors lecture the same material every year, recorded lectures, which entail a form of inverted learning, accompanied by sections, where face-to-face and guided interaction can be provided for learners, can be a dominant form for at least lower division instruction in higher education.

Advanced technologies enable all forms of synchronous and asynchronous interaction across distances (e.g., discussion forums, live chat). These new forms of lower division courses can have online asynchronous or synchronous conferences on set days where learners can ask instructors questions (e.g., Reddit). These online conferences are similar to the ways the new generation is interacting in virtual spaces, and not only can be quite effective and engaging but these discussions can be kept and archived for learners throughout the duration of the course. In addition, video lectures online can be accompanied by interactive quizzes or test questions. Both of these methods are currently utilized in MOOCs

where learners do not have the face-to-face interaction with course instructors. This form of content delivery can also apply to introductory graduate courses where the same material is presented to each cohort. This way classroom time will be reserved for interaction with peers and instructors or TAs. Of course, this form of delivery does not render the role of educational and disciplinary experts obsolete. For orchestrating these instructions and introducing new material over time etc. it is necessary to have experts overseeing this form of instruction.

In addition, video lectures enable to keep a record of the past. Many instructors accumulate a wealth of knowledge that is sadly lost when they are gone. Not everything can be published in a book or an article in order to pass down to the next generation of learners. However, video formats enable to capture instructors' insights regarding a topic or enable the preserving of an interview with a scholar, which can be kept for future generations. This way, classrooms become connected on a continuum from past to present onto future, while learners get to learn from different instructors' insights as well.

If instruction is provided in a virtual space and some form of face-to-face interaction with knowledgeable others and peers occurs in small sections or classrooms, then a form of DE has occurred. In other words, distance learning, which in a sense is learning that either occurs in the virtual world or through the virtual world, can become part of traditional learning. Considering how our society has changed with the incorporation of virtual worlds and especially social media into almost every aspect of people's lives, having a virtual presence has become common or even necessary. Consequently, traditional learning or traditional classrooms ought to soon mean a kind of learning that has a virtual or a distance component.

Instructional design and global learning. Following the abovementioned logic, if

traditional learning turns into a form of distance learning then global learning seems to be the next step. Most universities can have a number of classrooms with the technology set up that enables distance learning with actual classrooms, an example of which was presented in this study. That is, not all classrooms need to have that set up. Those classrooms that do will become the "connected classrooms," which can be used by different departments and instructors who can in turn be in different consortiums with different universities. The same principles explained above apply to global distance learning. That is, for global distance learning where the intention is to have learners interact with one another and co-construct knowledge especially during live sessions, first a form of inverted learning is necessary, which for the most part will heavily rely on video lectures that deliver important course concepts succinctly. These video lectures can be generic, in terms of not being instructors' own videos.

Next, as shown in the report of this study, learners in connected classrooms can either start the same course almost together, that is within a couple of weeks apart, or can join a consortium half way through their course where they have had time with their own instructors to engage in separate activities. For the first instance, the learners, similar to the engineering classroom in this study, can engage in interactive activities with remote learners from the beginning of the course. For the second instance, learners can learn separately with their own classmates and when they join the connected classrooms they can have formal presentations or can engage in collaborative projects with remote learners. When these presentations or projects are done with learners from different parts of the world learning opportunities greatly increase.

However, purposeful interaction may suffer or may be of low quality for remote learners who start a course mid-way and are not acquainted with one another. One

possibility here is that the actual classrooms that will be learning in connected classrooms can have a social media page, such as Facebook, with all course participants. Learners may or may not interact on this page but arguably seeing who they will be interacting with can be effective in easing their way into the connected classroom and the multi-site learning environment. Possibly, it can also create a sense of anticipation. Alternatively, in the real world learners will be interacting with or presenting material to audiences that they will not be acquainted with and this form of learning is preparing them for the way life is. The argument here is that presentation of projects to/with remote and diverse learners has the potential to greatly increase opportunities for learning and possibly can also impact learners' motivation considering the new learning environment.

I argue here that even few purposeful interactions in connected classrooms with remote learners can serve the objectives of global learning, that is, as opposed to a semester long course. Based upon the findings of this study I concluded that purposeful and guided interaction increased opportunities for learning, which is consistent with previous research. Therefore arguably few sessions of connected classroom learning can be instrumental for obtaining desired learning objectives.

To this end, any undergraduate upper division course can take part in global learning in connected classrooms, where after engaging in learning with their own university classmates and instructors they can have activities or presentation in connected classrooms. A presentation on a topic in communication, for instance, from American learners will certainly be different from those in India. This can be applied to lower division courses as well, either with national or global distance learners.[7] That is, the sections too can occur in

[7] Connected classrooms may be applicable to secondary education, considering the ubiquity of inverted learning in secondary education (e.g., Overmyer, 2012; Sams &Bergmann 2013). Connected classrooms may be

connected classrooms.

It is important to note that interaction with distance learners differs from interaction with face-to-face learners and will for the most part contribute to a sense of dis-connectivity due to the presence of actual distance among learners. However, because dialogue reduces the sense of distance, engaging in interactive activities with remote learners or doing exercises during live synchronous sessions can increase opportunities for learners from diverse backgrounds to interact and learn from one another. Based on conclusions of this present study, it is my argument that the main objective in global learning is not to make friends or build relationships with remote and diverse learners. The main objective is to engage in interactive learning because the diversity enhances opportunities for learning. This kind of global learning fosters good relations and provides opportunities for mutual understanding. That is, building relationships with remote learners becomes a byproduct of institutional global learning and not its main objective.

Lastly, it is important to note that this kind of global learning may not be suitable for all disciplines but may be applicable to some graduate seminars. However, I argue here that most disciplines in the near future will probably become a form of DE; in that most of their presentation of course concepts will take place in a virtual space.

In summary, higher education in general will possibly take a DE form in that there will be a shift from providing in person course lectures to provision of lectures in a virtual space. This then reserves classroom time for interactive activities and exercises. If traditional classroom learning turns to a form of DE, then traditional classroom learning can

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especially suitable for high schools, in particular for sophomore's and higher levels, may be at neighborhood as opposed to national or global level, and may be limited to one or two events. For example, often in the same neighborhood there are a couple of high schools who are rivals in sports games. Engaging the learners from these schools in interactive learning where for instance they present projects in connected classrooms may not only foster good relations but can be highly engaging, motivating the learners toward academic pursuits.

also turn into global DE with connected classrooms. Researchers have observed that in the near future all educational institutions will be offering a form of online or distance learning (Sterling, 2015), I here have added that in the near future traditional learning will become a form of distance learning.

Conclusion

This study undertook an exploration of the nature and significance of course participants' interactions in a multi-site engineering DE course. While currently researchers and educators are experimenting with new ways of teaching and instruction especially in DE, there is limited research that describes what is actually occurring in current DE programs and how the incorporation of new internet technologies into the design of new DE courses provides or enhances opportunities for learning. For instance, there is little known about how synchronous sessions can be utilized more effectively, given synchronous technologies are increasingly being incorporated into DE. To this end, my objective was to first investigate the nature and significance of course participants' live interactions in a multi-site DE course that utilized advanced internet technologies, to then explore new possibilities for instructional design in DE based upon my observations and findings.

In this present study I described and explored course participants' interactions which reflected the course design and instructors' intentions for learning outcomes. The nature and significance of interactions revealed insights concerning new directions for course design in DE. The advanced internet technologies enabled the learners from different geographical locations to participate in a course and engage in discussions. Learners' interaction with other learners was especially important because it enabled learners who were from diverse cultural backgrounds to share their insights and differing perspectives and co-construct disciplinary knowledge and contextual understanding of course concepts during guided

activities. An inverted approach to learning in turn enabled instructors to use the live sessions for guiding learners' learning by clarifying and explaining course concepts and by examining learners' understanding. Survey and interview reports validated classroom observations. In particular, learners reported benefitting from their instructors' guidance and peers' contributions during the live synchronous sessions. Given the main pedagogical and technological design features of the multi-site engineering course investigated in this present study, such as the incorporation of an inverted approach to learning and the providing of course material before the live synchronous sessions, I presented implications for design in DE and higher education in general.

Based on findings and conclusions from this present study and reviewed literature, I have concluded that in the near future traditional learning will become a form of distance learning. That is, in a sense all learning will become distance learning, in that a significant part of learning will occur in or through the virtual world. To this end, "traditional" or "regular" learning or classrooms will become those that have a virtual component. This in turn is in line with the way our society currently is and the direction it is taking. The incorporation of advanced internet technologies not only is changing traditional approaches to instruction, but is enabling locally situated global learning through connected classrooms, which in turn can foster good relations and further advance knowledge in the world.

At the out-set of this research report I noted that by exploring a current multi-site DE program in-depth my intention was to then explore new possibilities for instructional design in DE. The word *new* often evokes the idea of something never seen or heard before. I here argue that the new is almost always the recycled old or at least has the old in some form or shape in it. The new in a way is a déjà vu. That is, the new way or the new thing often is the re-occurring of the old in a new form or shape. Adapting McLuhan's (2003) philosophy, the

new is an extension of the old in a revised form. So that any new way of teaching or learning will or ought to have a reminiscence of the old in it.[8] The incorporation of advanced internet technologies do not create any "new" ways of teaching or learning, but more accurately by offering a different medium for interaction and knowledge construction change or extend the form of the "old," and thereby create a new experience.

As stated earlier, Zhao et al. (2005) have noted that factors that set DE apart from traditional face-to-face instruction were disappearing, due to the usage of advanced internet technologies which remove the effect of distance. Zhao et al. further have observed that new conceptual and theoretical frameworks for DE practice and research would be unnecessary. Because if DE is considered the same as traditional face-to-face instruction, then there is a plethora of theoretical, conceptual, and analytical frameworks that can be applied for understanding education in DE. The implications presented in this chapter for design in DE follow the same line of thinking, and further add that the incorporation of advanced internet technologies into every aspect of our lives will soon turn traditional or regular learning into a form of DE learning. That is, distance learning, in which there is a quasi-permanent or semi-permanent separation of instructors and learners in time and space, will become the dominant form of learning. In other words, all learning will be a form of distance learning.

[8] Arguably we love the new partly because we already know the new.

References

Agar, M. (1994). *Language shock: Understanding the culture of conversation.* New York: William Morrow.

Agar, M. (2006). An ethnography by any other name…, *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research,* 7:4.

Akarasriworn, C., & Ku, H. Y. (2013). Graduate students' knowledge construction and attitudes toward online synchronous videoconferencing collaborative learning environments. *Quarterly Review of Distance Education*, *14*(1), 35.

Anderson, T. (2003a). Modes of interaction in distance education: Recent developments and research questions. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 129-144). Mahwah, New Jersey: LEA Publishers.

Anderson, T. (2003b). Getting the mix right again: An updated and theoretical rationale for interaction. *The International Review of Research in Open and Distributed Learning*, *4*(2). 1-16.

Anderson, T. (2008). *The theory and practice of online learning*. Athabasca University Press.

Anderson-Levitt, K. M. (2006). Ethnography. In J. Green, G. Camilli, & P. Ellmore (Eds.), *Handbook of Complementary Methods in Educational Research,* 279-295.

Ashley, L. D. (2012). Case study research. In Arthur, J., Waring, M., Coe, R., & Hedges, L. (Eds.), *Research Methods and Methodologies in Education.* (pp. 102-107). London: Sage Publications Ltd.

Asterhan, C. S. C., & Schwarz, B. B. (2010). Online moderation of synchronous eargumentation. *International Journal of Computer-Supported Collaborative Learning*, *5*(3), 259–282.

Barron, B., & Engle, R. A. (2007). Analyzing data derived from video records. In S. J. Derry

(Ed.), *Guidelines for conducting video research in education: Recommendations from an expert panel.* Chicago: Data Research and Development Center.

Bazerman, C. (2008). Theories of the middle range in historical studies of writing practice. *Written Communication, 25,* 298-318.

Bernard, R. M., Abrami, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., ... & Huang, B. (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research, 74*(3), 379-439.

Biesta, G. (2012). Mixed methods. In Arthur, J., Waring, M., Coe, R., & Hedges, L. (Eds.), *Research Methods and Methodologies in Education.* (pp. 147-152). London: Sage Publications Ltd.

Blankson, J. & Kyei-Blankson, L. (2008). Nontraditional students' perception of a blended course: Integrating synchronous online discussion and face-to-face instruction. *Journal of Interactive Learning Research, 19* (3), 421-438.

Bloome, D., Carter, S., Christian, B., Otto, S., & Shuart-Faris, N. (2010). *Discourse analysis and the study of classroom language and literacy events: A microethnographic perspective.* New York: Routledge.

Branon, R. F., & Essex, C. (2001). Synchronous and asynchronous communication tools in distance education. *TechTrends*, *45*(1), 36-42.

Brenner, M. E. (2006). Interviewing in educational research. In Green, J. L., Camili, G., & Elmore, P. B. (Eds.), *Handbook of Complementary Methods in Education Research.* (pp. 357-370). Mahwah, NJ: Lawrence Erlbaum/AERA

Bryant, S. M., Kahle, J. B., & Schafer, B. A. (2005). Distance education: A review of the contemporary literature. *Issues in Accounting Education, 20*(3), 255-272.

Chun, D. M. (2007). Come ride the wave: But where is it taking us? *Calico Journal*, *24*(2), 239-252.

Derry, S. J. (Ed.). (2007). *Guidelines for conducting video research in education: Recommendations from an expert panel.* Chicago: Data Research and Development Center.

Derry, S. J., Hickey, D., & Koschmann, T. (2007). Ethical concerns in video data collection. In S. J. Derry (Ed.), *Guidelines for conducting video research in education: Recommendations from an expert panel.* Chicago: Data Research and Development Center.

Derry, S. J., Pea, R. D., Barron, B., Engle, R. A., Erickson, F., Goldman, R., ... & Sherin, B. L. (2010). Conducting video research in the learning sciences: Guidance on selection, analysis, technology, and ethics. *The Journal of the Learning Sciences*, *19*(1), 3-53.

DeVane, B., & Squire, K. D. (2012). Activity theory in the learning technologies. In D. Jonassen & S. Land (Eds.), *Theoretical foundations of learning environments* (pp. 242-267). New York, NY: Routledge.

Dillenbourg, P. (1999). What do you mean by collaborative learning?. *Collaborative-learning: Cognitive and Computational Approaches.*, 1-19.

Douglass, J. A. (2010). From chaos to order and back? A revisionist reflection on the California master plan for higher education@ 50 and thoughts about its future. *Center for Studies in Higher Education*.

Emerson, R. M., Fretz, R. I., & Shaw, L. L. (2011). *Writing ethnographic fieldnotes.* University of Chicago Press.

Faibisoff, S. G., & Willis, D. J. (1987). Distance education: Definition and overview. Journal of *Education for library and Information Science*, *27*, (4), 223-232.

Falloon, G. (2011). Making the connection: Moore's theory of transactional distance and its relevance to the use of a virtual classroom in postgraduate online teacher education. *Journal of Research on Technology in Education, 43,*187-209.

Fox, B. I., McDonough, S. L., McConatha, B. S., & Marlow, K. F. (2011). Technology in pharmacy education. Establishing and maintain a satellite campus connected by synchronous video conferencing. *American Journal of Pharmaceutical Education, 75* (5)1-10.

Fujioka-Ito, N. (2013). Designing a curriculum for a distance learning class: An example of a first-year Japanese course. *Theory and Practice in Language Studies, 3 (10),* 1717-1725.

Geertz, C. (1973). *The interpretation of cultures*. New York: Basic Books.

Gerber, J. (2014). *MOOCs: Innovation, disruption and instructional leadership in higher education* (Doctoral dissertation, University of California, Los Angeles).

Gold, R. (1997). The ethnographic method in sociology. *Qualitative Enquiry, 3,* 387-402.

Goldman, R., Erickson, F., Lemke, J., & Derry, S. J. (2007). Selection in video. In S. J. Derry (Ed.), *Guidelines for conducting video research in education: Recommendations from an expert panel.* Chicago: Data Research and Development Center.

Hart, C. (2012). Factors associated with student persistence in an online program of study: A review of the literature. *Journal of Interactive Online Learning, 11,* 19-42.

Hausera, L. (2013). Qualitative Research in Distance Education: An Analysis of Journal Literature 2005–2012. *American Journal of Distance Education, 27,* 155-164.

Heath, S. B. (1982). Ethnography in education: Defining the essentials. In P. Gilmore & A. A. Glatthorn (Eds.), *Children in and out of school: Ethnography and education* (pp.

33-55). Washington, D.C.: Center for Applied Linguistics.

Hill, J. R. (2012). Learning communities: Theoretical foundations for making connections. In D. Jonassen & S. Land (Eds.), *Theoretical foundations of learning environments* (pp. 268-285). New York, NY: Routledge.

Holliman, R., & Scanlon, E. (2006). Investigating cooperation and collaboration in near synchronous computer mediated conferences. *Computers & Education, 46, 322-335.*

Horning, A. (2007). The definitive article on class size. *WPA: Writing Program Administration*, *31*(1-2).

Hrastinski, S., Keller, C., & Carlsson, S. A. (2010). Design exemplars for synchronous e-learning: A design theory approach. *Computers & Education, 55,* 652-662.

Jeffrey, B. & Troman, G. (2004). Time for Ethnography. *British Journal of Educational Research, 30*, 535-548.

Johnson, D. W. (1981). Student-student interaction: The neglected variable in education. *Educational Researcher*, 5-10.

Johnson, G. M. (2006). Synchronous and asynchronous text-based CMC in educational contexts: A review of recent research. *TechTrends*, *50*(4), 46-53.

Jolivette, B. J. (2006). Social Presence and its Relevancy to Cognitive and Affective Learning in an Asynchronous Distance-Learning Environment: A Preliminary Literature Review. Online Submission.

Jung, I., Choi, S., Lim, C., & Leem, J. (2002). Effects of different types of interaction on learning achievement, satisfaction and participation in web-based instruction. *Innovations in Education and Teaching International*, *39*(2), 153-162.

Jurgens, J. C. (2010). The Evolution of community colleges. *College Student Affairs Journal*, *28*(2), 251-261.

Karal, H., Cebi, A., & Turgut, Y. E. (2011). Perceptions of Students Who Take Synchronous Courses through Video Conferencing about Distance Education. *Turkish Online Journal of Educational Technology-TOJET*, *10*(4), 276-293.

Kelly, G. J., & Chen, C. (1999). The sound of music: Constructing science as sociocultural practices through oral and written discourse. *Journal of Research in Science Teaching*, *36*(8), 883-915.

King, A. (1990). Enhancing peer interaction and learning in the classroom through reciprocal questioning. *American Educational Research Journal, 27(*4), 664-687.

Kuo, Y. C., Walker, A. E., Belland, B. R., Schroder, K. E., & Kuo, Y. T. (2014). A case study of integrating Interwise: Interaction, internet self-efficacy, and satisfaction in synchronous online learning environments. *The International Review of Research in Open and Distributed Learning*, *15*(1).

Lapadat, J. C., & Lindsay, A. C. (1999). Transcription in research and practice: From standardization of technique to interpretive positionings. *Qualitative Inquiry, 5,* 64-86.

Laurillard, D. (2000). New technologies and the curriculum. In P. Scott. (Ed.), *Higher education re-formed* (pp.133–153). London: Falmer Press.

Lou, Y., Bernard, R. M., & Abrami, P. C. (2006). Media and pedagogy in undergraduate distance education: A theory-based meta-analysis of empirical literature. *Educational Technology Research and Development, 54*(2), 141-176.

Martin, F., Parker, M. A., & Deale, F. D. (2012). Examining interactivity in synchronous virtual classrooms. *The International Review of Research in Open and Distance Learning, 13*, 227-261.

Mattheos, N., Nattestad, A., Schittek, M., & Attström, R. (2001). A virtual classroom for

undergraduate periodontology: a pilot study. *European Journal of Dental Education*, *5*(4), 139-147.

McBrien, J. L., Jones, P., & Cheng, R. (2009). Virtual spaces: Employing a synchronous online classroom to facilitate student engagement in online learning. *The International Review of Research in Open and Distance Learning*, *10*(3), 1-17.

McLuhan, M. (2003). *Understanding media: The extensions of man.* (Critical Edition). Corte Madera, CA: Gingko Press.

Merriam, S. B. (1998). *Qualitative research and case study applications in Education*. San Francisco, CA: Jossey-Bass Publishers.

Monroe, C. R. (1972). *Profile of the community college*. San-Fransisco: Jossey-Bass Inc.

Moore, M. (1989). Three types of interaction. *The American Journal of Distance Education*, *3*(2), 1-7.

Moore, M. G. (1993). 2 Theory of transactional distance. *Theoretical Principles of Distance Education*, 22.

Moridani, M. (2007). Asynchronous video streaming vs. synchronous video conferencing for teaching a pharmacogenetic pharmacotherapy course. *American Journal of Pharmaceutical Education*, *71* (1), 1-10.

Muuro, M. E., Wagacha, W. P., Kihoro, J., & Oboko, R. (2014). Students' perceived challenges in an online collaborative learning environment: A case of higher learning institutions in Nairobi, Kenya. *The International Review of Research in Open and Distributed Learning*, *15*(6). 132-161. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/1768/3180

Naismith, L., Lee, B.-H., & Pilkington, R. M. (2011). Collaborative learning with a wiki: Differences in perceived usefulness in two contexts of use. *Journal of Computer*

Assisted Learning, *27*(3), 1-15.

Ng, K. C. (2007). Replacing face-to-face tutorials by synchronous online technologies: Challenges and pedagogical implications. *International Review of Research in Open and Distance Learning*, *8*(1). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/335

Oliver, M., Roberts, G., Beetham, H., Ingraham, B., Dyke, M. & Levy, P. (2006). Knowledge, society and perspectives on learning technology. In Conole, G., & Oliver, M. (Eds.), *Contemporary perspectives in e-learning research: themes, methods and impact on practice*. (pp. 21-37). Routledge.

Overmyer, J. (2012). Flipped Classrooms 101. *Principal*, 46-47.

Park, Y. J., & Bonk, C. J. (2007a). Is online life a breeze? A case study for promoting synchronous learning in a blended graduate course. *MERLOT Journal of Online Learning and Teaching*, *3* (3), 307-323.

Park, Y. J., & Bonk, C. J. (2007b). Synchronous learning experiences: Distance and residential learners' perspectives in a blended graduate course. *Journal of Interactive Online Learning*, *6*(3), 245-264.

Patton, M.Q. (2002). *Qualitative research and evaluation methods*. 3rd Edition. Thousand Oaks,CA: Sage.

Prokofieva, M. (2013). Evaluating types of students' interactions in a wiki-based collaborative learning project, *Australasian Journal of Educational Technology*, *29* (4), 496-512.Pukkaew, C. (2013). Assessment of the Effectiveness of Internet-Based Distance Learning through the VClass e-Education Platform. *International Review of Research in Open & Distance Learning*, *14*(4), 255-276.

Pukkaew, C. (2013). Assessment of the Effectiveness of Internet-Based Distance Learning

through the VClass e-Education Platform. *International Review of Research in Open & Distance Learning*, *14*(4), 255-276.

Reveles, J. M., Kelly, G. J., & Durán, R. P. (2007). A sociocultural perspective on mediated activity in third grade science. *Cultural Studies of Science Education*, *1*(3), 467-495.

Rodriguez, C. O. (2012). MOOCs and the AI-Stanford like courses: Two successful and distinct course formats for massive open online courses. *European Journal of Open, Distance and E-Learning*. Retrieved from http://www.eurodl.org/?p=archives&year=2012&halfyear=2&article=516

Rodriguez, B. C. P., & Armellini, A. (2015). Expanding the interaction equivalency theorem *International Review of Research in Open and Distributed Learning*, *16* (3), 298-317.

Sams, A., & Bergmann, J. (2013). Flip Your Students' Learning. *Educational Leadership*, *70*(6), 16-20.

Simonson, M., Schlosser, C., & Orellana, A. (2011). Distance education research: A review of the literature. *Journal of Computing in Higher Education, 23*, 124-142.

Skukauskaite, A. (2012). Transparency in transcribing: Making visible theoretical bases impacting knowledge construction from open-ended interview records. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research, 13*.

Skylar, A. A. (2009). A Comparison of Asynchronous Online Text-Based Lectures and Synchronous Interactive Web Conferencing Lectures. *Issues in Teacher education*, *18*(2), 69-84.

Spradley, J. (1979). *The ethnographic interview.* Fort Worth, TX: Harcourt Brace.

Stahl, G. (2006). *Group cognition: Computer support for building collaborative knowledge*. Cambridge, MA: MIT Press. Retrieved from http://GerryStahl.net/mit/

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative

learning: An historical perspective. In R. K. Sawyer (Ed.), *Cambridge Handbook of the Learning Sciences*. Cambridge: Cambridge University Press.

Sterling, K. W. (2015). *Student satisfaction with online learning* (Doctoral dissertation, University of California, Santa Barbara).

Stewart, A. R., Harlow, D. B., & DeBacco, K. (2011). Students' experience of synchronous learning in distributed environments. *Distance Education, 32* (3), 357-381.

Szeto, E. (2015). Community of inquiry as an instructional approach: What effects of teaching, social and cognitive presences are there in blended synchronous learning and teaching? *Computers and Education, 81*, 191-201.

Sutton, C. (1996). Beliefs about science and beliefs about language. *International Journal of Science Education, 18*(1), 1-18.

Swan, K. (2001). Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance education*, *22*(2), 306-331.

Tallent-Runnels, M. K., Thomas, J. A., Lan, W. Y., Cooper, S., Ahern, T. C., Shaw, S. M., & Liu, X. (2006). Teaching courses online: A review of the research. *Review of Educational Research, 76*(1), 93-135.

Teng, D. C., Chen, N., Kinshuk, & Leo, T. (2012). Exploring students' learning experience In an international online research seminar in the Synchronous Cyber Classroom. *Computers & Education, 58,* 918-930.

U.S. Department of Education, Office of Planning, Evaluation, and Policy Development, *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies*, Washington, D.C., 2010.

Uzuner, S. (2009). Questions of culture in distance learning: A research review. *International*

*Review of Research in Open & Distance Learning, 10(*3), 1-19.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wanstreet, C. E. (2006). Interaction in online learning environments: A review of the literature. *Quarterly Review of Distance Education, 7*(4), 399-411.

Werner, O., & Schoepfle, G. M. (1987). *Systematic fieldwork, Volume 1*-(pp. 314-343). Newbury Park: Sage.

Williams, P., Nicholas, D., & Gunter, B. (2005). E-learning: What the literature tells us about distance education. An overview. Aslib Proceedings 57(2), 109-122.

Yamada, M. (2008). The role of social presence in learner-centered communicative language Learning using synchronous computer-mediated communication: Experimental study. *Computers & Education, 52*, 820-833.

Yang, Z., & Liu, Q. (2007). Research and development of web-based virtual online classroom. *Computers & Education, 48,* 171-184.

Yin, R. K. (2013). *Case study research: Design and methods*. Sage publications.

Young, J. R. (2013). Will MOOCs change the way professors handle the classroom? *Chronicle of Higher Education, LX* (11), A14-A15.

Yuan, L., & Powell, S. (2013). MOOCs and open education: Implications for higher education. *JISC Cetis White Paper*. Retrieved from http://publications.cetis.ac.uk/2013/667

Yun, K. (2005). Collaboration in the semantic grid: a basis for e-learning. *Applied Artificial Intelligence*, *19*(9 & 10), 881-904.

Zawacki-Richter, O., Backer, E. M., & Vogt, S. (2009). Review of distance education research (2000 to 2008): Analysis of research areas, methods, and authorship patterns. *International Review of Research in Open & Distance Learning, 10*(6), 21-

50.

Zhao, Y., Lei, J., Lai, B.Y.C., & Tan H.S. (2005). What makes the difference? A practical analysis of research on the effectiveness of distance education. *Teachers College Record, 107,* 1836–1884.

LIST OF APPENDICES

Appendix A1: Instructor Interview Form

Instructor Interview Form

Thank you for agreeing to participate in this research project and for allowing me to have your students' input for this project. I am examining the nature of interaction in distance learning and especially in multi-site learning settings. Your perspective concerning interaction in your course will greatly contribute to my understanding of the phenomenon I'm studying. I will be happy to share my findings with you.

If you would please reply to the following questions. This interview will take approximately 10-15 minutes of your time.

Section A

What were some of the most important learning outcomes that you intended for your students to obtain in this course?

Section B: With regards to the live 2 hour synchronous sessions

What was the intended purposes of interaction (both instructor-student and student-student interactions) during the live sessions (e.g., clarification of material, presentation of material, discussion of material)? Were these purposes realized as intended? Please explain.

For your intended purposes, please explain which kind of interaction (instructor-student or student-student) was more important during the live sessions in order to help the students obtain the course objectives?

Section C: With regards to students' off-line interactions (e.g., team discussions on Slack, collaboration for innovative team projects)

What were your requirements and/or what outcomes did you expect in terms of its contribution to their learning of the material?

Section D

Is there anything else that I haven't asked about interactions in your course that you feel would be important to know?

Submit

Appendix A2: Learner Survey Form

Survey for Students

Thank you for your time for taking this survey. I am doing a research project about the nature of interaction in distance learning and especially in multi-site learning settings. I'd like to learn more about your experience in this course and your perceptions concerning your interactions with other course participants. Your responses are confidential and pseudonyms will be used for you and your school. The survey will take about five minutes of your time.

From what campus did you participate in the Principles and Practices of Global Innovation course?

- ◯ University of Southern California (USC)
- ◯ Tsinghua University (THU)
- ◯ National Taiwan University (NTU)

What is your major:

Section A

Please indicate to what extent you agree with the following statements about what you have LEARNED from your Principles and Practices of Global Innovation course.

	Strongly Agree	Agree	Somewhat Agree	Disagree	Strongly Disagree
I learned a great deal about principles/practices of global innovation from this course	◯	◯	◯	◯	◯
I learned a great deal from the cross cultural team projects	◯	◯	◯	◯	◯

Section B

Please indicate to what extent you agree with the following statements about what you have learned from your INTERACTION with other students across the three campuses about principles and practices of global innovation.

	Strongly Agree	Agree	Somewhat Agree	Disagree	Strongly Disagree
I learned a great deal from my interaction with my classmates across the three campuses	◯	◯	◯	◯	◯
I learned more from interaction with classmates from my own campus than from classmates from the remote campuses	◯	◯	◯	◯	◯

Section C

Please RANK the following resources availabe for your learning in terms of what has been most helpful (5 = most helpful)

	1	2	3	4	5
Reading material	○	○	○	○	○
Team Discussions on Slack of posted material during the week	○	○	○	○	○
Students' presentations of cross cultural team projects	○	○	○	○	○
Instructor's explanations and clarifications during the live sessions	○	○	○	○	○
Students' Q & A with the instructor during the weekly live 2 hour sessions	○	○	○	○	○

Will you consider being interviewed for this research project (20 minutes) in exchange for a modest compensation?

- ○ Yes. If so, please provide your email below
- ○ No, thank you.

Please provide your email address in order to be contacted for a 20 minute interview for this project.

Submit

100%: You made it.

Never submit passwords through Google Forms.

Appendix A3: Remote Learner Interview Form

Student Interview

Thank you for your time for participating in this interview. I am doing a research project about the nature of interaction in distance learning and especially in multi-site learning settings. I'd like to learn more about your experience in this course and your perceptions concerning your interactions with other course participants. Your responses are confidential and pseudonyms will be used for you and your school. The interview is meant to take about 20 minutes of your time. You may skip any question If you do not wish to answer.

I.Background Questions

Current class year

- ◯ Sophomore
- ◯ Junior
- ◯ Senior

Gender

- ◯ Male
- ◯ Female

Major

II. Interview--Please answer the following questions in whatever lenght that you think is necessary in order to convey your thoughts (i.e., from one or two sentences to a paragraph)

1.How would you describe the difference between this course and other courses you have taken? How did this difference effect your decision in enrolling in the course?

2.In this course you had the opportunity of interacting with remote site students and presenting projects with them, please tell me about your interactions with your peers and what you learned from these interactions?

3.What else did you find rewarding in your interactions with the remote campus students? (i.e., things you learned or appreciated, any social benefits)

4.What did you learn from the cross cultural experience?

5.What did you find challenging in this course? (e.g., interaction with the remote site learners, work on projects or discussions)

6.What was your favorite part about the course?

7.What suggestions do you have about how your experience in this course and your interactions with your classmates could have been improved?

8.Is there anything else that I haven't asked that you feel would be important to know?

Submit

Never submit passwords through Google Forms.

Appendix A4: In Person Learner Interview Protocol

Thank you for your time today. I am doing a research project about the nature of interaction in distance learning and especially in multi-site learning environments. I'd like to learn more about your experience in this course and your perceptions concerning your interactions with other course participants. Your responses are confidential and pseudonyms will be used for you and your school. The interview will take about twenty minutes of your time. I would like to record our conversation. Is that okay with you?

I. Background Questions

Current Class Year:_____ Major:_____ Gender:_____

II. Interview

I wanted to start the interview by asking about your decision to enroll in this multi-site distance learning course and your experience in the course, especially concerning your interaction with your classmates.

1. How would you describe the difference between this course and other courses you have taken?
   a. [probe: how did this difference effect your decision in enrolling in the course?]

2. In this course you had the opportunity of interacting with remote site students and presenting projects with them, please tell me about your interactions with your peers?
   a. [probes: what you learned, how contributed to the understanding of the material, the discussions]

3. What else did you find rewarding in your interactions with the remote campus students?
   a. [probes: things you learned or appreciated, any social benefits]

4. What did you learn from the cross-cultural experience?

5. What did you find challenging in this course?
   a. [probes: interaction with the remote site learners, work on projects or discussions]

6. What was your favorite part about the course?
   a. [probes: which exercises or presentations]

7. What suggestions do you have about how your experience in this course and your interactions with your classmates could have been improved?

8. Is there anything else that I haven't asked that you feel would be important to know?

Thank you. I greatly appreciate your participation in this interview. Your responses are invaluable to my research. Is it okay if I contacted you with any follow-up questions? Would like to receive a copy of my research report when it is completed? Are there any questions I can answer for you concerning this interview or my research project?

Appendix B1: Consent Form for Learner Surveys

Approved by the UCSB Human Subjects Committee for use thru: 9/17/2016

PURPOSE:
You are being asked to participate in a research study. The purpose of the study is to investigate the nature of interactions among the learners and the instructor in this multi-site learning environment, in order to examine the meaning of these interactions.

PROCEDURES:
If you decide to participate, we will administer a short survey asking about your experience in the course. The survey will take about five minutes of your time.

BENEFITS:
Your participation in this survey will contribute to the construction of knowledge in my field of study and in turn will benefit the society.

CONFIDENTIALITY:
Your comments/responses could be published in the final document, i.e., published dissertation, however pseudonyms will be used to protect your identity. Your comments will not be furnished to other persons or agencies and will be used for the purposes of this study.

RIGHT TO REFUSE OR WITHDRAW:
You may refuse to participate and still receive any benefits you would receive if you were not in the study. You may change your mind about being in the study and quit after the study has started. Please note that whether you participate in this study or not, your grade in the course or class evaluation will not be effected by your participation.

QUESTIONS:
If you have any questions about this research project or if you think you may have been injured as a result of your participation, please contact:

Kanakara Petrosian
kpetrosian@education.ucsb.edu

If you have any questions regarding your rights and participation as a research subject, please contact the Human Subjects Committee at (805) 893-3807 or hsc@research.ucsb.edu. Or write to the University of California, Human Subjects Committee, Office of Research, Santa Barbara, CA 93106-2050

Appendix B2: Consent Form for Learner Interviews

Approved by the UCSB Human Subjects Committee for use thru: 9/17/2016

PURPOSE:
You are being asked to participate in a research study. The purpose of the study is to investigate the nature of interactions among the learners and the instructor in this multi-site learning environment, in order to examine the meaning of these interactions.

PROCEDURES:
If you decide to participate, we will administer an interview either through email, Skype, or phone, asking about your experience in the course. The interview will take about 20 minutes of your time.

BENEFITS:
Your participation in this interview will contribute to the construction of knowledge in my field of study and in turn will benefit the society.

CONFIDENTIALITY:
Your comments/responses could be published in the final document, i.e., published dissertation, however pseudonyms will be used to protect your identity. Your comments will not be furnished to other persons or agencies and will be used for the purposes of this study.

COSTS/PAYMENT:
If you choose to participate in the interview you will receive an amount of $20. This payment for your time and service will be given to you before the start of the interview. You may keep the payment if you withdraw from the interview at any time during the interview.

RIGHT TO REFUSE OR WITHDRAW:
You may refuse to participate and still receive any benefits you would receive if you were not in the study. You may change your mind about being in the study and quit after the study has started. Please note that whether you participate in this study or not, your grade in the course or class evaluation will not be effected by your participation.

QUESTIONS:
If you have any questions about this research project or if you think you may have been injured as a result of your participation, please contact:

Kanakara Petrosian
kpetrosian@education.ucsb.edu

If you have any questions regarding your rights and participation as a research subject, please contact the Human Subjects Committee at (805) 893-3807 or hsc@research.ucsb.edu. Or write to the University of California, Human Subjects Committee, Office of Research, Santa Barbara, CA 93106-2050

Appendix B3: Consent Form for Instructor Interview

Approved by the UCSB Human Subjects Committee for use thru: 9/17/2016

PURPOSE:
You are being asked to participate in a research study. The purpose of the study is to investigate the nature of interactions among the learners and the instructors in this multi-site learning environment, in order to examine the meaning of these interactions.

PROCEDURES:
If you decide to participate, I will administer a short interview asking about your experience in the course, and the nature of interactions across the sites. The interview will take about twenty to thirty minutes of your time.

BENEFITS:
Your participation in this interview will contribute to the construction of knowledge in my field of study and in turn will benefit the society.

CONFIDENTIALITY:
Your comments/responses could be published in the final document, i.e., published dissertation, however pseudonyms will be used to protect your identity. Your comments will not be furnished to other persons or agencies and will be used for the purposes of this study.

RIGHT TO REFUSE OR WITHDRAW:
You may refuse to participate in this study. You may change your mind about being in the study and quit after the interview has started.

QUESTIONS:
If you have any questions about this research project or if you think you may have been injured as a result of your participation, please contact:

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If you have any questions regarding your rights and participation as a research subject, please contact the Human Subjects Committee at (805) 893-3807 or hsc@research.ucsb.edu. Or write to the University of California, Human Subjects Committee, Office of Research, Santa Barbara, CA 93106-2050

Appendix C1: Instructor A's Discourse on Contextual Understanding of Content Subject Given on 08.31.15

Line #	Speaker	Discourse
215	Instructor A:	now we're going to explain to you the difference between
216		something we call the content of the subject
217		verses the context of the subject
218		that is very important
219		all the traditional courses teach you the content
220		content are those things that you can write in a book
221		and I can lecture you
222		but only knowing the content does not make you a good innovator
223		particularly in the global environment
224		you need to have more knowledge about the things around the content subject
225		that make sense to the customer and to you
226		those things we call contextual understanding
227		now contextual understanding is very different from content/
228		because I cannot give you a textbook
229		there's no text book I can write about the context
230		and the only way you can acquire contextual understanding
231		is after you study the content
232		you engage in collaboration and interaction with peers
233		so the contextual understanding is co-constructed between learners
234		in other words the learning occurs in this process between students
235		I am only providing you the subject material
236		for you to prepare yourself to engage in the interaction
237		and that is why we want to open the classroom to very far away in the world
238		so that you will have a chance to bounce the ideas
239		with people who are very different from you
240		because if you want to learn the context
241		if your partners are very different from you
242		in terms of their academic background
243		in terms of their cultural background and their ethnic background
244		the more difference between you and a partner
245		the more you're going to learn
246		so that is the reason we want to have the classrooms connected
247		and reach out to very far away
248		and you're going to see that this process is really the way
249		this is how you enter the real world
250		and this learning will continue even as you start to work for global companies
251		so a lot of learning occurs between people

Appendix C2: Instructor A's Discourse on Knowledge Construction and Peer Learning Given on 11.09.15

Line #	Speaker	Discourse
252	Instructor A:	traditionally we look at learning as a coding of information
253		that's why we give you textbooks
254		we give you slides
255		now if you take learning as information
256		then the learning basically is a transaction process
257		is a transmittal process
258		this is typical in classroom lectures
259		now the more modern view of learning
260		which is what our program believes in is
261		actually learning is not about transmitting information
262		because knowledge is actually not static information
263		knowledge is something we call a social construct
264		social construct is very important
265		in today's modern life
266		and that's why social networking
267		internet connection
268		becomes so important in world events
269		because what we perceive the world is not the static information
270		we read from history books
271		but rather the way we interact with people
272		from the different parts of the world
273		now if you view knowledge as a social construct
274		then learning becomes an interaction process
275		so learning is not a transmission process
276		and becomes an interaction process
277		however there are many different ways to interact
278		for example traditionally we have students interact with teachers
279		and that's kind of interaction you have
280		we also can have students interact with computers
281		a lot of students now learn the courses on computers
282		that's another kind of interaction
283		however there is a very important kind of interaction
284		which we focus here
285		that is called
286		the peer interaction
287		when a student interacts with a student
288		this is really what we are focusing on in this class
289		so if you look at the peer interaction
290		there are also different types
291		for example you can put students who don't think very differently
292		who don't have very different academic backgrounds together
293		so you want to focus on the homogeneity of the groups
294		in this way they can help each other to become better

295 in terms of content knowledge
296 however we want to experiment something very different
297 we want to be able to learn from the difference
298 in other words we purposely put students who think very differently
299 on the same subject together
300 together because our purpose is not to enhance content understanding
301 but rather
302 we try to enhance their contextual understanding of each other

Appendix D1: Mean and Frequency Table: Learning from Peers and Instructors

Survey Items	Mean*	Frequency
Section A		
A1. *I learned a great deal about principles/practices of global innovation from this course*	3.86	
Strongly Agree		5
Agree		16
Somewhat Agree		7
Disagree		1
Strongly Disagree		0
A2. *I learned a great deal from the cross-cultural team projects*	3.59	
Strongly Agree		7
Agree		7
Somewhat Agree		12
Disagree		2
Strongly Disagree		1
Section B		
B1. *I learned a great deal from my interaction with my classmates across the three campuses*	3.7	
Strongly Agree		9
Agree		8
Somewhat Agree		8
Disagree		5
Strongly Disagree		0
B2. *I learned more from interaction with classmates from my own campus than from classmates from the remote campuses*	3.66	
Strongly Agree		5
Agree		15
Somewhat Agree		6
Disagree		3
Strongly Disagree		1

*On a scale of 1-5, 5 being Strongly Agree

Appendix D2: Mean and Frequency Table: Learning from the Variety of Instructional Exchanges

Survey Items	Mean*	Frequency
Reading material	3.16	
Ranking 5		5
Ranking4		9
Ranking 3		7
Ranking 2		4
Ranking 1		5
Discussions on Slack of posted material	3.4	
Ranking 5		7
Ranking4		7
Ranking 3		9
Ranking 2		5
Ranking 1		2
Students' presentations of Cross- cultural team projects	3.6	
Ranking 5		6
Ranking4		14
Ranking 3		5
Ranking 2		2
Ranking 1		3
Instructor's explanations and clarifications during the live sessions	3.73	
Ranking 5		10
Ranking4		9
Ranking 3		5
Ranking 2		5
Ranking 1		1
Students' Q & A with the instructor during the weekly live 2 hour sessions	3.43	
Ranking 5		8
Ranking4		7
Ranking 3		8
Ranking 2		4
Ranking 1		3

*On a scale of 1-5, 5 being most helpful

Appendix E: Transcription Guide

...	Eliminated dialogue
--	Inaudible utterance
X, Y, Z	Pseudonyms for company names noted by learners during discussion