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An Analysis of Presence in an Asynchronous Online Undergraduate Mastery Course Using Structural Equation Modeling

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ACCEPTANCE

This dissertation, AN ANALYSIS OF PRESENCE IN AN ASYNCHRONOUS ONLINE UNDERGRADUATE MASTERY COURSE USING STRUCTURAL EQUATION MODELING, by JOHNATHAN YERBY, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education and Human Development, Georgia State University.

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AN ANALYSIS OF PRESENCE IN AN ASYNCHRONOUS ONLINE UNDERGRADUATE MASTERY COURSE USING STRUCTURAL EQUATION MODELING

by

JOHNATHAN YERBY

Under the Direction of Brendan Calandra

ABSTRACT

This study examined students' perceptions of teaching, social, and cognitive presence in an online, asynchronous mastery course as they related to interaction and student course satisfaction. The study design used structural equation modeling to examine the relationships. Data was collected from 166 students who were enrolled in an asynchronous online mastery course, which covered information technology literacy skills. The study was conducted over three years using a questionnaire built upon three previously validated instruments: The *Community of Inquiry* (CoI) *Survey* (Arbaugh, Cleveland-Innes, Diaz, Garrison, Ice, Richardson, & Swan, 2008), The *Noel-Levitz Priorities Survey for Online Learners* (Ruffalo Noel-Levitz, 2016) and the *Distance Education Learning Environments Survey* (Walker & Fraser, 2005). The results of the study included a confirmatory factor analysis and a structural equation model. Results showed that students' perception of teaching presence had the strongest positive direct

effect on student course satisfaction, while cognitive presence was not a significant predictor of course satisfaction. Cognitive presence was a significant positive predictor of interaction. Social presence had a positive effect on interaction, however interaction was not a significant predictor of course satisfaction. In addition, results showed that as students' perception of social presence increased, their reported course satisfaction decreased. The results of this research enhance the understanding of how the interdependent relationships between teaching, social, and cognitive presence affect one another. This study adds to the literature on asynchronous online learning, mastery-type courses, can serve as a model for analyzing and improving online course design and implementation, and may be used for future research and development in similar contexts.

INDEX WORDS: Community of Inquiry, Teaching presence, Social presence, Cognitive presence, Interaction, Course satisfaction, Mastery-type course, Asynchronous

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A Dissertation

Presented in Partial Fulfillment of Requirements for the

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in

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in

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DEDICATION

My greatest motivators have been my innate desire to succeed and create a better life for my son, Baron, and my wife, Casey. This has been a very tough process to continue working through while my three-month-old baby was diagnosed with cancer. I make myself succeed because the option to not do so does not exist. I dedicate these pages and the years of work that went into them to my family.

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I want to acknowledge my chair and advisor, Dr. Brendan Calandra, for his guidance in going through what seemed nearly impossible at times. Dr. Calandra has been a critic and motivator. He helped me find a new path when I ran into issues that seemed to be a dead end. Dr. Calandra is a person that has always given me great advice and asked questions that led me to thinking more critically about research and career development.

I thank my friends and family for frequently asking where I was in the process, how much longer it would take, and telling me that I could do this. My wife was always there to question what my next step was and how I planned on getting it done. My son, Baron, has been a welcomed distraction from the many hours of reading and writing. I appreciate my mom always being extremely proud of me and always being encouraging. I am very thankful that my son has two amazing grandmothers; I would not have been able to find the time to write without them.

I would not have gotten where I am today without encouragement and advice from my onetime teacher, then mentor, and eventual peer, Dr. Cindy Rumney. Dr. Calandra and Dr. Rumney are the two people I felt I could trust to give me honest advice and experienced perspective. Dr. Nannette Commander, was always an inspiring committee member, kept my spirits up throughout the process and was available to discuss professional challenges as they occurred. Dr. Commander has proven to be genuine, kind, and caring beyond expectations. I appreciate the hard work and flexibility of my committee members Dr. Mike Law and Dr. Min Kyu Kim. Dr. Kim, was able to provide critical feedback that allowed me to focus the topic of this dissertation. I am extremely thankful for the technology I needed to complete this study. Thank you to the incredible ladies of the Jay's Hope Foundation for providing a bit of a social life for my family and I, as I worked on completing my PhD while my son continued his battle with childhood cancer.

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1 Introduction

When this study was conducted, online education was growing quickly, with more than 7.1 million, or 33%, of learners taking one or more online courses in 2014, which was up from 1.6 million just seven years ago. The number of learners that completed all of what people refer to as "college" online was growing each year. In 2014 there were more than 2.8 million students taking their entire higher education program of study at a distance. Of these 2.8 million students, 48% were from public institutions. Between 2013 and 2014 the tremendous growth rate was the lowest percentage in the past twelve years at 6.1% growth. Online education was still quickly expanding and an extremely important component of education as a whole, but that was the first glimpse of any plateau. While online education continued to grow, decision makers were under increased levels of scrutiny and stakeholders sought a deeper understanding of what online education should offer. More public institutions were being held accountable through performance funding, public grading systems for the universities for the quality and effectiveness of their programs, retention, progression, and graduation rates through programs such as Complete College America and Right-to-Know (Allen & Seaman, 2014, 2016; Astin, 2005; Bosworth, 2010; Complete College America, 2014). The stakes of online education were high, the quality of that education and the dedication of learning institutions to making the effort successful, needed to match the stakes. In an article from the *New York Times*, a leader from the Association of American Colleges and Universities issued a response to a report about low graduation rates that too many programs "focused on efficiency and not enough on quality" (Lewin, 2014). For-profit institutions had given online education a stigma of being lower quality and leaving students with large amount of debt and no job (Friedman, 2016; Lucas, 2016a). Educational institutions were faced with the challenges of addressing an increased demand for

quality online learning to understand what leads to high quality programs and courses that produce satisfied and educated students that were ready to meet their personal and professional goals.

In 2003 only 57% of chief academic officers (CAOs) accepted online learning as equivalent in quality to face-to-face courses. That number increased dramatically from 2003 to 2014 with a peak of 77% of CAOs seeing online as good as face-to-face teaching, but for the first time in ten years the confidence in the quality of online courses decreased by three percentage points in 2014, and then another two points in 2015 to 71.4% of CAOs believing online education is as good as face-to-face (Allen & Seaman, 2014, 2016). It was conceivable that there was a reversal of an eleven-year trend of the acceptance of online program quality being equivalent to face-to-face learning, as the most recent two years of information suggested that CAOs were losing confidence in online education. The confidence in online courses over the past two years has been up and down, and there was a need to stabilize and improve this viewpoint amongst all stakeholders if institutions were going to continue to turn to online courses to meet the needs of their students. Online and hybrid courses were becoming increasingly common for learners to complete a degree regardless if it were a fully online program or a traditional program with students living on or near their campus. Blended instruction had a more favorable acceptance level by leaders than online only in the latest revision of the study from Allen and Seaman (2016). Blended learning is another option where portions of the course are online and the classroom time is dedicated to working with students. Blended learning may have been somewhat more convenient, saving time and resources for the parts of instruction that work well online, and creating that authentic in-person learning experience for students that feel engaged and connected to their course, peers, and the institution.

CAOs in schools without a large online program, reported that only 29% of their faculty accepts the value and legitimacy of online education. When this data is segmented into schools with large online enrollments, the measure jumps dramatically to 60% finding value and legitimacy of online education. That was still 40-71% of faculty that did not find value or legitimacy of online education. An explanation for the drastic difference in opinion by faculty could be limited experience with it, or limited knowledge of what is possible in online education (Allen & Seaman, 2016). Poorly designed online courses have degraded confidence in the entire medium. Well-designed online courses take resources that institutions must be willing to support for the endeavor to be successful, generate a feeling of confidence and acceptance by leaders, faculty, and learners. Online education continues to evolve and part of the evolution includes finding better ways to provide an engaging and satisfying experience that allows students to demonstrate their ability to apply knowledge and skills, as well as persist to complete the programs that they chose. Asynchronous online learning affords anywhere and anytime access, which is a component that initially attracted many learners to consider the medium. Creating an engaging course using a variety of teaching methods that utilize scaffolding, absorb type activities, do-type activities and effective multimedia principles has been successful for asynchronous online learning to remain a relevant and accepted method for people of all ages to learn (Clark & Mayer, 2011). Scaffolding helps learners' master content or performance by providing support as they progress through the early steps. Scaffolding is a great technique used to help students master skills, especially on lower-level skills that serve as the foundation to future capabilities. Students begin with a great amount of support, coaching, feedback, and direct instruction and as the students' understanding increases the amount of support from the instructor can decrease, allowing the learner to construct their own knowledge and understanding.

This study did not attempt to make another entry in the evolving debate of online versus face-to-face that has been studied over 400 times; instead it focused on students' perception of interaction and satisfaction within the LT 2010 course. Satisfaction in online courses has been a major factor in learners completing their courses (Levy, 2007). Satisfaction was an appropriate outcome variable in this study since it was more likely to be able to be captured and measured than retention within not only this course, but within a students' program of study. A program of study could be the completion of a certificate, associates, bachelors or graduate degree. The study sought to gain an understanding of how students' perceptions of each type presence, teaching, social, and cognitive, influenced their satisfaction with the course. Using structural equation modeling (SEM), as the statistical method, the study could determine if some types of presence were stronger positive or negative predictors of interaction and satisfaction.

One method of increasing the quality of education is to create meaningful interactions within the classroom regardless of whether the class is in person, synchronous online, or an asynchronous course. Interactions are defined as "reciprocal events that require at least two objects and two actions that mutually influence each other" (Wagner, 1994). These desirable mutual influences could be referred to as cognitive presence (CP), social presence (SP), and teaching presence (TP). Presence in a traditional face-to-face course has been somewhat of a given, with the fact that people shared the same physical space. Barring any disabilities, people in the same physical space can see each other in real time, hear each other, and share ideas in real time. Although being together physically allows people to gain a sense that they were present in a place and time; teaching presence in the face-to-face sense has been challenged as being unquantifiable and a nebulous, subjective characteristic in the mind of the perceiver (Bennett, 2010). However, in an online setting, there are easier and measurable ways to establish

presence. The Community of Inquiry (CoI) questionnaire has been used in many studies as a reliable survey to measure an understanding of students' perceptions of teaching presence, social presence, and cognitive presence (Arbaugh et al., 2008; Rubin, Fernandes, & Avgerinou, 2013). The CoI questionnaire lists between nine to twelve questions that are intended to measure a person's perception of each type of presence. In an online course, the questions are capable of being used as a design and facilitation checklist to assist the educator in achieving the actions and outcomes related to the types of activities associated with the teaching presence portion of the CoI questionnaire.

One method of creating quality learning experiences is for the design and facilitation of a course to integrate a CoI that includes teaching presence, social presence, and cognitive presence into the online classroom (Garrison, Anderson, & Archer, 2000). Teaching presence includes adhering to instructional design principles to ensure that the instructor explicitly described the topics, goals, and due dates. Teaching presence also seeks to promote engaging and focused dialog amongst the community of learners and providing meaningful feedback. In this study of an online asynchronous course, the course was designed with these elements in mind and facilitated to provide personalized meaningful feedback on assignments, discussions, and other activities. One of the possible ways to deliver sound instruction capable of producing satisfied learners is through strategies that develop the perception of teaching presence, social presence, and cognitive presence. (Aitken, 1982; DeShields Jr, Kara, & Kaynak, 2005; Herbert, 2006; Nguyen & LeBlanc, 2001; Ranaweera & Prabhu, 2003; Rosenstein, 2002).

The LT 2010 course sought to develop social presence through the use of activities and feedback loops to create interactions and a sense that all of the people in the course were real and present in the course. Something such as sending a message through e-mail and not receiving a

response could make the learner feel disconnected or like they were not interacting with other real people (Gunawardena & Zittle, 1997). Instructors can take actions such as participating in discussions, leading learners to interact through discussions, games, or other activities that learners are likely to genuinely enjoy to develop the perception of social presence. The feeling of being socially connected can be developed by the professor by creating a healthy environment for civil discourse and well-organized collaboration. An online course where students sense social presence allowed learners to feel a sense of belonging by learners working with each other and getting to know each other. Vivian Garrison (1977) defined social presence as the degree to which participants are able to project themselves effectively. The course examined for this research was designed to allow students several opportunities to project who they were to their classmates and the instructor. The skills that students set out to master in the course utilized in this study, allowed students to gain a better understanding of how to project themselves not only in this course, but also in everyday life on social media as well as professional and personal interactions.

The third component of the CoI model established by Garrison et al. (2000) is cognitive presence. In one of the few studies utilizing both the CoI model and SEM, Shea and Bidjerano (2009) determined that 70% of cognitive presence was explained by teaching presence and social presence. Cognitive presence was characterized by learners developing interest in the course and the desire to explore more related to what they learned. Gaining new perspectives for knowledge and skills that could have been applied to the student's life or real-world problems was also a portion of cognitive presence (Garrison, 2003; Garrison et al., 2000).

The three types of presence are interdependent on each other. Establishing presence in an online course, specifically in an asynchronous online course, may be more measurable or

quantifiable than in person, by having the ability to go back to examine the number, length, and quality of interactions. However, establishing presence online typically requires additional effort from the instructor in time and directed responses to each learner that is attempting to have a one on one interaction. By creating a rich sense of presence for learners in the course, the goal was to increase quality of interaction and perceptions, which may have positive correlation with student interaction and satisfaction. More satisfied students are more likely to persist in their academic program and retention of students in online courses is a growing concern that colleges and governing bodies are aiming to improve (Allen & Seaman, 2014; Jones, 2013; Levy, 2007; K. Moore, Bartkovich, Fetzner, & Ison, 2003). Instructional strategies that promote the three types of presence in the CoI model were implemented in the asynchronous online course utilized in this study.

Statement of the Problem

A course at a large university in the Southeastern United States enrolled approximately 600 learners per year in an online asynchronous course that was designed to have students master skills that they would need in their personal and professional lives. This study served as an evaluation of the design, implementation, and facilitation by measuring how students' perceptions of teaching, social, and cognitive presence affected their reported perception of satisfaction and interaction. This study sought to evaluate the presence variables from the CoI model and the influences that students' perceptions had on their reported course satisfaction and interaction in an asynchronous online mastery-type course, Learning Technologies 2010. Current research has provided studies that were isolated on one or two pieces of the proposed model of interest in this research, typically using regression. The closest literature to this study was conducted on learners in South Korea (Joo, Lim, & Kim, 2011), but there has not been a

study that sought to explore the learning experience as a whole system using student's perceptions of all three types of presence, interaction, and course satisfaction. Administrators and policy makers needed to have an understanding of what a quality online educational experience could look like and what the outcomes of the resources invested were. The IT 2010 course was carefully designed utilizing many instructional design strategies and facilitation was overseen by the same faculty member for a consistent and positive learning experience. College and university educators are often experts in their subject matter, but get varying levels of support in developing and facilitating an online course. Too often educators are directed to put a course online but not given the resources such as time, instructional design methods and tools for online learning, or training to do it properly. Learning management systems eventually included web forums, but they were still clunky in design and too often faculty did not receive training to use them effectively (Xin & Feenberg, 2006). Understanding what leads to satisfied learning experiences could produce a myriad of other positive outcomes such as improved retention, progression, graduation rates, plus higher levels of engagement with the course, the subject matter, the institution, the community, and the learner's profession. Satisfied learners are likely to persist and continue in their program of study (Aitken, 1982; Gunawardena & Zittle, 1997; Levy, 2007; Ranaweera & Prabhu, 2003). One method to improve satisfaction and encourage positive outcomes is ensuring a quality experience that engages students mentally, and makes them aware that there is an instructor who cares about their success, and peers that are engaged with them in the asynchronous online course. Learners that are satisfied and persisting in their study demonstrated a positive relationship to retention, progression, and graduation (Ranaweera & Prabhu, 2003). A 2016 study found that it has taken students longer to graduate than the expected time period of four years for a Bachelor degree. The increased time and cost will sink

students into debt and in many states, lower graduation rates will result in reduced state or federal funding. The domino effect of reduced funding could result in programs or entire institutions being discontinued, which could then result in a less prepared workforce (Complete College America, 2014; Strang, 2016). In a *New York Times* interview, Georgia State University President, Mark Becker, stated, "I'm appalled that so many universities continue to engage in practices known to be, at best, modestly effective," in response to looking at methods that blame the retention problem on the quality of the student, rather than the actions of an institution (Kirp, 2016). This study informed educators of how intentional instructional design affected learners in LT 2010, which could later be applied to similar asynchronous online mastery-type skills courses.

The review of literature revealed a 2011 study conducted in South Korea that used the CoI model to examine the effects of teaching presence on social presence and cognitive presence, perceived usefulness, and learner persistence, defined as the likelihood of one staying enrolled at the institution (Joo et al., 2011). Student achievement was not easily measured in this study since this was an introductory mastery type course, in which achievement was positively skewed, and the response to the survey was completely anonymous based on approval for the research to proceed. In Joo's study learners took open-book tests and were graded on progress; in this study, learners worked on mastering skills, so achievement was not ideal for this study either. This study hypothesized that teaching, social, and cognitive presence were interdependent, affecting each other as well as having direct and indirect effects on satisfaction and interaction. The CoI model was the framework utilized to determine if the design and nature of the course produced satisfied learners and to explore the role of interaction. In the analysis, interaction was both a desirable outcome as well as an endogenous variable used to understand

how interaction affected satisfaction in LT 2010. This study was valuable because it tested new relationships that had not been examined within a system, on American students, and using the CoI model as the framework. Evaluating all of these factors at the same time allowed a model to explain the degree or effect of each of the explanatory variables on each of the dependent variables of student interaction and course satisfaction. There were several studies that isolated one or two single relationships and measured them with linear regression, but very few that examined learning as a set of interdependent relationships. Examples included estimating the relationship of social presence on interaction (Lowenthal, 2012), social presence as a predictor of satisfaction (Gunawardena & Zittle, 1997; Richardson & Swan, 2003), and teaching presence and the relationship to learner satisfaction (Bozkaya & Aydin, 2008). However, the variables that were measured in this research were not previously measured together at the same time in a single model.

Educational institutions often focus on the positive possibilities offered by online learning but at times fail to make the proper investments in time, work, planning, and knowledge required to make the course effective (Ouzts, 2006). The early days of online learning were limited by slow Internet connections and crude learning management systems. Some professors that were forced to teach online would do things like record a one- to three-hour-long lecture as video or audio and post that online for online students. Other professors would engage in practices such as assigning a reading from the text and some sort of rote memorization and test system. One study (Wimbish, 2001) described the poorly designed online course from the student's perspective as creating feelings of isolation from faculty and peers, being lost in cyberspace, and receiving a much lower quality learning experience. Distance education has the additional challenge of staying or creating student engagement that can already be slightly

elusive in face-to-face courses. When there is no person standing in front of the student, or facilitating conversation, or hands-on lab exercises, creating engaging experiences can be more difficult. One research study found that 91% of the students that were beginning a distance education course expected it to be engaging, but by the end of the course only 9% of the students suggested that the technology made the class more interesting or enjoyable and 54% thought it was harder to learn than in a traditional class (Cleveland & Bailey, 1994). For technology to work in distance education, reliability, quality, and medium richness are key. If the technology is not working reliably, and of high quality, it simply becomes a distraction from the goal of the course (Webster & Hackley, 1997). In Horton's book *Designing E-learning,* he gave several examples of poor instructional design that happened when there was no motivation or support to design quality online courses. The first example he described as "RAPRAPRAPAWAP, which stands for read a paper, read a paper, read a paper, and write a paper." Another poor technique used in place of proper instructional design is "Pack 'em, yak 'em, rack 'em, and track 'em," which means very large course enrollments with lecture-style delivery, having students recite back information, and then recording statistics to document the successful recital of learning. A technique very common in the corporate world, but certainly on the list of poor instructional designs, is "warn and scorn," where the learner is forced to sit through a series of videos until they finish clicking all of the "next" buttons. The goal of this type of design is not educating or learning; it is rather a compliance device, or legal way out of when a learner or worker does something wrong to be able to say that they should have been aware since they completed the training (Horton, 2011). Experts in instructional design created the course being examined in this study, there were also policies and procedures to assist individual instructors on how to facilitate this asynchronous online course. In this examination, the asynchronous online course

being evaluated was carefully devised to avoid the common mistakes of poor instructional design, which led to students perceiving presence, interaction and satisfaction.

In response to the need for more comprehensive training of instructors and better design of courses in online learning, this study utilizes the CoI model to examine the impact of teaching presence, social presence, and cognitive presence on students reported perception of satisfaction and interaction. Current research has provided studies that were isolated on one or two pieces of the proposed model of interest in this research, typically using regression (citations?). The closest literature to this study was conducted on learners in South Korea (Joo, Lim, & Kim, 2011), but there has not been a study that sought to explore the learning experience as a whole system using students' perceptions of all three types of presence, interaction, and course satisfaction. The course utilized in this study was carefully designed to include many instructional design strategies and facilitation was overseen by the same faculty member for a consistent and positive learning experience. Experts in instructional design created the course, and there were also policies and procedures to assist individual instructors with course delivery. In this examination, the asynchronous online course being evaluated was carefully devised to avoid the common mistakes of poor instructional design, which led to students perceiving presence, interaction and satisfaction.

The course evaluated in this study was Learning Technologies 2010 (LT2010), an introductory computer skills course. The course was designed as a mastery type course where learners were allowed to revise work after receiving feedback. There was a template and guideline for the course, making intentional use of instructional design strategies to lead to positive learning outcomes which included the perception of teaching, social, and cognitive presence by the learners in the class. The course was taught by multiple instructors, but each of

the instructors used the same template, including exercises, teaching schedule and material, guidelines on how and when to provide feedback, how to manage discussions, and the pacing of the course. With this study focusing on a single course with a well-documented template, the effects of different sections of the class having different instructors was mitigated. Since this asynchronous online course was a mastery-type course, in which students are given opportunities to revise their work in an effort to master skills rather than earn a grade, satisfaction was chosen to be a more desirable and researchable outcome than retention in the course or achievement as measured by course grade. Retention is typically very high in this introductory course since learners have the opportunity to correct mistakes and persist in the course. A student may not complete this single class for one reason or another, but they may still move forward to earn their bachelor's degree in whatever their major is, or it is possible that a student may complete this course, earn a passing grade, but then drop out of the university for some reason that this study was not able to determine. This course was offered to learners early in their collegiate education, not to test what they know, but to develop skills in using technology that was designed to serve them throughout their education and lifetime. The goal of this course was to leave students with real tangible useful skills, not just rote memorization of facts. Learners varied on how they mastered the skills such as: communicating over the Internet, understanding how to find and use reliable information, create original work using technology, acting ethically online, and contributing back to the Internet. Research shows that mastery-type courses, like LT 2010, are appropriate for building a type of foundation since there were differences among learners in aptitude for types of learning, the quality of instruction available, students' ability to understand that instruction, perseverance, and time allowed for learning (Bloom, 1968). The course used for this study provided a variety of instructional activities with absorb, do, and connect examples

such as basic drill activities, guided analysis, and hands-on practice (Horton, 2011). Absorb-type activities informed and enabled learners to obtain information by reading, listening or watching. Do-type activities transformed information into knowledge and skills by discovering, evaluating, or applying knowledge. Connect-type activities allowed learners to apply the information, knowledge, and skills to their lives. Connect-type activities included using software to perform their work, having learners track down information that they wanted to know, or participate in guided research. Due to the fact that this was a mastery-type course, grades tended to be skewed positively, with the majority of learners taking the opportunities to master skills and therefore earn a higher grade (Bloom, 1968).

Purpose of the Study

The study sought to determine whether perceptions of teaching presence, social presence, and cognitive presence in LT 2010 had a positive impact on interaction and learner satisfaction. This course was worth examining because over 600 learners per year take this course, and it can be a significant predictor of completing college. It is also one of the courses students usually take early in their academic program, so achieving a positive learning experience was a desirable outcome. Establishing the perception of interaction was a desired outcome for the course in hopes that students would then feel an increased engagement with the program, the course, and institution. Students that are interacting are likely to be more involved and engaged. The research on the relationship of satisfaction and interaction in a mastery-type online asynchronous course, such as LT 2010, with the interdependent variables from the CoI model of teaching, social, and cognitive presence was lacking. This study explored the value of efforts made by the course designer and instructors of the LT 2010 course over a three-year period to create the perception of presence. The results provided a better understanding on what impact the work

done to create the idea of presence, had on student course satisfaction. The results of this study can be used as a resource for administrators and instructors to prioritize how to best allocate resources to produce a quality asynchronous online course and satisfied learners. Many aspects and activities of the course were designed to achieve high levels of interaction and satisfaction, and this study uncovered areas in LT 2010 that were working very well as well as some areas that needed to be improved in design, implementation, and facilitation. The results provided feedback to the instructors and designer on strategies that worked in this mastery-type course as well as activities that may need to be revised to achieve the more desired outcomes. The outcomes of this study can be used as a method to perform a type of quality assurance or continuous improvements after the course has ended. This study could be replicated after enhancements are implemented and the study could also serve as a summative assessment of the course as a whole. The results provided a starting point to begin investigating areas that could be modified to better meet the needs of the students.

Rationale

If tools and pedagogical strategies to develop the perception of teaching, social, and cognitive presence in the design of online courses showed positive relationships with higher perceptions of interaction and reported course satisfaction, then additional consideration should be given to investing resources into designing of future courses. The undergraduate introductory asynchronous online mastery-type LT 2010 course employed activities such as planned frequent interaction between the instructor, the learners, and having learners engaged in exercises that allowed them to apply their knowledge to problems in their lives. Designing, implementing, and facilitating courses with all of the well-thought-out design of engaging activities took considerable time and skill. Institutions and instructors should be gaining efficiencies for the

expended effort, time, skill, and money used to design courses, but if an institution haphazardly throws a course online without understanding the consequences, it could result in negative outcomes. Examining the direct and indirect effects using SEM allowed researchers a more complete systematic view of how each of the types of activities an instructor or instructional designer perform affect interaction and satisfaction. Structural equation modeling has been used in tandem with the CoI model in only a few studies. Garrison and Cleveland-Innes (2005) used SEM to determine how graduate students developed their learning strategy based on their perception of interaction and teaching presence. Marks, Sibley, and Arbaugh (2005) used SEM to measure the effect of many variables, such as student-instructor interaction, student-student interaction, the number of prior courses taken, perceived flexibility, and number of individual and group projects, on perceived learning and satisfaction. That study revealed that instructor behaviors toward students were the most important explanatory variable in the model that explored 14 different constructs. Shea and Bidjerano (2009) studied the structural relationships between the CoI factors in relation to age and gender. Garrison, Cleveland-Innes, and Fung (2010) investigated the interdependent causal relationships between teaching, social, and cognitive presence. Lee (2011) sought to understand the perceptions of multicultural students in a Korean university of what the role of the instructor should be. Structural equation modeling has been used by Joo et al. (2011) to examine perceived levels of presence, usefulness, and ease for satisfaction and retention. The pairing of the theoretical CoI model and the statistical procedure SEM produces very interesting, complex, and practical findings. There were many combinations of factors involving the CoI model and other positive outcomes that would add to the literature with a new complex yet practical results. This study did not seek out to prove if the CoI model is valid. it Instead it looked at how using the model to measure students' perceptions

of teaching, social, and cognitive presence affected the desirable outcomes of course satisfaction and interaction. The model produced added to the literature of two relatively recent CoI and SEM studies (Shea & Bidjerano, 2009; Garrison et al., 2010) to further validate that teaching presence directly and positively affected social and cognitive presence, while social presence was a mediating variable which led to cognitive presence. The course was designed to help learners master technology skills and while doing so it is desirable that they are satisfied with the experience and that interaction in the online environment was apparent and meaningful to the students.

Prior research showed that earning an A or B in an introductory course was a predictor that the student was 70% likely to graduate, regardless of their major (Kirp, 2016; Treaster, 2017). This study considered measuring achievement as an outcome, but the survey results were anonymous which prevented being able to tie a single response to a single user, and a majority of students were able to earn an A or B in Learning Technologies 2010. Determining specific grades and having that information along with the perception information could produce interesting results for a future study. One method that was employed in this course that has been shown to significantly reduce the number of D's and F's in the course was having frequent instructor feedback and instructors that were present (Kirp, 2016). As of the time this study was conducted, 33% of learners were taking online courses, and it was recommended by experts that study online education, that the instructors encourage learners to continue in their program of study (Allen & Seaman, 2014). It was conceivable that a student could have been influenced to continue or stop pursuing their degree because of a bad experience in an online course that did not motivate them to be engaged, failed to pique their interest in the field, or allowed them to progress. Research has found that first-year student retention was most influenced by how

satisfied the student was with their learning experience (Aitken, 1982). Another study using Herzberg's two-factor theory concluded that students that have a positive experience were more likely to be satisfied and more likely to complete their program (DeShields Jr et al., 2005). The rationale for this study included providing evidence to policy makers and educators on which activities learners found value in. Instructors have limited time to engage in the teaching, scholarship, and service expected by their institution, and they should make efficient use of their limited time by engaging in the activities that have positive impact for their learners, the institution, and themselves. The course being evaluated in this study was designed by experts in the field to create a positive learning experience for students, and this study provided an opportunity to look back at the strengths and weaknesses of the design to make continuous improvement. The research questions that were examined in this study shed light on which of the activities were working as intended for learners and which ones may not have mattered or been successful in achieving the desirable outcomes of interaction and satisfaction. For example, if a perception of teaching presence was not shown to be present, then the person responsible for the course could have used the results to go into the course, examine the methods and tools that were being used, which were intended to create this sense of presence, and then modify the course.

Learning Technologies 2010

The course description for Learning Technologies (LT) 2010, a three-credit hour course was: "Computer Skills for the Information Age. Students learned how to use the computer as a tool for effective organization, analysis, and communication of data. Students developed competence in word processing, spreadsheets, databases, presentations, simple web page design, and the efficient use of Internet sources." LT 2010 was offered during the fall, spring, and

summer semesters at a large research institution in the Southeastern United States. In the spring semester, there were nine to ten sections with up to 25 students in the course, for a total enrollment of 225 to 250. In the summer semester, there were four to five sections with up to 25 students in the course, for a total of 70 to 125 students. The fall semesters were identical to the spring semesters with 225 to 250 students enrolled. The total number of students taking this course per year was 520 to 625, so there was value in a thorough examination of what design elements were working as intended and as an assessment to identify areas for improvement. In this study, only the summer semesters were measured for sake of keeping a consistent schedule over the period of three years. The summer semester enrollment is smaller than the spring and fall, so it took three years to get a sample size capable of measuring everything in this study. The researcher investigated differences between sections or instructors over time. The data used in this study was perception based data that learners in each section of the courses over the three-year period volunteered to provide. During the spring and fall semesters the course duration was 16 weeks, but during the summer semester the course was seven weeks long. Every section followed the same template from a single master course designer who was also active in assisting teachers with implementation and facilitation issues. The syllabus of the course made it clear that this was a completely online asynchronous course that was designed to enable learners to become more efficient and confident with technology in their personal and academic endeavors. The course was not a correspondence course or a complete on your own schedule type of class. Student outcomes for LT 2010 were:

- Demonstrate a functional knowledge of basic information-age terminology and concepts relevant to university and professional settings;

- Fearlessly and confidently use information technology to enhance your work in a university or job setting;
- Navigate your technology-enhanced university studies in a safe and ethical manner;
- Demonstrate competence in using productivity software to process, manage, and present information; and
- Demonstrate an entry-level proficiency in designing, developing, and maintaining a positive personal Web presence.

An analysis of the outcomes indicated that focus of the goals in this course were on the lower levels of intellectual outcomes of comprehension. Words such as demonstrate and navigate showed that most of the goals were aimed at basic knowledge acquisition for the students, however as the students mastered concepts they were expected to not only use, but also apply the skills and knowledge to more complex problems (Bloom, 1968). Students were required to purchase the book *Computer Skills for the Information Age: An Early College Student's Primer*, second edition, which could be purchased online for $58. One of the authors of the text was the master course designer. The course was fully online, which meant that the learners never met each other in person for this course. Never physically meeting each other could be another deterrent to creating a sense of social presence. The Learning Management Tool was Desire2Learn (a.k.a. Brightspace). Brightspace claimed to make the user experience easy to design, create content, and grade, which in turn was expected to leave more time for actual teaching and learning (D2L, 2016). Brightspace was like many other popular learning management systems such as Blackboard or Moodle, where there were course building tools and content management. To build the course, the designer of LT 2010 had to spend a considerable

amount of time creating modules, dates, discussions, prompts, and several other design elements. The planning work that all went into creating the LT 2010 course in D2L eventually ended up being a part of what students perceived as presence.

The layout was designed to be easy for students to use, an example is shown in Figure 1. The main content was listed in the Content Browser widget in the top left of the page, where most Americans first look to begin reading the screen (Hoekman, 2010). Students also saw News, Calendar, and Updates. When the course was designed, there were dates that controlled when new content appeared for the student, so that students were following a schedule in their online asynchronous course, just as they would have a schedule in a face-to-face course. As an example, in the 2016 sections, activity one started on June 6 and was to be completed by June 12. Activity two began on June 13th and ended when activity three began on June 17th and so on until activity 15 started on July 26th and concluded on July 28th. The summer semesters, which this study examined, required learners to stay involved throughout each week of the course.

In the fall and spring semesters, the course took place over 16 weeks instead of seven, which could have allowed for a slightly slower pace and differences in how often the student needed to stay engaged in the course to be successful in the class. Having longer breaks between having to do something in the course could detract from presence by allowing gaps and disconnections, but having the longer timeline could add to presence by having people in the course spend more time together over 16 weeks. Prior research showed a significant difference on the ability to build a community of inquiry amongst learners between a five-week course and a full semester that lasted sixteen weeks (Grady, 2013). This course lasted seven weeks, in an asynchronous online format where learners were not required to ever meet in person or even for a synchronous online session.

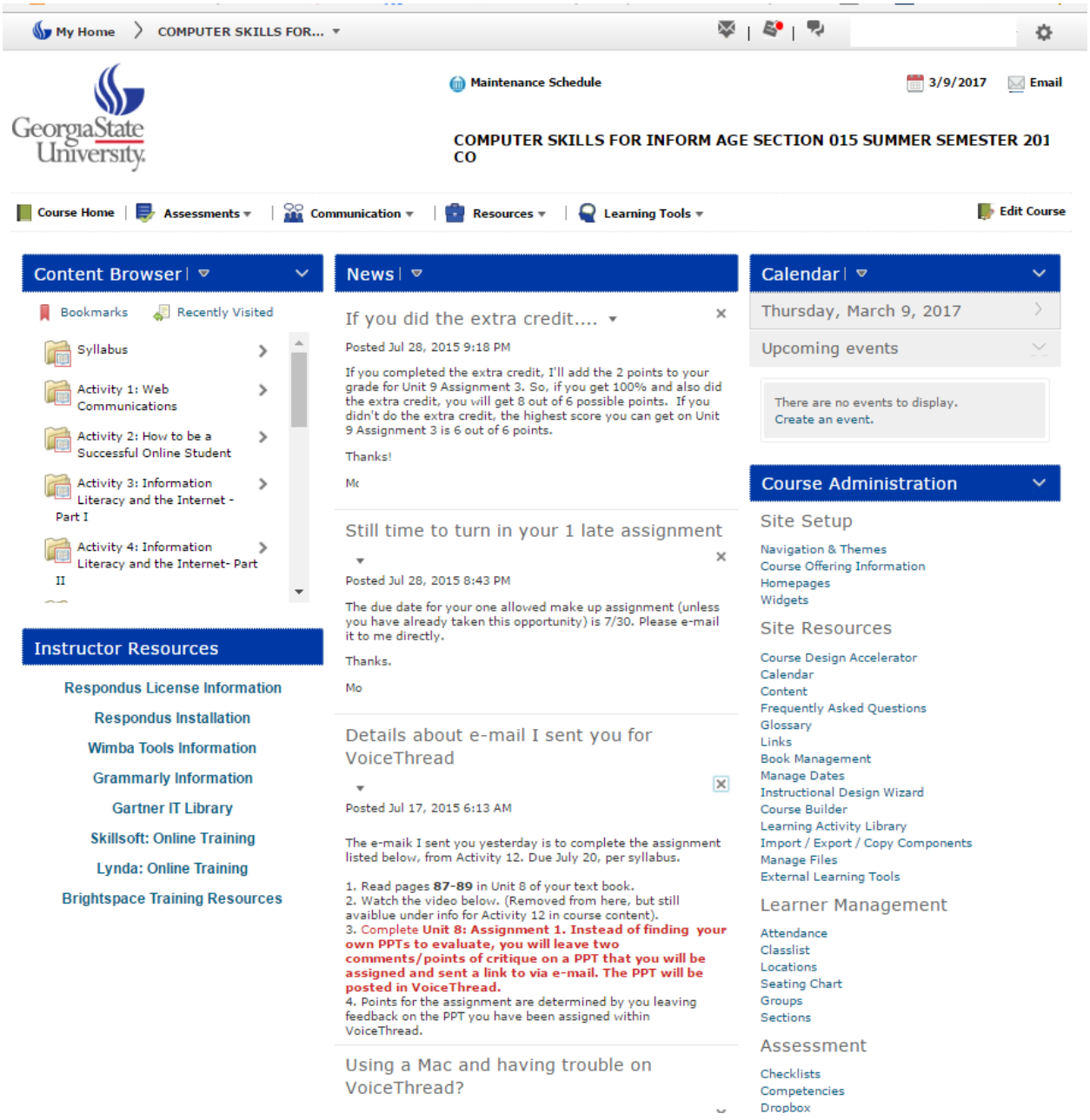

Figure 1. Learning Management System homepage for LT 2010

There were several other important tools in the LMS such as the calendar and the news section right in the middle of the pages, which were useful for the instructor to post reminders and general feedback to the entire class, which was equivalent to a face-to-face instructor standing in front of a class and saying to them, "don't forget that …." The instructors that

facilitated the course had a list of instructor resources such as training on the LMS, secure online testing, using writing tools such as Grammarly, and access to Lynda.com which was useful to enhance their own understanding of the topics that they were teaching. Instructors and students created free accounts on collaborative online tools such as VoiceThread.com. Students created their own blogs online using a blog hosting service built for the university, but accessible to the open internet. Students were presented with a video lesson to help them learn about what the blog site was and how to build their own. As a student, the only other widgets available on the main page was the calendar with upcoming dates that showed when activities began and ended plus the updates, which showed assignments submitted and the number of unread discussion posts.

Students would work through the modules as they were released at a time and location that was convenient for them. There were no synchronous meetings that required the learners to be online or at a specific place, but they did have the schedule listed above and shown in the course syllabus (see Appendix A. Course Syllabus). The instructor was involved frequently through direct feedback on assignments and discussions. There was news or announcements made multiple times per week to keep students informed of due dates, expectations, and often provided encouraging feedback to keep students motivated and engaged. Modules typically contained a webpage with text, graphics, links to external resources such as Wordpress, questionnaires, and embedded professional videos. Assessments and activities followed the learning content in the modules, which could be one of the thirteen assignments submissions that students created in LT 2010, one of the seven graded discussions, or completing practical hands-on exercises and then submitting their results in the LMS. One example, shown in Figure 2,

taught students how to search for information on the web using Boolean operators, by using interactive lessons created using Adobe Flash software.

Figure 2. Example Lesson using Boolean Operators.
Adapted from Colorado State University Library Tutorials by Brown-Sica, M. Retrieved from http://lib.colostate.edu/tutorials/boolean.html. (2016). Licensed under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 United States License.

The LMS also had a menu across the top of the page to group useful tools for students such as directly navigating to course content, viewing all the assignments, discussions, or surveys in the course, a class-list was available for the learners to see who was in the online asynchronous course with them and then they had the ability to e-mail or instant message their classmates. The instructor or researcher did not have the ability to monitor communications between learners via e-mail or instant message, but they could see when students shared information in a discussion board whether it was open to the entire course or setup for only select students that may have been working in a group.

Through the design of the course, teaching presence was intended to be established through actions such as; regularly posting announcements as the teacher, not just a robotic LMS feedback, personalized feedback on assignments, e-mails, and discussion, discussion board

interactions, plus through the timing of when items were released to learners and writing of the modules. The timing portion and some of the announcements were planned well ahead of the course, but interacting with these tools and techniques established the perception that the instructor was there in that learning experience with the students. Social presence was intended to be established through the discussions and sharing of content such as student blogs. Some of the discussion items specifically required that students post a response to the initial prompt from either the learning module or textbook and reply to their classmates. Some of the discussions did not require the reply portion. One activity that should have made students aware that they were in a class with other students that they could interact with was critiquing each other's PowerPoint and then the uploaded their critique to VoiceThread, which allowed students to hear each other's voice, instead of just reading each other's written text. Interestingly, as of February 2017, the banner on the Voicethread.com webpage described their product with the following statement: "VoiceThread fills the social presence gap found in online learning interactions" (VoiceThread. 2017). When the activity using the VoiceThread website was designed, there was no specific mention of social or any other type of "presence," but the publishers of the tool seem to have gained a better understanding of the value of their own tool. Some research found that medium richness was a contributing factor in creating a sense of presence (Lopez & Nagelhout, 1995; Volery & Lord, 2000). Lastly, cognitive presence was intended to be created by allowing learners flexibility in which problems they solved as they completed the tasks. The flexibility would then hopefully increase students' interest in the subject, provide them with the ability to combine information as they mastered skills, plus think about fundamental concepts and how they were important for their lives. From the writing of the textbook to the design of the course, there was careful planning to develop a meaningful positive educational experience for learners

in LT 2010. The course set out to have learners master skills that would allow them to confidently use information technology to enhance their work. This study examined how students' perceptions of teaching presence affected social and cognitive presence and satisfaction. The structural model estimated the influence of interaction on satisfaction. The analysis also measured how social presence affected cognitive presence, interaction, and satisfaction.

Research Questions

The study sought to determine how students' perception of teaching, social, and cognitive presence directly and indirectly influenced the variables of perceived interaction and satisfaction in LT 2010. A graphical conceptual model of the research questions is shown in Figure 3. Structural equation modeling is a confirmatory statistical analysis, therefore, based on the literature, the perception of presence should have had a positive relationship with interaction and satisfaction. This research sought to answer four questions.

In an asynchronous online mastery information literacy skills course:

1. How did students' perceptions of teaching, social, and cognitive presence affect course satisfaction?
2. How did students' perception of cognitive and social presence influence their perception of interaction?
3. Did students' perception of interaction have a positive influence on student course satisfaction?
4. Did students' perceptions of teaching presence influence cognitive presence directly and indirectly through social presence as a mediating variable?

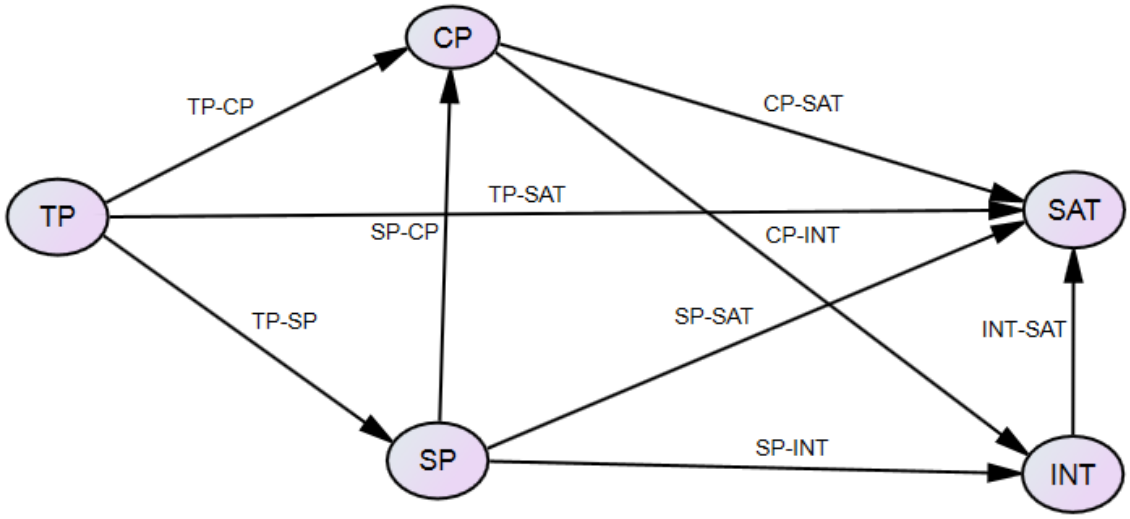

Figure 3. Conceptual model

Significance of the Study

This study added to the theoretical development of how learners' perceptions of teaching, social, and cognitive presence, based on the CoI model, explained interaction and satisfaction in an online asynchronous mastery-type course. The discussion describes practical issues of design and facilitation that were intended to increase satisfaction and interaction in an asynchronous online, skills-building, mastery-type course. This research was a new examination of a system of variables using SEM, on a mastery course, that added to the literature of an area and model that has not previously been studied. Future research may explore how this can be applicable to other asynchronous online courses or other mastery-type courses. This study adds to the literature on presence, but did not set out to prove that CoI is a good framework for course development. The CoI model and questionnaire were used to understand students' feelings and perceptions about their learning experience. The results of this study gives decision makers information on how to prioritize resources to develop an asynchronous online program that learners are likely to be satisfied with. This study ensured that the data used was appropriate for the statistical method.

Structural equation modeling is a complex technique to measure multiple relationships with latent variables, and doing this type of research required conceptualizing the model, constructing the path diagram, model specification, which included modifications and measurement models, identification results, parameter estimation, assessment of model fit with modifications, and interpretation. Without doing all of the aforementioned steps, the results of the study may have been less reliable.

The underlying conceptual framework for this study was based on the CoI model to examine how students' perceptions of teaching, social, and cognitive presence affect interaction and student satisfaction in an asynchronous online course. In online courses, specifically asynchronous mastery-type online courses like LT 2010, there is a risk of learners becoming detached from any sort of feedback or interaction with the instructor, classmates, and actively learning. The LT 2010 course had elements throughout the design intended to keep students engaged and present. The aim of this study was to identify students' perceptions of teaching, social, and cognitive presence in a course that employed instructional design strategies meant to develop a sense of these types of presence, and determine how these perceptions affected interaction and satisfaction. The discussion identified elements of the course that were working as designed as well as areas of the course that could be improved. The results of this study may be a useful tool for examining activities and design for other courses that are similar to LT 2010.

Definition of Terms

Amos: "AMOS (Analysis of Moment Structures) is an add-on module for SPSS. It is designed primarily for structural equation modeling, path analysis, and covariance structure modeling, though it may be used to perform linear regression analysis and ANOVA and ANCOVA. It features an intuitive graphical interface that allows the analyst to specify models

by drawing them. It also has a built-in bootstrapping routine and superior handling of missing data." (Arbuckle, 2013; IBM Corp, 2013).

A priori: Relating to what can be known through an understanding of how certain things work rather than by observation; presupposed by experience; being without examination or analysis (Merriam Webster Online, 2016).

Asynchronous: Not in sync or at the same time. Interaction and communication does not occur at the same time. Asynchronous courses offer the benefit of anywhere and anytime learning within the terms of the course. Asynchronous does not infer go at your own pace.

Blended learning (also known as hybrid or mixed-mode courses): Classes where a portion of the traditional face-to-face instruction is replaced by web-based online learning ("What is blended learning?," 2016).

Comparative Fit Index (CFI): This incremental measure of is directly based on the non-centrality measure. Let $d = \chi 2 - df$ where df are the degrees of freedom of the model. This measure should only be calculated if RMSEA is less than 0.158, otherwise one will obtain too small a value of the CFI (Kenny, 2016).

Confirmatory factor analysis (CFA): A statistical technique used to verify the factor structure of a set of observed variables. CFA allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists. The researcher uses knowledge of the theory, empirical research, or both, postulates the relationship pattern a priori and then tests the hypothesis statistically (Suhr, 2006a).

Cognitive presence: The extent to which learners are able to construct and confirm meaning through sustained reflection and discourse (Garrison, Anderson, & Archer, 2001).

Community of Inquiry (CoI): A framework that reflects a collaborative-constructivist approach to learning by fusing individual construction of meaning and collaborative validation of understanding.

Estimation: Using a sample statistic to determine the probable value of a population parameter. The size of a relationship is the goal of the estimation, not statistical significance (Vogt, 2011).

Learning management system (LMS): Hosted software platform that allows the use of roles for instructors, designers, and learners to keep track of records, share content, communicate, and provide feedback.

Mastery learning: Learning where the goal is to master skills or knowledge rather than a single instance of testing. Mastery learning seeks affective change and the development of objective and subjective improvement in the skill or knowledge (Bloom, 1968).

Normed Fit Index (NFI): This is the very first measure of fit proposed in the literature (Bentler & Bonett, 1980) and it is an incremental measure of fit. The best model is defined as model with a $\chi 2$ of zero and the worst model by the $\chi 2$ of the null model (Kenny, 2016).

Online learning: Learning that takes place using the Internet. This can include synchronous or asynchronous learning, learning management systems, interaction, broadcasts, and collaboration.

Path diagram: A graphic representation of a hypothesized causal model. The numbers on the lines are beta weights or path coefficients, which are expressed in z-scores, and they can be either positive or negative (Vogt, 2011).

Root Mean Square Error of Approximation (RMSEA): This absolute measure of fit is based on the non-centrality parameter. Its computational formula is: $\sqrt{}$ (χ2 - df) ... If χ2 is less than df, then the RMSEA is set to zero (Kenny, 2016).

Social presence: "The ability of participants to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop inter-personal relationships by way of projecting their individual personalities" (Garrison, 2009).

Structural equation modeling (SEM): a very general, chiefly linear, chiefly cross-sectional statistical modeling technique. Factor analysis, path analysis, and regression all represent special cases of SEM. Structural equation modeling is a largely confirmatory, rather than exploratory, technique (Rigdon, 2015).

Synchronous: in sync or together. Interaction and communication happens in real time with participants all present at the same time.

Teaching presence: The design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Anderson, Rourke, Garrison, & Archer, 2001).

Tucker Lewis Index (TLI): The normed fit index (NFI) analyzes the discrepancy between the chi-square value of the hypothesized model and the chi-square value of the null model. However, NFI tends to be negatively biased. The Tucker-Lewis index resolves some of the issues of negative bias. Values for both the NFI and TLI should range between 0 and 1, with a cutoff of .95 or greater indicating a good model fit

Assumptions and Limitations

The study measures students' perceptions of each of the variables, presence, interaction, and satisfaction, as reported by survey questions that were originally included on three different

instruments (see Appendix B. Original Survey Items). The survey instrument was put together from three previously validated questionnaires. A team of four college professors with at least five years of experience teaching online examined which questions from each of the three instruments would be able to answer the research questions of interest in this study. In social sciences it is common to measure perceptions or feelings, which are not measured in the same way as easily quantifiable things like length, weight, or time. The data collected in this research was reported perception information from students enrolled in the LT 2010 course in the summer semester of 2014, 2015, and 2016. Log data was not included in this analysis for multiple reasons including the approval of the study, the anonymity of the perception responses could not be tied back to individuals, and it would have required an even more complicated analysis than was already planned using SEM. The survey items were then processed into latent to give a fuller composite picture of the variables. Using SEM, the data, and a priori relationships influenced which of the measures were used to develop the final structural models. Using SEM, the researcher determined which questions were included in the final model and which ones did not allow the model to be valid or capable of conducting the analysis. Therefore, in this study that began with 34 items, the final model ended up including less than half of the items surveyed. When developing latent variables, the researcher must make decisions on which variables work best and still measure the desired latent variables being formed. Other studies utilizing SEM have also trimmed or modified their model to fit the data by removing variables (Adams, Nelson, & Todd, 1992; Anderson & Gerbing, 1982, 1988; Boomsma & Hoogland, 2001; Chin & Todd, 1995; Joo et al., 2011; Kenny, 2014; Lei & Wu, 2007; MacCallum, 1986, 1995; Rindskopf, 1984). In a published article covering issues and consideration of using SEM, Lei and Wu (2007) stated “When the hypothesized model is rejected based on goodness of-fit statistics, SEM

researchers are often interested in finding an alternative model that fits the data. Post hoc modifications (or model trimming) of the model are often aided by modification indices, sometimes in conjunction with the expected parameter change statistics."

The students in this course self-selected into an online course, which could have been an issue if the study was attempting to compare the results of a fully online asynchronous course to a traditional face-to-face course. The LT 2010 course, offered at a university in the Southeastern United States, enrolls over 600 students per year and is always available only in the asynchronous online format. All the explanatory variables were complex latent variables created as factors from prior research. The course was a mastery-type course where grades were positively skewed, so the achievement outcome was not appropriate for this study. Student satisfaction is not the same measure as student achievement, but it is a necessary component of a successful learning environment (Lowenthal, 2012). There were multiple instructors teaching the course with the same content and schedule. All instructors worked under direction with clear instructions of expectations. The guidelines and master course designer mitigated possible teacher effects. The period that the course was being examined was a seven-week long summer semester over the years of 2014, 2015, and 2016. Although the results of this study are for Learning Technologies 2010 and the students that were enrolled in that course, the findings may be helpful for other courses similar to this online asynchronous mastery-type class.

2 Review of the Literature

Introduction

In this chapter, literature related to the CoI framework was analyzed alongside research about student course satisfaction and interaction to uncover which types of presence made a significant difference in learners' perception of interaction and satisfaction. Since the results of this study on LT 2010 may be useful for other courses with similar characteristics, literature about online education is also included in this chapter. Satisfied learners tend to learn more, and because the purpose of an educational experience (whether it is online, face-to-face, or a blending of both) is to structure the educational experience to achieve defined learning outcomes, it is beneficial to find methods that produce satisfied, engaged learners (Garrison & Cleveland-Innes, 2005). The CoI model is useful for faculty to base course design on or to redesign courses and determine the practical implications of instructional strategies that attempt to stimulate students' perceptions of teaching, social, and cognitive presence as measured by the CoI questionnaire. This study did not seek to determine if the CoI model was valid or not, instead it used the existing body of research to explore relationships to satisfaction and interaction in a particular online asynchronous mastery-type course, LT 2010. To begin the study, it was important to clarify what online education was, how it was conducted using instructional design, and how the CoI theoretical model can be implemented in activities and assignments. Once the initial steps were completed, the researcher was able to determine learners' perceptions of types of presence, and then explore the relationships between interaction and satisfaction.

Garrison et al. (2010) used SEM to test the hypothesis that teaching, social, and cognitive presence were interrelated variables. That study confirmed positive relationships from

perceptions of teaching presence to perceptions of cognitive presence and teaching presence with social presence. This study examined teacher, social, and cognitive presence from the CoI model as interdependent variables and simultaneously measured their effects on satisfaction and interaction, which has not previously been studied in the literature. This investigation was focused specifically on the Learning Technologies 2010 course, where learners completed fifteen modules designed to help them master information literacy skills. In the same 2010 study by Garrison et al., gender was also tested and found not to be statistically significant (Garrison et al., 2010). Although the study was published by leading researchers in the field in a high-ranking journal, the findings did publish with a model that was below the recommended model fit indices. The model fit for that 2010 study reported GFI as 0.69, when 0.95 or higher is recommended (Hooper, Coughlan, & Mullen, 2008). The fit indices reported for AGFI and RMR were also outside of the recommended levels for SEM. Model fit in SEM can be thrown off for a large number of reasons, including that the model may not be consistent with the data or with the sample size, which was more likely. Fit is the ability of a model to reproduce the data. A good-fitting model means that the proposed solution is not wrong. There may be more than one good-fitting model that could be produced as a plausible solution for the data in the study. The results of Garrison et al. (2010) study was not incorrect; it identified a gap in the literature to be explored and look for a better fitting model in a new study to test their findings. In this statistical analysis a single model using multiple regression equations or multivariate analysis of variance was not able determine an absolute perfect solution, but calculating model fit statistics allowed the researcher to create a structural model with acceptable levels of confidence that the model was not wrong (Kenny, 2014).

The researcher of this study took great care to ensure that the statistical method employed was appropriate for the data collected. Through an extensive review of the existing literature, there was one other study that also took care to use appropriate statistical methods, examine some of the similar variables, and report on satisfaction. The study, titled *Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model,* found that teaching presence had a significant effect on cognitive and social presence. That study also concluded that teaching and cognitive presence had a positive influence on satisfaction (Joo et al., 2011). Joo's 2011 study did not examine the relationship of social presence to learner satisfaction, which this study did examine. It was interesting that the relationship between social presence and satisfaction was not investigated, because that is one of the areas where the existing literature has the most conflicting findings. Thus, Joo's (2011) study did not examine the variable of interaction, which this study did address. The justification for examining interaction was that these are often variables closely associated with active learning (Johnson, Johnson, & Smith, 1991; Prince, 2004; Soller, 2001). This study adds to the literature on satisfaction and interaction, for this online asynchronous mastery-type course, using measures from the well-proven CoI model. Future research may include conducting a similar analysis of this course or comparable learning experiences to find areas that may not be achieving the desired outcomes of satisfaction and interaction.

Online Education

With over 33% of learners taking one or more online courses in 2015, there is a need to understand the nuances between traditional face-to-face classroom learning experiences and what is referred to as online education (Allen & Seaman, 2014, 2016). The term "online learning" does not define the expectations, methods, or execution of how learning is conducted. There are

many forms of online learning, which trace its beginning back to a type of distance learning called correspondence learning or correspondence courses. Research published a decade or more ago may have referred to distance learning as computer-based learning, computer-mediated courses, computer conferencing courses, or web conferencing enhanced courses. The reasons that an institution or learner decides to enroll in an online education includes achieving a balance with other responsibilities, the lure of anytime, anywhere learning, access to programs not otherwise accessible geographically, plus the possibilities of lower costs, faster completion, and self-paced learning (The Learning House & Research, 2012). Every online, distance, or correspondence type of course does not offer every one of the affordances previously listed. Every learning management system (LMS) does not offer the same set of tools for instructors to create the same educational experience. Before describing the differences between correspondence courses, distance, asynchronous, and synchronous learning, it is valuable to define each term. As of 2010 the definitions of "correspondence" and "distance education" are described in section § 600.2 of the Electronic Code of Federal Regulations as:

> Correspondence course:
>
> 1. A course provided by an institution under which the institution provides instructional materials, by mail or electronic transmission, including examinations on the materials, to students who are separated from the instructor. Interaction between the instructor and student is limited, is not regular and substantive, and is primarily initiated by the student. Correspondence courses are typically self-paced.
>
> 2. If a course is part correspondence and part residential training, the Secretary considers the course to be a correspondence course.

> 3. A correspondence course is not distance education. Distance education means education that uses one or more of the technologies listed in paragraphs (1) through (4) of this definition to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor, either synchronously or asynchronously. The technologies may include—
>
> (1) The Internet;
>
> (2) One-way and two-way transmissions through open broadcast, closed circuit, cable, microwave, broadband lines, fiber optics, satellite, or wireless communications devices;
>
> (3) Audio conferencing; or
>
> (4) Video cassettes, DVDs, and CD–ROMs, if the cassettes, DVDs, or CD–ROMs are used in a course in conjunction with any of the technologies listed in paragraphs (1) through (3) of this definition (Office of Post-secondary Education, 2012).

Online education became so common that it was possible for academics to describe a class as a "traditional online course" when comparing it to some newer method of distance learning. In 2009, the U.S. Department of Education conducted a 12-year meta-analysis to understand the effectiveness of online education. The analysis of 51 studies revealed that students who took all or part of their courses online performed better than those taking the same class through face-to-face instruction (Means, Toyama, Murphy, Bakia, & Jones, 2009). That research is refuted by another meta-analysis of 355 studies conducted by Thomas Russell, where the conclusion is that there is no significant difference between face-to-face and online (Russell,

1999). Possible reasons for no significant difference between online and face-to-face instruction lie within the details of how the course was conducted. Courses with attention directly to course design, policies affecting interaction amongst the teacher and students, and conducting activities in the course to purposefully encourage engagement have been linked to online courses leading to the equivalent learning outcomes as a face-to-face course (Yerby & Floyd, 2013). A qualitative study utilizing the CoI framework (Garrison et al., 2000), explored the things that students missed most about having their class online, instead of in person. The five themes that emerged from that study were issues related to the robustness of dialogue, spontaneity and improvisation, the perceptions of being a "real" person, getting to know one another, and differences in what the requirements to be an online learner were versus showing up for class (Stodel, Thompson, & MacDonald, 2006). The acceptance of online learning by CAOs continued to rise each year for 13 years, but with an expanded consideration of learning declared as online learning, that support started to decline in 2013 and 2014 (Allen & Seaman, 2016). The literature about delivery of online courses is split. The less often discussed challenges of online education includes students that are disengaged, bored, learned less, and absorbed only a fraction of the intellectual atmosphere that they would have likely gained in a traditional face-to-face course. In an interview the co-director of the Babson Institute said, "There's one major factor driving online learning's expansion… The universal appeal is access. It's not that online is inherently better or worse—it's that taking a course online allows you to complete a program you couldn't otherwise" (Quartz, 2016). Mayadas and Miller (2014) stated that "engaged intentional design of learning experiences has also evolved to promote the most effective design to serve the learners, their life experiences and the opportunities and limitations of the particular environment." The researchers pointed out that many graduate programs have deliberately

designed academic offerings for people who were developing their career by day, and took advantage of academic offerings that were predominantly available online with zero or limited requirements to be physically on campus (Mayadas & Miller, 2014). Such rapid adoption of online courses left some educators confused about how to integrate appropriate technologies into online learning environments in a way that would have a positive influence on student learning in many different subject matters (Shea & Bidjerano, 2009). While the number of online course offerings grew, many American professors showed skepticism toward the idea. Educators viewed the mandate to go online as a shift of their primary mission, to educate students to be productive educated members of society, to running universities more like businesses (Lucas, 2016a). Decisions clearly coming from administrators for the sake of reaching more learners were not always benefitting educators who lacked the support to make high quality courses, or be compensated for the time and skill when they did produce such a course. Union groups such as the American Federation of Teachers have passed a resolution to oppose undergraduate degrees earned fully online. The group says that there must be interaction to be a real undergraduate degree, and that people must get together (TrainingZone, 2000). It's clear that a large percentage of decision makers, CAOs, and administrators found value in online education. Students are seeking out online educational experiences, and industry has not rejected hiring graduates of online courses or even fully online education. There is a division of levels of comfort, support, or adoption among the people expected to carry forth the next evolution of online learning (Jong et al., 2012). Teaching online needs to be supported in terms of what is an effective use of time, methods, and resources. The author of *Technology and the Disruption of Higher Education: Saving the American University,* argued that the key to success was the chief potential roadblock, the faculty (Lucas, 2016b).

The Learning Technologies 2010 course examined in this study did make the investment in time and design aimed at achieving positive outcomes such as students mastering skills and being satisfied with their experience. The course designer and instructors did support the idea and mechanisms of online education. This study measured whether the design of the course and various instructional strategies, i.e., having the instructor work closely with the student in a relatively small online class, give feedback, encourage interaction among learners, and provide opportunities for students to be mentally involved, made a difference on the students' perception of interaction and satisfaction. The online mastery-type course was an important course in the academic journey for the over 600 students per year. Learning Technologies 2010 helped students master skills that they needed in future courses and the course was typically one of their early courses in the academic career. Earning a grade of A or B, in an introductory course, such as LT 2010, has shown to be predictor of future success in their academic program (Kirp, 2016; Lucas, 2016a). Conducting this study helped to confirm the positive aspects that were attributed to design, implementation, and facilitation of the course as well as uncover areas that could benefit from improvement. The results of this study can be used for similar courses to evaluate what learners perceive as valuable or worthwhile.

In the next section, correspondence courses are discussed as a method that is generally less desirable when it comes to creating a sense of presence. There are other types of online learning that include open schedule courses, where learners have a great deal of freedom to determine when they want to complete the work required for a course. In an open-schedule format, learners may have a deadline for the semester and have complete control of when they complete during that time frame, or there may be an option that the student does not even register or take a course until they've completed the series of exercises. With such freedom of when to

complete work, learners can feel greater levels of isolation, and need to have much more self-discipline to seek help when they have an issue. Research on high locus of control found it was not a significant factor for staying in the course or dropping out (Levy, 2007). Interaction and the perceptions of presence are typically very low in correspondence courses since there is little to no interaction. Learning Technologies 2010 is not a correspondence course, but it is important that this distinction be made in order to gain an understanding of trends in online education.

Correspondence courses. Correspondence courses still exist, however, they are currently often supplanted by online courses, which offers interaction with teachers and other students, additional opportunities to connect cognitively to the subject matter, and a forum for feedback (Explorer, 2016). In March 2012, a federal audit required a small Catholic college in Indiana to refund $42 million in federal financial aid funding back to the government due to improper reporting of correspondence courses as distance education. The audit listed seven findings, including incorrect calculations of Title IV awards for students enrolled in correspondence courses, cost of attendance budgets not supported, funds improperly dispersed, and the college not complying with the requirements of offering distance education. The summary went on to detail that the college was not eligible for Title IV funding since they had 50% or more of their students in correspondence courses, not distance education where there is interaction between students and the instructor (Poulin, 2016; Whitman, 2012). Thus, far the difference between correspondence courses and other things considered distance education or online learning has been described. In most circumstances, correspondence courses are considered inferior to or less desirable than online courses. Online courses give the option of interaction and feedback regardless if the class meets at the same time synchronously or if learners and the instructor interact over a defined period of time such as a three-day span. The

course used in this study was not a correspondence course, but it was an asynchronous online course. A student in a correspondence course may have been mailed a list of readings, videos, or lessons, then they completed exercises that were most likely not proctored. Correspondence education was one acceptable option for students who are seeking to prove that they know something, work well independently, and were not procrastinators (Explorer, 2016).

Synchronous and asynchronous education. One of the most alluring benefits of online learning is that students could complete their educational goals anywhere and anytime (Huang, 2002; Moskal, Dziuban, & Hartman, 2009). The "anywhere" portion of the concept holds fairly true, as long as the learner had an Internet connection that can transmit the learning materials and the Internet connection is not blocking or filtering access. The "anytime" convenience comes with a major caveat. If the online learning is synchronous that means the learner is involved in live communication by using something like chat, teleconferencing, videoconferencing, or sharing a live view of some hosted application. Synchronous courses are sometimes described as "fixed time" online courses, where there is a specific time the learners need to be online and in the system used for communication (Explorer, 2016). If a learner was required to attend live sessions, then the promise of "anytime" was no longer the benefit that was one of the main draws for online education. However, the constraints of being online at a certain time versus being in a certain classroom at a certain time, has still been a major benefit for many learners. Synchronous learning may have been less flexible in regards to time, but it could have provided a richer experience with more immediacy, and closer to what has been thought of as a traditional experience where students sat in the same physical space to learn and interact. Some online courses were partially synchronous where learners had some of the benefit of flexibility of "anytime," but worked in smaller groups to decide how and when the group "met." Many

learning management systems, such as Desire2Learn come with tools able to facilitate live interactions, but there is also a plethora of free applications that are able to run on computers and mobile devices, which enhance the benefit of anywhere learning. New applications and platforms allowed seamless real-time chat, video discussions, and educator-to-student interactions to enhance social connections, immediacy, learning support, feedback, and created a space for genuine interaction in real-time that was more difficult to do in an asynchronous setting (Morrison, 2014). With the new plethora of tools, educators had to work carefully and intentionally to ensure that the tool supported the pedagogy. Educators should not implement a tool because it was new. Horton describes this phenomenon as "wouldn't it be cool if …," where instructors sought to impress with the latest gizmo or trend, spending more time focusing on the tool, or the wow factor of the tool, than on the goal of educating students in the subject matter that should have been taught (Horton, 2011). Educators should conduct a needs analysis before deciding to implement a tool (Morrison, 2014). The LT 2010 course in this study did use new collaborative technologies such as VoiceThread, but it was thoughtfully implemented for the benefit of learning and interacting, not just because it was neat. Synchronous courses typically had higher requirements on resources for learners, such as a high-speed Internet connection capable of streaming voice and video, speakers, and a device with a camera and a microphone. Often applications for collaborating in real time had to be installed onto the device, so the device the student was using must grant permission to install software. Students attempting to install software on computers that were owned by the university or workplace sometimes had problems due to access. There are numerous web applications that did not required installation, that could lessen the burden of administrator access.

Asynchronous courses certainly maintained the advantage of "anywhere" just as well as synchronous courses, or perhaps slightly better if the student do not need to be in a place with a computer and Internet connection at a certain time of a certain day. The benefit of "anytime" was much more likely realized in asynchronous courses. However, an asynchronous online course did not mean at your own pace for the majority of these types of courses. The convenience or affordance of asynchronous online was that a learner typically still followed some sort of schedule, likely a semester or half-semester schedule, just as they would have in a traditional face-to-face course, however they had the flexibility in the time of day, or day of the week. Courses that do not meet at the same time can make it more convenient for users to interact, but with some coordination assistance from technology and properly designed experiences (Hiltz & Wellman, 1997). The coordination and assistance from technology was an important caveat to making asynchronous education work. One student in a qualitative study about asynchronous courses stated that the medium was not as asynchronous as he or she had anticipated. If they missed a bit of time it was hard to catch up to the conversation that continued without them present. If students did not understand how to share their thoughts using the tool provided—text, audio, or video—then they were likely to have trouble interacting. In a face-to-face setting, there aren't new tools to learn in order to pose a question, ask for help, share a screen with a classmate, or pass an object to the person next to you. In asynchronous courses, the goal of the course was to teach the learning outcomes, and in some cases there was never an opportunity to get to know classmates in the same manner that may be possible in a face-to-face course (Wegerif, 1998). To get asynchronous online courses to be as effective as possible in engaging students and achieving learning outcomes the activities and interactions should be something that they enjoy or had some motivation to participate in. Grades were used as a

motivator in many online courses, but requiring students to post only to earn a grade did not equate to students being cognitively and social present in what they are sharing with the community (Rovai, 2002b)

Learning Management Systems

Most online education made use of a learning management systems to conduct courses, keep track of grades, provide feedback, and have a record of activities that occurred in the course. Learning management systems (LMS) may be referred to as content management systems (CMS), computer mediated learning, e-learning, computer-based instruction (CBI), computer-assisted instruction (CAI), computer-assisted learning (CAL), or integrated learning systems (ILS). The learning management system used in this study was Desire2Learn (a.k.a. Brightspace). Benefits of using learning management systems included the ability to streamline and automate the process of checking the originality of students' work, and use rubrics to equitably and efficiently grade work (Llewellyn, 2011). Learning management systems were typically very expensive systems that a university or entire university system decided to purchase, and then every instructor who is teaching online was expected to conduct their online courses using the tools and services available within the learning management system (McGill & Klobas, 2009). Pricing examples include San Jose State University contracts with Desire2Learn at a cost of $361,198 per year (Hill, 2012). In August of 2010 the University System of Georgia formed a committee to determine the next LMS that all 34 schools would be mandated to use. The committee made the decision to switch from Blackboard, which was costing $590,000 per year to Desire2Learn, with a $3.5 million price tag over the next five years, or $700,000 annually (Llewellyn, 2011). While the price tag of approximately $700,000 per year sounds astronomical, the cost per student in the University System of Georgia breaks down to about $2.50 per user,

which was below what it would have costed if each individual college purchased a LMS separately. In 2014, the University System of Georgia was recognized with an award from National Association of State Chief Information Officers for increased graduation rates by 5.1 points over the previous two years and improved student engagement (Stokes, 2014). Learning management systems were ubiquitous with online learning, yet of the few studies that did evaluate how the LMS affected students, the findings were mixed. Some studies results showed that e-learners reported higher computer self-efficacy and a lower level of satisfaction with the process (McGill & Klobas, 2009; Russell, 1999). Other studies suggest that online students had improved outcomes, higher learning performance, and were more satisfied (Chou & Liu, 2005; Zhang, Zhao, Zhou, & Nunamaker Jr, 2004). The research regarding the effectiveness of learning management systems was still developing when this study was conducted and research available was contradictory or sponsored by the companies that sell the software platforms. This study did not focus on comparing the LMS of this study to an alternative. The course was administered through Desire2Learn, which was mandated as the LMS to use by the university system office. The guiding principles of the University Systems of Georgia LMS selection task force directed them to:

- Recommend a product that meets 21st-century needs of students and faculty supporting the improvement of retention and graduation rates
- Recommend a product that will be used for multiple purposes (e.g., academic instruction/research/training/continuing education/economic development)
- Recommend a student-focused minimum LMS suite to maintain affordability and increase efficiency

- The task force will partner with IT to recommend an enterprise solution with an architecture that provides optimal performance/stability and supports increased enrollments of 100,000 additional students by 2020
- The work of the task force will be an open and transparent process to include all stakeholders (Llewellyn, 2011)

Learning management systems have become the default for online learning, however there was a growing sentiment that LMSs were more hindrances than they were helpful. LMSs were mostly from organizations serving a large customer base that was paying a great amount of money for a reliable, protected online records management system. Within a large system, many LMSs were being criticized as unnecessary, or not taking advantage of the newest methods and technologies. A 2006 study provided reasons for using tools beyond the LMS to provide students with a greater locus of control, allowed them to self-govern, easily collaborate, and they were able to continue working beyond the schedule of the semester (Dalsgaard, 2006). Levy (2007) found that locus of control was not a significant factor for staying enrolled in a course. Another study compared institutions' use of learning management systems to the university library. The library no longer holds every single piece of useful information, but it is a centralized component to connect users to resources (Downes, 2004). As far back as 2004 a study discussed the emergence of the "net generation" as a new population of students that were much more technologically sophisticated to find meaning or relevance in a largely text-based, asynchronous, LMS (Dede, 2004). Students were very aware that there were technologies that allowed them to connect and communicate beyond the LMS, and they were increasingly expecting those technologies to be a part of their entire educational experience in and beyond the classroom (Scialdone, 2014). Most of the research on learning management systems was

concerned with adoption, with very little emphasis on how the technology affected pedagogy (McGill & Klobas, 2009).

While there were more examples of how learning management systems may be a hindrance to learning and interacting, the literature also provided many examples that supported the use of such systems. One study showed a prediction that the amount of perceived learning and course satisfaction was explained by student interaction with the LMS (B. Arbaugh & Benbunan-Fich, 2007). The number of times that a student even logged into the system could be used to predict course grades (Kupczynski, Gibson, Ice, Richardson, & Challoo, 2011). Analyzing log data may have provided a richer understanding of students' perceptions of presence and even their satisfaction and interaction, but that information was not collected for this research. Using an LMS to do things such as use recorded audio feedback led to positive aspects of learning and application of content (Ice, Curtis, Phillips, & Wells, 2007). A 2013 study (Rubin, Fernandes, & Avgerinou) found that the overall ease of use of the LMS had no significant effect on cognitive or social presence. That study also found that students that read everything in their LMS reported a significant difference in sensing cognitive presence, because they were deeply engaged with course concepts required to progress through four stages of knowledge construction. A surprising finding suggested that the ease of use of the LMS did nothing to enhance cognitive or social presence and had a significant negative effect on teaching presence (Rubin, Fernandes, & Avgerinou, 2013). Other findings listed disadvantages of using an LMS, as being constrained to very basic learning activities such as document sharing, discussions that are largely text-based and not in real time, and quizzes (Lane, 2008). Tools missing from the LMS are the informal interactions, the stories, jokes, and casual discussions that may or may not be related directly to the course topic (Dunlap & Lowenthal, 2009). In an

LMS many instructors are all business, their contact with students condensed down to just the necessary information, so there could have been a loss of who everyone was as a person, what they did over the weekend, or what their interests were outside of class (Kuh, 1995). A 2015 study found that students preferred Facebook as a LMS over the university offering because it made communication with the instructor and classmates easy, increased their interest, and made them more active in the course (Albayrak & Yildirim, 2015). Increases in the time spent on social media, the collaborative nature of the systems, the overall social environment, and the interface has made a robust learning opportunity using social media to develop social presence (Biocca, Harms, & Burgoon, 2003). In conclusion, the literature on the effectiveness of using a learning management system to develop a community of inquiry was split. There were methods that have shown to be reliable in building community and presence, but there was also evidence that tools existed beyond the LMS that were capable, perhaps better than the LMS, at building a community in an asynchronous online course.

Community of Inquiry

The seminal research of Randy Garrison, Terry Archer, and Walter Anderson's (2000) CoI model was developed to create successful computer-mediated communications in a higher education setting. As of March 2017, a search on Google Scholar for "Critical inquiry in a text-based environment: computer conferencing in higher education" showed that the article had been cited 3,738 times. The first article was followed by three additional works describing methods for measuring the three types of presence that the CoI model addressed (Anderson et al., 2001; Garrison et al., 2001; Rourke, Anderson, Garrison, & Archer, 1999). Garrison's 2003 book titled *E-Learning in the 21st Century* had been cited 3,284 times, according to Google Scholar as of March, 2017. The 2003 book was updated to a newer edition in 2011, but the core concepts that

made the CoI model theoretically and practically applicable remained as the cornerstone of an effective model for designing online learning experiences. The model was built upon constructivism and philosophical perspectives from Dewey (1959) and Piaget (1973) to support learners being a part of the learning experience by contributing to the perception of presence. The CoI framework through years of contributions and critical reviews has emerged to be a useful foundation for educators focused on higher learning processes. The theory focused on the process of creating a deep and meaningful learning experience through the interdependent elements of teaching, social, and cognitive presence (Akyol, 2012; Akyol & Garrison, 2008). A study originally written in French in 2010 touted the CoI framework as the most advanced e-learning model to date (Jézégou, 2012). This study did not propose to determine if the CoI model is a good model or not, it was instead, an investigation of how the framework related to satisfaction and interaction in the Learning Technologies 2010 course at a research based university located in the Southeastern United States. Implementation of practices aligning with principles and theories of the CoI framework for asynchronous online courses have been significantly associated with higher levels of perceived learning (Rovai, 2002a; Shea, 2006; Shea, Sau Li, & Pickett, 2006, Kim, Kim, Khera, & Getman, 2014). The framework was useful in this study to measure students' perceptions of the three types of presence from the CoI model.

The CoI theoretical framework, was built upon collaborative constructivism, which relied on three interdependent elements of teaching, social, and cognitive presence. The diagram shown in Figure 4 (Garrison et al., 2000) graphically illustrates how the three types of presence work together to help achieve desired outcomes in learning, which included setting a climate conducive to learning, supporting civil discourse amongst learners, allowing students to develop new thoughts to challenge or influence attitudes, knowledge, or beliefs that they previously held,

and the ability to select content. While interaction was a significant contributor to making a desirable educational experience, Garrison and Cleveland-Innes stated that "interaction is not enough" (Garrison & Cleveland-Innes, 2005; Randrianasolo, 2013). Learners needed more than just interacting to foster a positive educational experience, there needed to be guidance from the design of the course, directly from the instructor, and there must be regulations to create a safe place to interact. To carry out all the tasks the facilitator made use of applications, a communication medium, such as the learning management system or social applications, set within an educational context, which followed standards and instructional design best practices. With the three types of presence working together to create the aforesaid other positive outcomes the goal was to create a high-quality educational experience (Garrison, Anderson, & Archer, 2000).

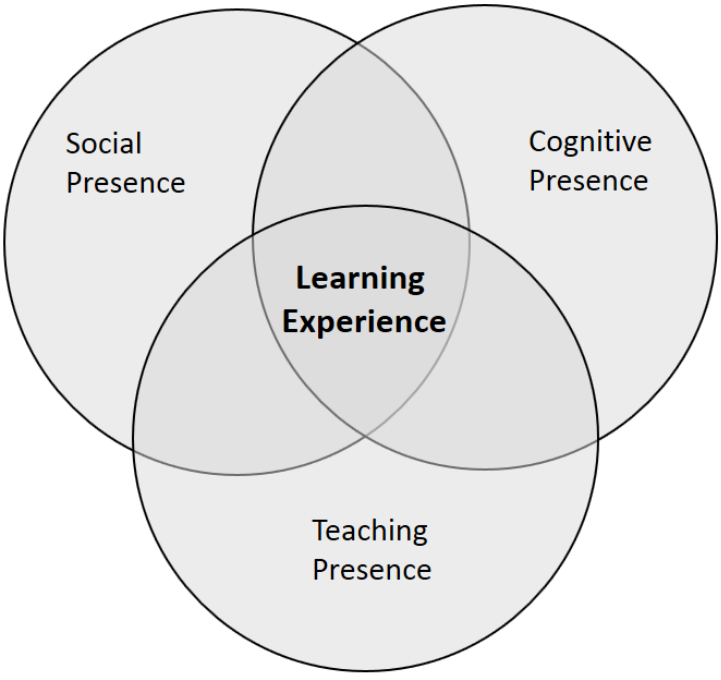

Figure 4. Community of Inquiry theoretical framework.
Adapted from "Critical Inquiry in a Text-based Environment: Computer Conferencing in Higher Education," by Garrison, R., Anderson, T., & Archer, W., 2000, *The Internet and Higher Education, 2*(2–3), 87-105.

A more detailed look at how the CoI model has been used is shown in the concept map in Figure 5. Schie's (2008) concept map gave examples of activities and actions that were used to develop the educational experience described in the CoI model. The concept map was not directly used in the development of the LT 2010 course, but the majority of the elements of instructional design practices coincided. The diagram was included in this manuscript to provide a theoretical perspective as well as a practical application of the theoretical model.

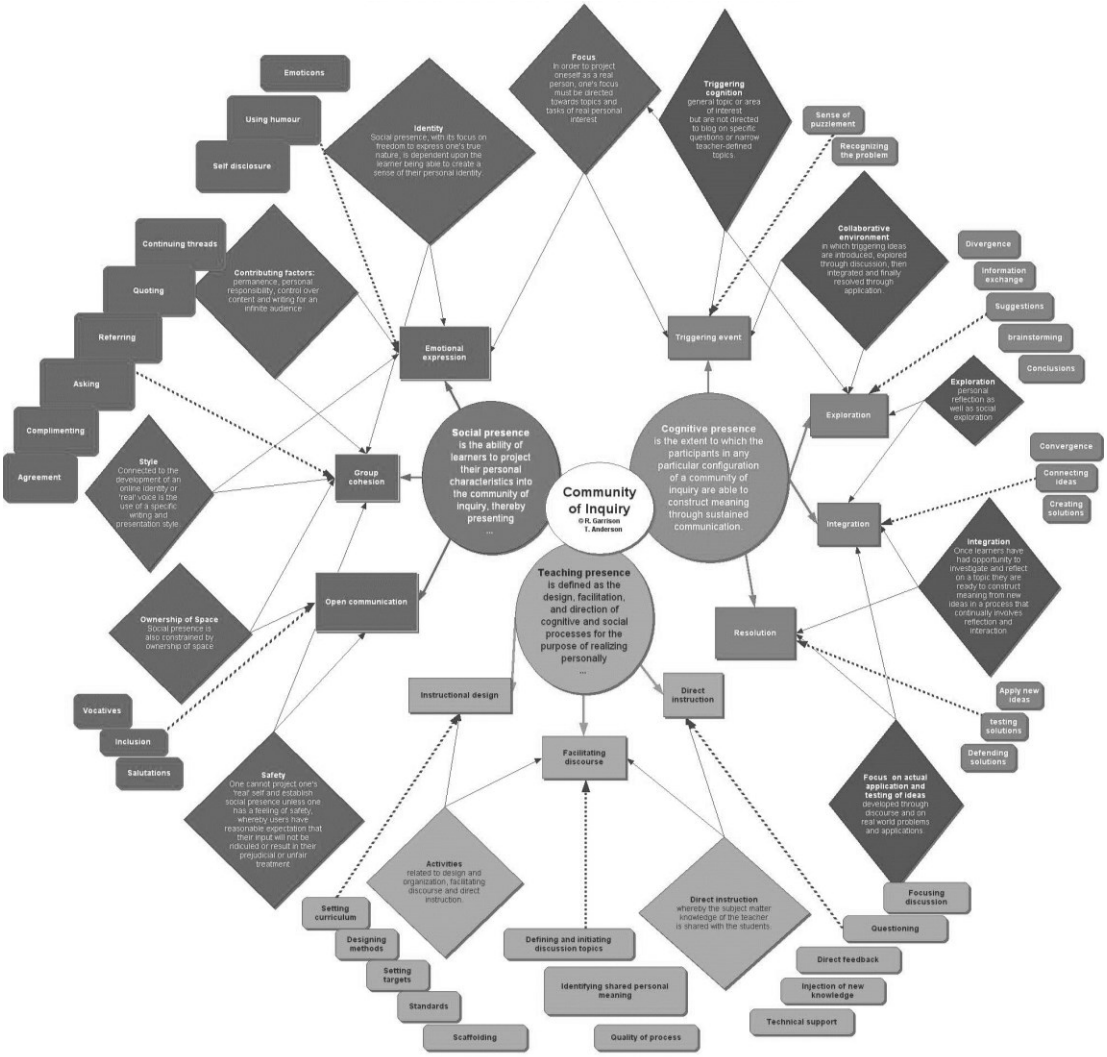

Figure 5. Community of Inquiry concept map
Reprinted from *The Community of Inquiry*, by J. Schie. 2008. Retrieved from http://cde.athabascau.ca/coi_site/documents/concept-map.pdf.

In using the CoI model, the literature that intended to focus on one of the three types of presence, often ended up describing the other types as well. An article focused on teaching presence described awareness of emotional and motivational aspects in addition to cognitive awareness as the key to develop teaching presence. The fact that cognitive presence was required by the instructor to purposefully develop teaching presence showed strengths of the CoI framework by demonstrating that all components were important. The potential weakness exposed was that it can be difficult to parse out which activities or actions led to specific types of presence (Immordino-Yang & Damasio, 2007). The three presence variables were interdependent, and in the results of this study the good fitting models demonstrated that interdependence with two equally well fitting model, but not being able to rule out one model over the other. To increase the usability and application of the CoI method, the researchers specified a CoI Coding template to list categories and indicators of each type of presence shown in Table 1.

Table 1. Community of Inquiry Coding Template

Elements	Categories	Indicators (examples only)
Cognitive Presence	Triggering Event	Sense of puzzlement
	Exploration	Information exchange
	Integration	Connecting ideas
	Resolution	Apply new ideas
Social Presence	Emotional Expression	Emotions
	Open Communication	Risk-free expression
	Group Cohesion	Encouraging collaboration
Teaching Presence	Instructional Management	Defining and initiating discussion topics
	Building Understanding	Sharing personal meaning
	Direct Instruction	Focusing discussion

Note. Adapted from "Critical inquiry in a text-based environment: Computer conferencing in higher education." by R. Garrison, T. Anderson, & W. Archer, 2000, *The Internet and Higher Education, 2(2-3)*, p 4.

Creating a community within online courses has been viewed as essential to support the collaborative learning and civil discourse that was associated with higher levels of learning. Thompson & MacDonald (2005) and Rovai (2002a), as cited in (Garrison, 2007) agreed that a sense of community helped to mitigate the potential for online learners to feel disconnected and that the perception of community could be created in an online environment. Delivering content to students was one important component of teaching, but educators needed to go beyond simply supplying content, by getting to know the learners in their courses. The instructor should know who they were intellectually, who they were as actual people, and what their needs were (Edmundson, 2012). Creating a community and understanding who the learners in a course were, has been imperative to learning, as Coolio (1995) explained: "They say I gotta learn, but nobody's here to teach me. If they can't understand it, how can they reach me? I guess they can't, I guess they won't." Failure to create a sense that there were actual people sharing the educational experience, understanding needs, and prior experiences, can affect the learning experiences, which could have an impact on satisfaction, and levels of engagement.

Teaching Presence

Teaching presence has been defined as "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001). Many articles focused on teaching presence as being required for successful online learning (Blignaut & Trollip, 2003; Dixson, Kuhlhorst, & Reiff, 2006; Finegold & Cooke, 2006; Garrison & Cleveland-Innes, 2005; Kanuka & Anderson, 2007; Meyer, 2004; Murphy, 2004; Shea, 2009; Vaughan, 2004; Xin & Feenberg, 2007). This type of presence is established in both the design of the course and through the facilitation of learning activities (Scialdone, 2014). Teaching presence was developed by and

perceived by other students within other courses when they interacted and learned from one another (Garrison, 2011). Teaching presence has been found to be a significant determinant for student course satisfaction, perceived learning, and perception of a sense of community (Garrison & Arbaugh, 2007). Goal-directed instruction through teaching presence supported a sense of connectedness and promoted active learning (Shea et al., 2006). In a recent publication, the thing that students in online degree programs listed as the biggest problem with their educational experience was missing or disengaged professors. Students that experienced this problem wondered where their professor was, felt that learning was impersonal, isolated, and non-interactive. The fifth item listed in that same article, which fell within the purview of the instructor or instructional designers assisting the professor, was poor online course design. Technology was not the issue; it was the institution's willingness to spend the time, money, and skill to create a well-designed experience (Phillips, 2016). Teacher immediacy behaviors and learning outcomes have been well researched in the face-to-face environment (Christophel, 1990; Gorham, 1988; Madden & Carli, 1981; Powers & Rossman, 1985). Immediacy behaviors include verbal actions such as giving praise, feedback, soliciting opinions from students, and non-verbal interactions such as eye contact, facial expressions, and gestures. To truly develop teaching presence, the instructor had to do more than just be present, he or she had to actually interact, provide feedback, and be engaged with the learners (Chickering & Gamson, 1987; Merchant, Goetz, Cifuentes, Keeney, Kennicutt, & Davis, 2014). The literature has shown that developing teacher immediacy helped to lessen the psychological distance between instructors and students that was positively correlated with greater learning (Christophel, 1990; Gorham, 1988; Kelley & Gorham, 1988; Rodríguez, Plax, & Kearney, 1996). The original CoI model conceptualized by Garrison et al. (2000) included practical actions, similar to teacher immediacy

behaviors, that instructors could objectively measure or complete such as: stating topics and goals, clearly explaining due dates for assessments, engaging learners in dialog, providing timely feed-back to students, and providing intellectual focus by supporting open and purposeful communication. Teaching presence and the pedagogical skills needed to design and facilitate have been proven to be important for student success (Croxton, 2014).

Bennett (2010) stated that teaching presence in the face-to-face sense was challenged as being unquantifiable and a nebulous, subjective characteristic in the mind of the perceiver. Multiple other studies refute Bennett, and suggested that teaching presence in the face-to-face environment included things such as the environment, behaviors, beliefs, identity, and the mission (Meijer, Korthagen, & Vasalos, 2009). A study about actualizing core strengths for new teachers, reported that one of the participants described the importance of developing presence in the following manner: "This sense of being-while-teaching was what I felt to be the most crucial aspect of my process of becoming a teacher" (Adams et al., 2013). Since the pioneer era of North America, teaching presence was developed by the instructor by first designing the educational experience, then they served as a facilitator and co-creator of the environment conducive to learning, and they served as an expert in the subject, which allowed them to scaffold learning (Anderson et al., 2001). As the definition of how to establish presence in a face-to-face environment became clearer, it was possible to translate similar type of behaviors and structure to the world of online teaching. Teaching online required that the environment was designed for learners to learn in. Instead of designing a classroom with bright posters on the wall and enough seats to see the whiteboard, the online educator made use of a learning management systems that students were able access to using an Internet connection. Once students were securely and safely in the learning management system, the educator had much more work to

create a conducive learning environment. The instructor used instructional strategies to make the class navigable, useable, and have the resources for learners to accomplish the goals of the course. The design of the educational experience should have included well-designed activities that met the goals of the course. Appropriate technology should be employed to allow learners to efficiently complete learning, course, and program objectives. To establish presence, the instructor needed to create a community that established behaviors that were appropriate for the course. Students needed to feel a similar set of freedoms and boundaries that an educator set in a face-to-face environment when establishing teaching presence (Beldarrain, 2006).

While developing teaching presence the instructor must walk a careful line of asking learners to contribute and engage in civil discourse while keep dialog going in online discussions, but being vigilant to not end a conversation when someone weighs in as an absolute expert on the subject. Some online instructors described their online teaching as "having a completely different personality online, writing more stilted things, more formal things." Others described themselves as "more reserved online… more intellectual," and as "more precise" (Coppola, Hiltz, & Rotter, 2001). Anderson et al. (2001) described the roles of the professor shifting throughout a course. In one role, the job was to maintain control of the class to create and maintain the learning space, direct learning, and set due dates. In a different role, that same instructor attempted to rely less on being the sole authority, demonstrating dominance and submission, and instead sought additional cooperation from participants (Anderson et. al., 2001).

Teaching presence was an interesting construct because it was the one component in the CoI model that designers had the most direct control over. The other variables relied much more on the work and dedication of the students. Teaching presence has been traced back as the core component to establishing and maintaining social and cognitive presence (Garrison et al., 2009).

All the variables measured in this study were latent variables that were gleaned from the students' perceptions. Student perceptions of teaching presence were elicited through having teachers interact often and in many instances, deeply with each student. Not every interaction was deep, but there was still the perception that the instructor was there involved in the educational experience, both as designing the course, monitoring it, and providing guidance. Developing a sense of teaching presence required the time and skill to design the environment at the beginning, facilitate the experience throughout the semester, and provide exercises to demonstrate expertise in the subject. Critics of online learning have said that online education tended to be a monologue instead of a conversation and that there can never be the same immediacy that a teacher can provide in person. The critics went on to critique how even courses where there were video lectures, if they were filmed years ago, then it didn't matter who was watching the video, there was not going to be any sort of realness or interaction (Edmundson, 2012). With a demanding order from administration to take an existing face-to-face course and "put it online," instructors feel the pressure of making courses with skills or resources that they simply do not have (Boettcher, 2000). The results were poorly designed courses where instructors were spending much of their time working on uploading content, instead of interacting with learners and demonstrating that they were real people who were there to assist learners. One method of online course development that has shown promise of creating the perception of teaching presence was to assign reflective practice activities, or lead-in prompts where the learners got a sense of the instructor being present and "real" (Hall, 2013). Reflective practice activities were just one of many proven methods, but nearly every activity required additional work and time from the instructor, before and during the course. For teaching presence to be perceived by students, the teacher should share the educational experience, while also

leveraging the affordances of technology such as the learning management system and collaborative tools.

Kim et al. (2014) found that teaching presence had the highest level of satisfaction out of four variables from a revised CoI model that also included a fourth type of presence, called learner presence. Richardson and Swan (2003) reported a significant correlation between the involvement on instructors and course satisfaction. Other studies have found that the lack of feedback, which is a major component of teaching presence, from instructors contribute to dissatisfaction (Northrup, Lee, & Burgess, 2002). Teacher immediacy behaviors and learning outcomes have been well researched in the face-to-face environment (Christophel, 1990; Gorham, 1988; Madden & Carli, 1981; Powers & Rossman, 1985). Immediacy behaviors include verbal actions such as giving praise, feedback, soliciting opinions from students, and non-verbal interactions such as eye contact, facial expressions, and gestures. To truly develop teaching presence, the instructor had to do more than just be present, he or she had to actually interact, provide feedback, and be engaged with the learners (Chickering & Gamson, 1987; Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014). The literature has shown that developing teacher immediacy helped to lessen the psychological distance between instructors and students that was positively correlated with greater learning (Christophel, 1990; Gorham, 1988; Kelley & Gorham, 1988; Rodríguez, Plax, & Kearney, 1996). Grady (2013) compared small courses with a five-week enrollment versus a 16-week enrollment and found that satisfaction decreased in the compressed time frame. She also found that in large-scale online courses where she had 329 students, was less able to interact and be present for students, that satisfaction was significantly lower than when there 20 students that she could be there for (Grady, 2013). The original CoI model conceptualized by Garrison et al. (2000) included

practical actions, like teacher immediacy behaviors, that instructors could objectively measure or complete such as: stating topics and goals, clearly explaining due dates for assessments, engaging learners in dialog, providing timely feedback to students, and providing intellectual focus by supporting open and purposeful communication. Another researcher used a treatment of changing the student to faculty communication by adding things like a pre-course welcome letter, giving the students professional and personal information about the teacher, increased frequency in which she communicated, she showed more appreciation for students' work, and made a commitment to respond to every e-mail every day of the week (Grady, 2013). With the literature overwhelmingly supporting the notion that teaching presence positively affects students course satisfaction, the path was included for analysis in this study that examined an online asynchronous mastery type course.

While developing teaching presence the instructor must walk a careful line of asking learners to contribute and engage in civil discourse while keep dialog going in online discussions, but being vigilant to not end a conversation when someone weighs in as an absolute expert on the subject. In a paper that followed Garrison, Anderson, Archer's (2000) seminal work in which they developed the CoI model, they published *Critical thinking, cognitive presence, and computer conferencing in distance education.* In the 2001 study, they showed that there was a positive directional relationship that cognitive presence was created and supported in online classes with appropriate teaching and social presence (Garrison et al., 2001). Some online instructors described their online teaching as "having a completely different personality online, writing more stilted things, more formal things." Others described themselves as "more reserved online… more intellectual," and as "more precise" (Coppola, Hiltz, & Rotter, 2001). Anderson et al. (2001) described the roles of the professor shifting throughout a course. In one role, the job

was to maintain control of the class in an effort to create and maintain the learning space, direct learning, and set due dates. In a different role, that same instructor attempted to rely less on being the sole authority, demonstrating dominance and submission, and instead sought additional cooperation from participants (Anderson et al., 2001). Careful and purposeful implementation of the teacher engaging and directing students have been activities that which led to perceptions of cognitive presence (Swan et al., 2008). As the literature suggested that teaching presence positively affects cognitive presence, the path was measured in this study to determine if the design and facilitation of LT 2010 produced a positive relationship from teaching and social presence to cognitive presence.

Social Presence

Social presence was the most researched component of the three interdependent presence variables from the CoI model. Garrison et al. (2000) defined social presence as "the ability for learners to project their personal characteristics into the CoI, thereby presenting themselves as real people." The theory of social presence can be traced back to the book, *The Social Psychology of Telecommunications* (Short, Williams, & Christie, 1976). Their social psychology theory was based on intimacy and immediacy. Intimacy is how people establish relationships through communications, eye contact, facial and body cues, and the topics of conversation (Argyle & Dean, 1965). Some researchers argued with Short et al. (1976), and stated that social presence was subjective, and varied in perception from person to person (Gunawardena, 1995). Immediacy, which was also a major component of teaching presence, was described as the psychological distance that people put between themselves and others when communicating (Walther, 1992). Immediacy research suggested that face-to-face interactions were more immediate than using video, and video was more immediate than communication by phone

(Lowenthal, 2012; Mehrabian, 1972). Establishing intimacy and immediacy in an asynchronous online course takes additional work and finesse. As the technology used to create social presence in an online setting advanced, the definition and criteria in social presence has been redefined (Lowenthal, 2013; Tu & McIsaac, 2002). Social presence also has theoretical underpinnings of the social constructivist approach, which states that learning was considered a social and active process (Jonassen, 2000; Vygotsky, 1978). Social learning can be view in two different ways, that individual learning takes place within a social context (Bandura, 1977), or that learning is best achieved through social interactions between peers where attitudes, beliefs, and opinions have a high preponderance to change (Reed et al., 2010).

Research shows that social and teaching presence established through design, facilitation, and direction, has previously led to personally meaningful and educationally worthwhile learning outcomes (Anderson et al., 2001). When the CoI framework was initially developed the relationship between the three types of presence was described as interdependent (Garrison et al., 2000). The directionality was not a part of the original CoI model since it did not use SEM or path analysis, instead at the place that the three types of presence overlapped was were a deep and meaningful educational experience happened (Arbaugh et al., 2008). Additional development to understand how the interdependence or causal nature of the three types of presence led to other studies that theorized that not only at teaching, social, and cognitive presence interdependent, but that teaching presence is the core to establishing social and cognitive presence (Garrison et al., 2010; Kozan & Richardson, 2014; Shea & Bidjerano, 2009). Garrison et al. (2010) explained:

> The findings have provided insights into the dynamic relationships among the presences. Consistent with the framework and previous research, there is evidence that the three

> presences are interconnected and influence each other in the hypothesized manner. That is, it was shown through student perceptions that teaching presence directly influences the perception of social and cognitive presence. Perceptions of social presence also significantly predict perceptions of cognitive presence. Therefore, social presence must be seen as a mediating variable between teaching and cognitive presence. (p. 35)

In Akyol and Garrisons (2011) research they found that the systems were too complex in nature to develop clear directional paths, that a metacognition was a very important component of intelligence and higher learning. In the conclusions of multiple studies, the researchers stated that the relationship between cognitive presence and teaching and social presence was a complex interaction that needed to be better understood (Arbaugh et al., 2008; Boston et al., 2009). The relationship between the three types of presence were evaluated in this study as the clarified relationships between the variables has been explained in the literature. The literature is still developing to understand how the variables work together and one of the prominent researchers that developed the CoI framework (Garrison) has published studies indicating that the relationship is directional as well as subsequent work that stated that the relation was complex and it was not clear if the relationships were in fact directional. There is a need for additional analysis to review the paths hypothesized by scholars that have utilized CoI with SEM (Garrison et al., 2010; Kozan & Richardson, 2014; Shea & Bidjerano, 2009). Teaching presence was expected to have a direct relationship on cognitive presence as well as a mediated relationship through social presence to cognitive presence.

Examples in the concept map, as presented in Figure 5, include developing the perception of social presence with group cohesion by having learners ask each other questions, complement one another, and continue an online threaded discussion. The modern learning management

systems have easy-to-use tools that educators can make use of to facilitate these activities. The concept map of the CoI model suggests that a person cannot project one's "real" self and establish social presence unless they have a feeling of safety, just as a learner would have a reasonable expectation that the physical classroom was a safe place to share ideas (Stanney & Salvendy, 1998). With the class taking place inside the LMS, it should help develop a sense of safety from the whole world reading and responding to students sharing their beliefs and attitudes. Deeper learning has been found when students had a chance to interact, ask questions, explain their opinions, and reflect on their knowledge (Soller, 2001). Activities that allowed students to interact, especially in asynchronous online courses, allowed students to feel more of a part of the community or class. Technology allows students to communicate through advanced LMS such as Desire2Learn, Blackboard, Canvas, or Moodle, both asynchronously and synchronously when students in a group were available. These learning management systems have been typically university-controlled systems that were safe places for students to communicate openly. Using predictable systems gave instructors an oversight and ability to promote civil discourse to further cultivate the perception that there were other people sharing the experience and socially present (Woods & Baker, 2004). Students were given a safe place to share ideas. Online students were possibly even less likely to be affected by the physical seat that learners sat in, their socioeconomic status, or other characteristics that may have made interacting less approachable versus sitting in a room with a group of people whom may have been strangers.

In establishing teaching and social presence, the person interacting with the world through the medium that has been deemed appropriate makes many decisions, small and large, to create the portrayal that they wish to create. A prominent sociologist in the twentieth century,

Erving Goffman, described the process of creating and managing impressions as the dramaturgical theory. Goffman theorized that life was like theatre. Individuals have the opportunity to control or guide the impression that others have of them by changing or fixing their setting, appearance, and manner (Goffman, 1978). Users control how they are perceived, especially in an online course setting where they have control of what is shared to be interpreted by others. A study that focused on relationships of presences in virtual worlds found that learners could establish their 'sense of being' which subsequently led to co-presence. Co-presence was an extension of social presence, where it was conceptualized as 'being there' (Bulu, 2012). There are collaborative and reflective advantages that asynchronous online learning affords that has been shown to foster an environment where social and cognitive presence can be established, but the design and facilitation of the course must be focused on learning, not just a place to connect or put people in a chat room (Garrison, 2003a). Learning in groups tends to encourage students to gain deeper levels of learning by contributing to their own learning and gaining additional perspectives. Instead, in online learning, making social connections has been only limited by time and access to the sharing medium (Palloff & Pratt, 1999). Social presence was measured in this study using questions from the CoI survey and focused specifically on getting to know course participants, a sense of belonging, comfort interacting with other learners, and the ability to share points of view (Arbaugh et al., 2008). The path from social presence to cognitive presence was measured to determine how the perceptions of social presence affected students' sense of cognitive presences in the LT 2010 course.

Lowenthal (2012) examined three themes related to social presence which were; (a) social presence and student satisfaction (b) social presence and interaction, and (c) social presence and student learning. The original CoI framework identified emotional expression,

open communication, and group cohesion as the three main categories (Garrison et al., 2000). In each section the researcher provided an analysis of existing literature that conflicted each other. The literature was conflicted on how the perception of social presence related to course satisfaction. To account for the changing definition of social presence, Lowenthal produced a coding sheet for qualitative content analysis, as shown in Table 2, that not only provided the category and indicator, but also definitions, criteria, and examples. This table is a useful tool to design learning experiences.

Table 2. Coding sheet used for content analysis

Category & Indicator	**Definition (Swan)**	**Criteria**	**Examples**
Affective Responses Paralanguage (PL)	Features of text outside formal syntax used to convey emotion (i.e., emoticons, exaggerated punctuation or spelling)		Someday……; How awful for you □□; Mathcad is definitely NOT stand along software; Absolutely!!!!!
Emotion (EM	Use of descriptive words that indicate feelings (i.e., love, sad, hate, silly); conventional or unconventional expression of emotions	Refers directly to an emotion or an emoticon. Use of capitalization only if obviously intended	When I make a spelling mistake, I look and feel stupid; I get chills when I think of . . . I am scared; This is fun; Sorry this is such a lame email; Hope you are OK;
Humor (H)	Use of humor joking, teasing, cajoling, irony, sarcasm, understatement	Only code if a clear indication that this is meant to be funny, e.g., extra punctuation or an emoticon	God forbid leaving your house to go to the library; I'm useless at computers but will this make me a bad nurse??? Ha ; LOL
Self- Disclosure (SD	Sharing personal information, expressing vulnerability or feelings	An expression that may indicate an emotional state but does not directly refer to it; Uncertainty, non-comprehension	I sound like an old lady; I am a closet writer; We had a similar problem. I'm not quite sure how to . . .; This is strange; I don't understand how; I don't' know what that means; As

			usual I am uncertain; It's all too much. ..
Interactive Responses Acknowledgement (AK)	Referring directly to the contents of others' messages; quoting from others' messages agreement; Reference to others' posts	Explicit or implicit recognition that another message has been the motivation for this message	Those 'old machines' sure were something; we won by a landslide So what you're saying is . . .; I thought that too . . . For me the question meant .
Agreement / Disagreement (AG)	Expressing agreement or disagreement with others' messages	Expressing agreement with each other or contents of messages	I'm with you on that; I agree; I think what you are saying is right. I think that would be a good plan; I think your suggestion is good
Invitation (I)	Asking questions or otherwise inviting response. Students ask questions of each other or moderator		Any suggestions? Would you describe that for me, I am unfamiliar with the term. Does anybody know ?
Expressing Appreciation (EA)	Showing appreciation of each other	Showing appreciation or approval of each other or contents of messages or complimenting	You make a good point; Right on; Good luck as you continue to learn; I like your briefing paper . . .; It was really good;
Cohesive Responses Greetings & Salutations / Phatics (GS)	Greetings, closures. Communication that serves a purely social function		Hi Mary; That's it for now, Tom Hi; Hey; Bye for now;
Vocatives	Addressing or referring to classmates by name		You know, Tamara, . ..; I totally agree with you Katherine Sally said that .
Group Reference / inclusivity (GR)	Referring to the group as 'we', 'us', 'our'. Addresses the group as a possessed or as a whole	Any reference to the group with a possessive pronoun	We need to be educated; Our use of the Internet may not be free. We need some ground rules;
Embracing the Group (EG)	Revealing life outside the group that is not emotional or expressing vulnerability or feelings. Also that isn't related to the course	Any expression that lets the group know about the circumstance of the author	The task asks us to . . .The kids are asleep now; I'm a physiotherapist; It's raining again; It's 4am—I'm off to bed;

Note. Adapted from "Social presence: What is it? how do we measure it?" by P. Lowenthal, 2012, *Doctoral dissertation, University of Colorado Denver*, p 74.

Social presence includes students being involved in many aspects of the learning experience. Garrison et al. (2000) reported that in computer conferencing classes there needed to be higher levels of student-student and student-teacher interaction compared to what was needed in a classroom. Astin's Theory of Involvement (1984) stated that students learn more when they were involved academically and socially in the education. Involvement was defined as "the amount of physical and psychological energy that the student devotes to the academic experience" (Astin, 1984). Creating social presence in computer-based courses in 1999 was far more difficult than it was in 2016 with the proliferation of collaborative technologies. It was possible that collaborative technologies and other tools had the potential to enhance online learning but, that did not mean that designers and instructors were implementing them where and how they should have been used. There are many online classes that do not properly use of tools to create the best learning experience for students. An investigative article found that over $10 billion is spent on technology each year in the U.S. and most of it adds no benefit to learning outcomes (O'Connell, 2015). It is up to the teacher, designer, and institution to support the use of appropriate methods and tools. Social presence allows learners to project their personal characteristics into the community of the online course, thereby conveying that each person in the class is a real and present person. Being perceived as a real person positively increased levels of social presence and interaction (Garrison et al., 2000). The perception of social presence can be influenced by the technology that makes reading or viewing all posts from fellow students and instructor a significant factor. The affordance of technology to interact affects the perception of social presence (Rubin, Fernandes, & Avgerinou, 2013). When the LMS does not allow easy communication, students reported feeling lost in the multi-threaded discussions, while trying to determine who was talking about what. Too many topics and too

many messages made some students motivated to withdraw or just observe the conversation amongst other people (Tu & McIsaac, 2002). In a more recent study (2014) students reported that online discussions strategies needed improvement to allow them to engage in collaborative activities (Kim et al., 2014). The interaction should be meaningful to be worthwhile in an online course. This study set out to explore how social presence affected interaction.

The literature on perceived social presence and the influence or relationship with learner satisfaction has been mixed. One study examined variables of which items in an online course led to higher levels of satisfaction, and they reported that the degree, to which other learners were perceived as a "real person" was a significant positive predictor of satisfaction (Gunawardena & Zittle, 1997). Another study (Akyol & Garrison, 2011) concluded that social and cognitive presence were important, but social presence was seen by some participants as "irrelevant in this kind of learning environment" and other responders indicated that "I am not there to create a network or to meet other people; [I am here]to get something very specific done." Joo et al., (2011) using SEM and the CoI framework found social presence not to be a significant factor for satisfaction. Several other studies indicated that social presence was significantly positively related to satisfaction (Bulu, 2012; Cobb, 2011; Gunawardena & Zittle, 1997; Richardson & Swan, 2003; Walther, 1992). Trust has also been a barrier to developing social presence in an online class where learners do not know each other (Tu & McIsaac, 2002). A 2004 study concluded that students recognized that social presence was there, but they did not learn more or feel any more satisfied. The same study also proposed better activities than using discussions, calling students by name, humor and instead focus on activities that will intrinsically motivate students to interact (Wise, Chang, Duffy, & Del Valle, 2004). In a study of graduate health sciences students, So and Brush (2007) expected that social presence would have a

positive correlation with course satisfaction, but their hypothesis was rejected. With such a large amount of conflicting literature related to the perceptions of social presence and course satisfaction, this study simply set out to measure the relationship with no expectation if it would be positive, negative, or not significant.

Cognitive Presence

Cognitive presence was described as the extent to which the participants in any particular configuration of a CoI were able to construct meaning through sustained communication (Garrison et al., 2001). Cognitive presence can be formed through practical inquiry, critical thinking, and community building. The concept of cognitive presence is rooted in educational psychology, where the emphasis was more on what was happening inside a person's brain, rather than on controlling his or her external behaviors (Dewey, 1916; Piaget, 1973). In the LT 2010 course, students were exposed to several concepts that aligned with Dewey's philosophy of pragmatism which was initially developed by Peirce. The course was designed so that learners gained an understanding of information literacy skills, not just by reading or listening to someone describe them, but by actually using the and applying the skills (Dewey, 1916; Dewey 1938). Learners were a part of the learning experience where they had to perform actions to create outcomes. Dewey was a proponent of the social aspect of learning, which further implicates social presence as an interdependent variable in this study (Dewey, 1916). The goal of education using Dewey's vision of was not to simply disseminate information, but to gain wisdom by using information to apply to problems and challenges (Dewey & Bentley, 1949; Scialdone, 2014). Cognitive presence can be established in online learning environments using constructivism, where students are able to take their existing view of the world and prior experiences and apply them to the learning situation (Piaget, 1973). The course provides

structured exercises, but the freedom for participants to share what is in their minds. They had the freedom to construct knowledge not only from the course text, but also by integrating experiences from each other. The CoI framework defined learning using a collaborative constructivist philosophy. Development of cognitive presence enabled students to move beyond surface learning, into deeper stages of learning where they connected ideas, thought beyond the prescribed exercise, and applied knowledge to their personal lives (Garrison et al., 2001). Garrison and Vaugh (2008) described that inquiry occurred in four phases; triggering event, exploration, integration, and resolution. The trigger was something that would intrigue the student, then exploration would motivate the student to explore, discuss, or ask questions. Integration occurred when students constructed their own knowledge or shared ideas, and when the new skill or knowledge was applied somewhere or students were able to draw conclusions and demonstrate their understanding, that was the resolution phase (Garrison & Vaugh, 2008).

As the CoI model has continued to develop since its inception in 2000, an important study in 2009, using SEM, revealed the nature of interdependence amongst the three variables of teaching, social, and cognitive presence. Social presence and teaching presence have been shown to be large contributing factors to creating cognitive presence. The study revealed that teaching and social presence combined accounted for 70% of the variation in students' perceptions of cognitive presence, as shown in Figure 6.

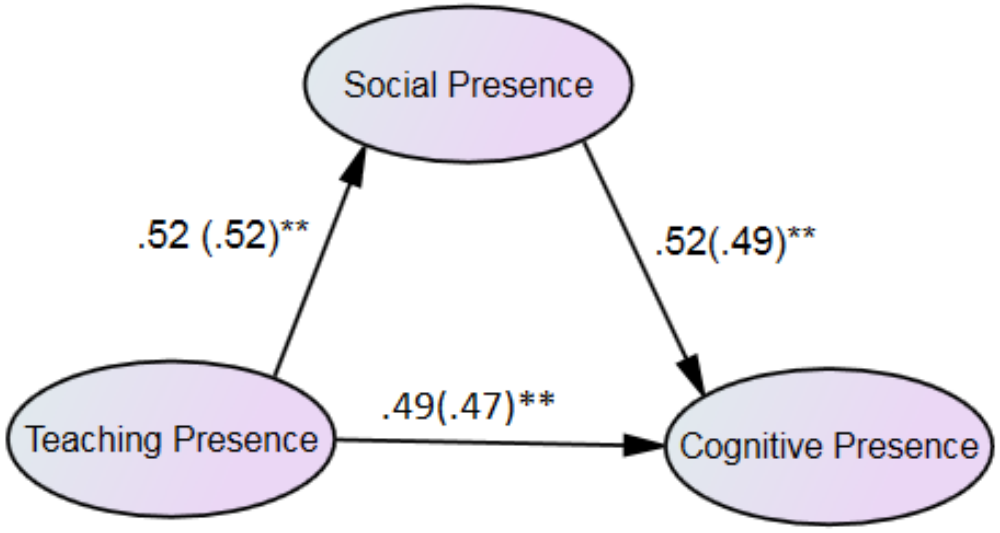

Figure 6. Influence of teaching and social presence on cognitive presence. Adapted from "Community of inquiry as a theoretical framework to foster 'epistemic engagement' and 'cognitive presence' in online education" by P. Shea & T. Bidjerano, 2009, *Computers & Education,* 52(3) p. 548.

It is suggested that cognitive presence (i.e., critical, practical inquiry) can be created and supported in a computer conference environment with appropriate teaching and social presence (Garrison et al., 2001). Educators can lead learners to guide their own learning by asking leading questions, having students converse to construct their own knowledge, and having students report examples of how their course knowledge can be useful in their professional and personal lives. Abraham (2013) reported that when learners were equipped to use technology, have optimism, or feel that they were able to be innovative, the perception of cognitive presence was more likely to be present. However items that were expected to have a negative influence, such as discomfort with technology, or insecurity, were not found to be a significant deterrence of cognitive presence in online courses (Abraham, 2013). In another study using a simple regression analysis, the relationship between perceived cognitive presence and satisfaction was r = .065 in an online course (Akyol & Garrison, 2011). Satisfaction or motivation was often the reason why instructors employed certain instructional technology or teaching strategies. Some

cognitive theories have been based on the idea that academic learning was mostly a cognitive activity and a student's motivation was heavily influenced by what they perceived as important and what they believed they could accomplish (McMillan & Forsyth, 1991). Engaging learners cognitively requires activities that are intriguing to learners, applicable to their current status, or something that challenges previously held thoughts and opinions (Sitzmann, 2011).

Interaction

In online courses that used methods and tools to develop social and teaching presence the instructor has been able to transcend the role of being a lecturer to also become a facilitator. As an instructor and facilitator, students' participation was enhanced, which allowed them to be active learners (Harasim, Hiltz, Teles, & Turoff, 1995; Simonson, Smaldino, Albright, & Zvacek, 2000). Chickering and Gamson (1987) found that working with others increased involvement in learning, sharpened thinking, and deepened understanding. The LT 2010 course that was studied in this analysis lasted approximately seven weeks. Walther (1992) reported that established prior interaction influenced how people communicated online as well as their use of emoticons (Tu & McIsaac, 2002; Walther, 1992). The length of the course in this study could have created an effect on students' perception of interaction. In this study interaction was measured using items from the previously validated survey instrument *Distance Education Learning Environments Survey* to discover the extent that students agreed that they worked with others, related, shared ideas and information, collaborated, and worked in groups (Walker & Fraser, 2005).

The original survey used a scale with five items, but the modified instrument for this study used an 8-point Likert scale. The justification for using a modified scale included consistency with the rest of the survey, a larger scale could have allowed the researcher to

uncover additional nuances between neutral, versus barely agreeing or disagreeing. The data could be analyzed as continuous instead of categorical.

Since distance education did not offer face-to-face instruction as the traditional classroom does, many researchers focused on the study of interaction in distance education (Comeaux, 1995; Eastmond & Lawrence, 1998; McDonald & Gibson, 1998; McHenry & Bozik, 1995). Comeaux (1995) stated that interactions in the online classroom should be conducive to interpersonal communications and able to use humor to bridge the psychological distance. Three meta-analyses found that the effects of interaction or collaboration was mixed and sometimes not clear on students' perceived level of collaboration (Lee, 1999; Merchant et al., 2014; Sitzmann, 201; Vogel, 2006). When collaboration was perceived, it was at times, difficult to gauge the level or richness of interaction. Interaction was an important component of learning, but measuring the perception of interaction has proven difficult in some studies. An international study examining the effects of using the CoI model to redesign an English composition course for English as a second language students found that interaction was just as important as any of the content (Randrianasolo, 2013).

As online learning continues to evolve and instructors continue to find the improved methods to engage learners, there have been paradigm shifts to move towards collaborative technologies that encourage and even force interaction among the community of learners. In 2004 Dziuban, Shea, and Arbaugh wrote an article about the changing role of faculty for online education, and explained that interaction with and between students was a major component of being a good online professor. Online interactive discussions have shown to be the most influential feature of online courses for establishing interaction (Swan et al., 2000). Yet, another study found that the online discussions specifically were pointed out as needing major

improvement to engage in collaboration (Kim et al., 2014). A 2014 study investigated the effects of game-based instruction on student collaboration, revealed that, initially games created a higher level of interaction amongst learners, but the positive impact showed a significant decline as the game was used in repeated treatments. The diminishing return indicates that game-based learning was one of many tools that can boost interaction, but was less likely to sustain the initial novelty (Merchant et al., 2014). Another study found that online discussions were superior since they allowed learners time to think and reflect before responding right away as it would be done in a face-to-face course (Hiltz, 1994). Similarly, Chickering and Gamson (1987) stated that learning was not a spectator sport; rather students needed to interact, write about, relate to past experiences, and apply concepts to their daily lives. Shea (2006) listed three related changes which included a philosophical shift from objectivism to more constructivism-based teaching, a theoretical change from behaviorism to socio-cognitive interpretations of education, and more teachers moving beyond direct instruction to include more facilitation of collaborative learning. In online learning environments with lower levels of structure for the learners and more interactions, social presence and satisfaction have been positively affected (Horzum, 2015).

The presence of interaction was not a given when learners decided that they wished to complete a course or an entire program online. Garrison and Cleveland-Innes (2005) point out that interaction alone did not guarantee that learners were cognitively engaged in an educationally meaningful manner. Interaction could mean group cohesion, but that was not enough to change learning outcomes or create significant changes in cognitive development (Garrison & Cleveland-Innes, 2005). Some learners and educators believed that an asynchronous online course should allow learners all the conveniences of working in a silo regardless of the rest of the world. Without interacting with the instructor or peers, was it an educational

experience, or was the person just consuming what was published? Without interaction, the learner may as well have been sitting alone reading a book or a webpage. Online asynchronous courses should include interaction, feedback, ability to gain new perspectives, and participate in civil discourse. Moore's transactional distance theory was derived from Dewey, to say that there was "a psychological and communication space to be crossed, a space of potential misunderstanding between the inputs of instructor and those of the learner" (Dewey, 1959; Dewey & Bentley, 1949; M. G. Moore, 1993). Moore said that without interaction, there was an increased likelihood of feeling isolated, separated not only by the physical distance of being in an online course, but also isolated in the way that interaction online can come off as not being there or perceived as superficial. Moore went on to recommend that when designing online or distance education, teachers must consider the structure and dialog. Structure is the flexibility or rigidity of the instructional methods and strategies employed in the course. In Moore's theory dialog is the interaction between the instructor and the learner. Findings in another study suggested that the online classroom design needed to be conducive to the interpersonal dimensions of communication to bridge not only the physical distance, but also the psychological distance (Comeaux, 1995). This study includes dialog as interaction between any of the people in the course, which would include students and the instructor. The shared dialog and interpersonal dynamics have shown to foster a sense of interaction (McDonald & Gibson, 1998). Woods and Baker's (2004) study proposed that the learner was in the center of interaction. Their model, like this study, did include interaction from the instructor by being present, or instructor immediacy as well as mentoring. The authors described immediacy as "a benefit of interactive learner-instructor communication, since active ongoing communication is likely to result in an increased feeling of psychological closeness between the learner and instructor." The model also

included creating cohesiveness and community amongst the learners, just as the LT 2010 course in this study set out to do (Woods & Baker, 2004).

Student Course Satisfaction

Student satisfaction has been cited as one of the most important desirable outcomes in many studies examining online learning (Allen & Seaman, 2014; DeLone & McLean, 1992; Garrison & Cleveland-Innes, 2005; Sun, Tsai, Finger, Chen, & Yeh, 2008). Horzum (2015) defined student satisfaction as the "fulfillment and pleasure level of the students about different aspects of learning service which they received in an online learning program." Student's satisfaction in a course has shown to be a major factor in persisting in their program of study (Herbert, 2006; Levy, 2007). Research showed that educational institutions have been facing similar problems that consumer-oriented businesses faced, such as dealing with the impact of advanced technology, shifting consumer demand, and a larger population of people wanting to pursue their education online (Shaw, 2014). Institutions and professors who understand what leads to satisfaction have had a better chance of achieving their objectives (Kara, Spillan, & DeShields, 2004).

In this study, satisfaction was measured using four questions from the Noel-Levitz Priorities Survey for Online Learners (PSOL) (Noel-Levitz, 2014). Satisfaction was the students' perception of satisfaction; it was not a physically measurable quantity. The questions were measured using an 8-point Likert scale, with 8 being strongly agree. The questions explored students' satisfaction with faculty's responsiveness, the quality of online instruction, and the satisfactoriness of the interactions in the course. Another study using questions from the same PSOL survey found that teacher interaction to be a significant predictor of students perceiving satisfaction (Herbert, 2006). Herzberg (1968) conducted extensive research on

satisfaction and came to the conclusion that; the opposite of satisfaction was not dissatisfaction, but instead no satisfaction. The same went for dissatisfaction, the opposite was no dissatisfaction. Ways to enhance satisfaction included providing opportunities for achievement, recognizing contributions, creating work that was rewarding, matched the skills and abilities of the person, and provided ways for people to succeed (Herzberg, Mausner, & Snyderman, 2011).

Research has shown that a student perceiving social presence increased student-reported course satisfaction as well as student perceptions of learning (Joo et al., 2011; A. Moore, Masterson, Christophel, & Shea, 1996; Schutt, Allen, & Laumakis, 2009). Learner satisfaction was significantly influenced by the structure the online class, transparency, and communication from the teacher (Eastmond, 1995; Romiszowski & Chang, 1992; Swan, 2001). The CoI model has shown the following individual relationships; cognitive presence was significantly positively related to satisfaction, and separately social presence has been positively related to satisfaction (Akyol & Garrison, 2008). It is evident that satisfaction was positively related with the three interdependent variables in the CoI model, but very few previous studies had examined presence and satisfaction as a system involving multiple variables at once with a complex statistical method such as SEM. One study that examined the CoI model and online learner satisfaction using individual regression analyses found that teaching presence had the largest predictive effect on satisfaction (Rubin, Fernandes, & Avgerinou, 2013). Student satisfaction was chosen as the variable of interest for this study, without focusing on achieved levels of learning, since this was a mastery-type course and learners varied according to where they begin the course. Furthermore, it was beyond the scope of this study to gauge learning gains. Research was too contradictory to state unequivocally if satisfaction can be a good indicator of learning (Benner, Sutphen, Leonard, & Day, 2009; Missildine, Fountain, Summers, & Gosselin, 2013).

Teaching online posed a greater challenge to developing a sense of immediacy or presence, especially when the course was using reusable content and there was little interaction amongst members of the class. Research from 1995 and 1998 focused on the technological problem of being able to use "full motion video for the Internet" and found other methods to create immediacy such as using humor, encouraging discussion, providing feedback, and addressing students by name (J.B. Arbaugh, 2001; Comeaux, 1995; Freitas, Myers, & Avtgis, 1998; Gorham, 1988). For the most part we have moved beyond the technological challenge of being able to deliver videos to learners; now the concern is the content and the pedagogical worth of the multimedia. Successful designers have shifted their focus, not to figuring out how to share a video, but to following sound practices like including content that was related to what the students' learning objectives or course outcomes were, using sequencing to help learners make sense of the systems that they were working in, and using chunking to keep users' attention and allow for review (Tempelman-Kluit, 2006). Chunking meant breaking a large lesson into small pieces, which allowed learners to quickly revisit the portions they needed to review, hold attention through a series of small lessons, and made the material seem easier to handle for many people (Sigafoos et al., 2007). Research suggests that people have short attention spans when it comes to online video, for most types of video. Shown in Figure 7, most video the content needed to grab viewers' attention in just the first 10 seconds, and by 60 seconds half of the audience had left. The good news for educators was that tutorial-type videos received a longer attention span and high satisfaction from learners, if they were relevant and answering something that viewers was interested in gaining a better understanding. Therefore, videos should be refined to stay meaningful, but an increased focus on the essentials of learning.

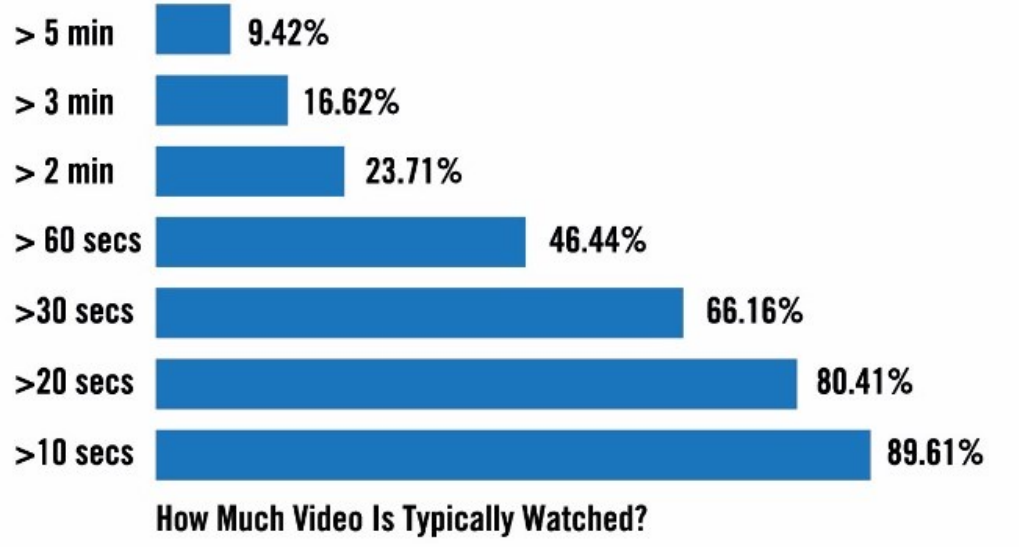

Figure 7. How much video is typically watched?
Reprinted from *The Video Effect*, by N. Camp, 2013, Retrieved from http://www.thevideoeffect.tv/2013/05/08/online-video-attention-span-how-long-should-a-video-production-be/. Copyright 2013 by The Video Effect.

Conclusions

This study could utilize the CoI model to determine how their perceptions of presence affected interaction and satisfaction. The paths measured were supported by the literature included in this chapter and illustrated in Figure 8. The literature in this chapter indicated that teaching and cognitive presence would have a direct positive influence on students' satisfaction in the course. The relationship of social presence and satisfaction was mixed per years of research. Social presence has been investigated many times, but the findings have been inconsistent, therefore this study didn't hypothesize a positive or negative relationship with satisfaction, but instead sought to measure the path with no expectation. Using SEM allowed the researcher to conduct the analysis that was mostly confirmatory, while also exploring an unknown relationship of social presence to satisfaction.

Learning Technologies 2010 made careful use of instructional design techniques to purposefully enhance interaction, teaching, social, and cognitive presence. Activities included

offering students personalized feedback and opportunities to correct mistakes, which has been shown to improve performance (Chickering & Gamson, 1987). Learners completed exercises where they were supposed to interact with each other through discussions, blogs, and voice. Students were encouraged and given the freedom to apply their knowledge and skills to real problems, that should have increased the perception of cognitive presence and made the course seem more relevant to them. The introductory computer skills course was designed as a mastery-type course where learners were allowed to revise work after receiving feedback. The course encouraged cognitive presence as a part of the instructional technology design methods, but there was a greater emphasis placed on teaching and social presence. Classes taken early in an academic career and mastery-type courses have been shown to be important for learners, and the letter grade that a student earns during one of their first introductory courses is a strong predictor of graduation (Kirp, 2016; Lucas, 2016a). With this asynchronous online course being a mastery-type course, in which students were given opportunities to revise their work to master skills rather than earn a grade, satisfaction was chosen to be a more desirable and researchable outcome than retention in the course or achievement as measured by course grade. The course grades were skewed positively, with most learners taking the opportunities to master skills and therefore earn a higher grade. The grades that a student earned in other courses taken early in an academic career have been shown to be a significant predictor of graduation (Treaster, 2017). The survey that participants completed was completely anonymous, so there was no way to tie back responses from a different course survey administered by the university or actual grades earned in the LT 2010 course. This study utilized SEM to understand the relationship between the variables shown in the conceptual model in Figure 8. Conceptual Model. Of the few studies that have previously utilized the CoI model and SEM, three stated that there was a directional relationship (Garrison,

Cleveland-Innes, & Fung, 2010; Joo, Lim, & Kim, 2011; Shea & Bidjerano, 2009, 2010) while the original model (Garrison, Anderson, & Archer, 2000) stated that the relationships were highly interdependent and did not have a direction, that they would naturally covary with each other. Garrison who was one of the creators of the CoI framework and initially stated that the variables were interdependent, later published one of the three studies that demonstrated the directional paths as shown in Figure 8. This study measured the relationships of teaching, social, and cognitive based upon the existing literature that there is a directional relationship from teaching presence to social and cognitive presence. The results of this study will add to the literature that has called for more examination of using SEM with the CoI theoretical framework.

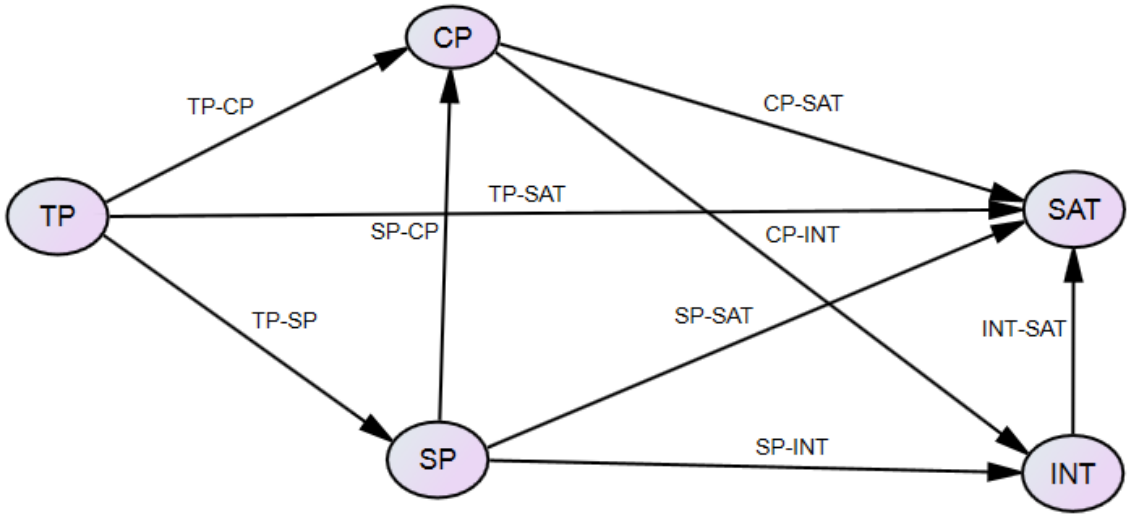

Figure 8. Conceptual Model

3 Methodology

Introduction

The purpose of this study was to determine the direct and indirect effects between the CoI model variables of presence in the asynchronous online course Learning Technologies 2010, with student interaction and course satisfaction. The statistical methods that were used to measure the relationships of multiple interdependent variables, as measured with complex latent variables, required using a confirmatory factor analysis first to ensure that the items being measured loaded into distinct factors, and then SEM with path analysis to determine direct and indirect relationships based on prior literature. Using SEM allowed the researcher to evaluate multiple relationships simultaneously. The results of the structural model provided two plausible models, one with slightly better fit and the other with a better ability to estimate the relationships of interest in the study. This chapter states the research questions that were investigated, the design of the study, recruitment and description of the participants, instrumentation, procedures, and a description of the statistical analysis.

Purpose of the Study

The study sought to determine whether perceptions of teaching, social, and cognitive presence in an online asynchronous mastery-type course had a positive impact on interaction and learner satisfaction. The study examined the direct influence of teaching, social, and cognitive presence on the two outcomes of interaction and satisfaction in a course titled Learning Technologies 2010. This course was worth examining because over 600 learners per year take this course and it can be a significant predictor of completing college and it was one of the courses that students typically take early in their academic program, so achieving a positive learning experience was a desirable outcome. Increasing the perception of interaction was a

desired outcome for increased engagement with the program, the course, and institution. Students that were interacting were likely to be more involved and engaged. The research on the relationship of satisfaction and interaction in a mastery-type online asynchronous course, such as LT 2010, with the interdependent variables from the community of inquire model, teaching, social, and cognitive presence did not exist. This study explored the value of efforts and resources such as time and skill that were expended to create the perception of presence. The results of this study can be used as a resource for administrators and instructors to prioritize how to best allocate resources to produce a quality asynchronous online course and satisfied learners. Many aspects and activities of the course were designed to achieve high levels of interaction and satisfaction, and this study demonstrates uncovers areas in LT 2010 that are working very well as well as some areas that can be improved in design, implementation, and facilitation. The results provided feedback to the instructors and designer on strategies that worked in this mastery-type course as well as activities that may need to be revised to achieve the more desired outcomes. The outcomes of this study can be used as a method to perform a type of quality assurance or continuous improvements after the course has ended, or as a summative assessment of the course as a whole. The results provided a starting point to begin investigating areas that could be adapted to better meet the needs of the students.

Rationale

If tools and pedagogical strategies to develop the perception of teaching, social, and cognitive presence in the design of online courses showed positive relationships with higher perceptions of interaction and reported course satisfaction, then additional consideration should be given to investing resources into designing of future courses. The undergraduate introductory asynchronous online mastery-type LT 2010 course employed activities such as planned frequent

interaction between the instructor, the learners, and having learners engaged in exercises that allowed them to apply their knowledge to problems in their lives. Designing, implementing, and facilitating courses with all of the well-thought-out design of engaging activities took considerable time and skill. Institutions and instructors should be gaining efficiencies for the expended effort, time, skill, and money used to design courses, but if an institution haphazardly throws a course online without understanding the consequences, it could result in negative outcomes. Examining the direct and indirect effects using SEM allowed researchers a more complete systematic view of how each of the types of activities an instructor or instructional designer perform affect interaction and satisfaction. Structural equation modeling has been used in tandem with the CoI model in only a few studies, for instance Garrison and Cleveland-Innes (2005) used SEM to determine how graduate students developed their learning strategy based on their perception of interaction and teaching presence. Marks, Sibley, and Arbaugh (2005) used SEM to measure the effect of many variables, such as student-instructor interaction, student-student interaction, the number of prior courses taken, perceived flexibility, and number of individual and group projects, on perceived learning and satisfaction. That study revealed that instructor behaviors toward students were the most important explanatory variable in the model that explored 14 different constructs. Shea and Bidjerano (2009) studied the structural relationships between the CoI factors in relation to age and gender. Garrison, Cleveland-Innes, and Fung (2010) investigated the interdependent causal relationships between teaching, social, and cognitive presence. Lee (2011) sought to understand the perceptions of multicultural students in a Korean university of what the role of the instructor should be. Structural equation modeling has been used by Joo et al. (2011) to examine perceived levels of presence, usefulness, and ease for satisfaction and retention. The pairing of the theoretical CoI model and the

statistical procedure SEM produces very interesting, complex, and practical findings. There were many combinations of factors involving the CoI model and other positive outcomes that would add to the literature with a new complex yet practical results. This study did not seek out to prove if the CoI model is valid, it instead is looked at how using the model to measure students' perceptions of teaching, social, and cognitive presence affected the desirable outcomes of course satisfaction and interaction. The course was designed to help learners master technology skills and while doing so it is desirable that they are satisfied with the experience and that interaction in the online environment was apparent and meaningful to the students.

Prior research showed that earning an A or B in an introductory course was a predictor that the student was 70% likely to graduate, regardless of their major (Kirp, 2016; Treaster, 2017). This study considered measuring achievement as an outcome, but the survey results were anonymous which prevented being able to tie a single response to a single user, and a majority of students could earn an A or B in Learning Technologies 2010. Determining specific grades and having that information along with the perception information could produce interesting results for a future study. One method that was employed in this course that has been shown to significantly reduce the number of D's and F's in the course was having frequent instructor feedback and instructors that were present (Kirp, 2016). As of the time this study was conducted, 33% of learners were taking online courses, and it was recommended by experts that study online education, that the instructors encourage learners to continue in their program of study (Allen & Seaman, 2014). It was conceivable that a student could have been influenced to continue or stop pursuing their degree because of a bad experience in an online course that did not motivate them to be engaged, failed to pique their interest in the field, or allowed them to progress. Research has found that first-year student retention was most influenced by how

satisfied the student was with their learning experience (Aitken, 1982). Another study using Herzberg's two-factor theory concluded that students that have a positive experience were more likely to be satisfied and more likely to complete their program (DeShields Jr et al., 2005). The rationale for this study included providing evidence to policy makers and educators on which activities learners found value in. Instructors have limited time to engage in the teaching, scholarship, and service expected by their institution, and they should make efficient use of their limited time by engaging in the activities that have positive impact for their learners, the institution, and themselves. The course being evaluated in this study was designed by experts in the field to create a positive learning experience for students, and this study provided an opportunity to look back at the strengths and weaknesses of the design to make continuous improvement. The research questions that were examined in this study shed light on which of the activities were working as intended for learners and which ones may not have mattered or been successful in achieving the desirable outcomes of interaction and satisfaction. For example, if a perception of teaching presence was not shown to be present, then the person responsible for the course could have used the results to go into the course, examine the methods and tools that were being used, which were intended to create this sense of presence, and then modify the course.

Participants and Sample Size

Data from three years was combined from the summer semesters of an asynchronous online mastery information literacy course. In 2014, 52 of the 73 students that were enrolled in the LT 2010 course completed the survey for a response rate of 71.2%. After the first summer semester of data collection, it was clear that a larger sample size would be needed to proceed with the SEM analysis. The researcher extended the university approvals to extend the research

and worked with the master course designer to discuss the structure and content of the course. The course was able to remain intact and relatively unchanged for the three years of data collection, which allowed the sample to be aggregated. In 2015, 47 of the 62 students that were enrolled in the LT 2010 course completed the survey for a response rate of 75.8%. In 2016, 67 of the 101 students that were enrolled in the LT 2010 course completed the survey for a response rate of 66.3%. Over the three-year period there were 166 usable surveys from the 236 students that were given the opportunity to participate in the study completed for a response rate of 70.3%. Using the entire population of the course can be considered as a convenience or availability sample, however this study was seeking to understand a specific course utilizing specific methods. The results of this study may be less generalizable to courses that are significantly different from the LT 2010 course. In 2014 and 2015 there were four sections of the course, in 2016 there was five sections of the course. The same master-designer was used all three years of the course and the template and content did not change during the time that this study was carried out. The textbook used in the course by all instructors was coauthored by the master course designer. In the introductory asynchronous online information literacy course, over the summer semesters of 2014, 2015, and 2016, 236 undergraduate students from a variety of majors at a large urban research university in the Southeastern United States who were enrolled in a fully online asynchronous were asked to complete the survey. All participants in this study self-selected to take the online course, and the course was always offered online only. The activities conducted in each section of the course were identical. The amount of and type of activity in the discussion boards between each section was very similar. In each section instructors did the same type of activities, such as making announcements, posting discussion prompts, and providing feedback on assignments. Although the instructors followed the same

template for the course and used the same expectations for feedback, there was a slight difference in tone in feedback from the instructors. Some of the sections used more encouraging language such as "Great job," and reached out to students to let them know that they were still able to take advantage of the opportunity to make up a missed assignment, urging them to "Keep going—you're close now." Later analysis found that there was no significant difference between sections or years when using the variables included in this study. Other sections still demonstrated that the teacher was present and available, but were more matter-of-fact, stating things such as, "We passed the midpoint this week, and I'm happy to see so many of you all really doing your best." Overall the sections, even though conducted by different instructors, were very similar in items that would develop teaching, social, and cognitive presence. The pedagogical strategies such as offering personalized feedback or having students record their voice and share with their classmates never changed throughout the lifetime of this study (Chickering & Gamson, 1987). A one-way ANOVA was conducted to determine if the perception of presence was significantly different from one section to another, or from one year to another, to further reduce the chance for an instructor effect to be the explanatory variable in the study.

Since the target population of this study only included students who were in a particular course during a particular semester, it could be considered a convenience sample. The sample, as shown in Table 3, shows mixed levels of participants' prior experience with online courses. Although online courses are becoming more and more popular, not only in higher education, but also in the K-12 environment, corporate, and public sector applications, yet there was still 37.4% of the respondents that indicated that this was their first online course they had ever taken.

Table 3. Prior experience taking online courses

This was my first online course	37.40%
I have taken two online courses, including this course	27.3
I have taken 3-5 online courses, including this course	27.3
I have taken more than 5 online courses, including this course	8

Table 4 shows that most of the participants expected to do well in the course. The students' expected grades in the course were predicted to be positively skewed in the results because this was a mastery-type course where students had the opportunity to learn skills and resubmit work that may not have been the highest quality. The study did not collect log data or actual grades, instead it only collected the grades that the students expected to earn in the course. There was a need for building skills and confidence at the lower level to ensure that students had the skills needed to build upon (Dewey, 1959).

Table 4. Expected grade in the online course

A	78.8%
B	18.2
C	2
D	1
F	0

Due to privacy-related issues, limited demographic data for each participant in the sample was collected. However, the general characteristics of the undergraduate population at the university that the LT 2010 course was taught in, around the time this study was conducted are displayed in Table 5 (Forbes, 2016). In the study, there were no missing values, univariate, or multivariate outliers from the 166 usable responses. The response rate for the study was 70.3%.

Table 5. Characteristics of undergraduate population

Total Undergraduate Students	**24,868**	
Gender		
Women	14,423	58%
Men	10,445	42%
Race/Ethnicity		
American Indian or Alaskan		0.17%
native		11.24%
Asian		0.12%
Native Hawaiian/Pacific Islander		39.59%
Black or African American		8.87%
Hispanic/Latino		31.61%
White		4.29%
Two or More Races		2.38%
Race/Ethnicity Unknown		1.82%
Non-Resident Alien		
Attendance Status		
Full-Time		74%
Part-Time		26%
Student Age		
Under 18		1%
18 to 24		76%
25 to 64		22%
65 and Over		0%
Student to Faculty Ratio	22	
First-to-Second Retention		
Full-Time		82%
Part-Time		54%
Overall Graduation Rates		
4 year		21%
6 year		53%
Percent on Financial Aid		91%
Total Annual Cost	$40,068	

Note. Adapted from *Forbes, America's Top Colleges*. Retrieved from https://www.forbes.com/colleges/georgia-state-university/. 2016.

Participants in the study were college students taking a completely online course that was designed to enable students to be more efficient users of technological resources specifically related to their academic and professional career. The course was characteristically taken by first-year students regardless of any demographical information or prior experience. The name of the course was Computer Skills for the Information Age. The three-credit-hour course was delivered asynchronously using a university-supported LMS, Desire2Learn, that enabled several

interactive functions such as chat, e-mail, discussion boards, and assignment dropboxes with the ability to provide instructor feedback through text, rubrics, audio, upload documentation, check for plagiarism or originality via built-in modules, or many forms of html code including embedded video. The course required students to purchase a textbook as either a hard copy or an e-book. Students were given 15 graded course activities with detailed instructions provided for each. Some of the exercises came from instructions in Desire2Learn, while other activities simply stated, "Complete Unit 2: Assignment 1 in your book." Having the course textbook was required to be successful in the course. This online course was not a correspondence course, where a series of assignments are sent out and students return them at their own pace. Instead this online course followed a schedule similar to one that a traditional face-to-face course would follow. The scheduling and pacing were intentional to keep students and the instructor present throughout the semester. The course was examined over a period of three-years, only focusing on the summer semester so that data was not being mixed between a 7-week long course and a 15-week long course where the perceptions of presence could have changed with the amount of time that learners had to get to know each other and the instructor. The findings in this study examining the summer semester may change if the semester were to last 15 weeks instead of seven weeks. Longer courses could result in the perceptions of presence changing with the amount of time that learners have to get to know each other and the instructor (Tu & McIsaac, 2002; Walther, 1992). The duration of the course can have an effect on building social connections between learners, as longer durations offer more opportunity for coalescence (Shea et al., 2006). With correspondence courses, there would be a great likelihood that there would be no interaction, no perceived teaching and social presence and a reduced amount of cognitive presence. This specific course was intentionally designed to enable students to master concepts

and skills, rather than the more common method of assessing skill or knowledge and letting that single assessment serve as a representation of the student's performance. In this learning and mastery course, if a student submitted his or her work and had difficulties with a particular assessment, the instructor often contacted the student and offered feedback and guidance on how the student could improve his or her submission. Students were then able to resubmit their work and have it reevaluated. To the point that this specific course was designed to be a learning and mastery course, there was an expectation that students who put forth the effort to complete the assessments would have grades more positively skewed. In an effort to mitigate any effect in the study plus simply for the sake of keeping the learning experience consistent between different sections or instructors, there was a master course designer who provided training, guidance, and support to the instructors throughout every semester. Each course was conducted as similarly as possible, with each instructor providing the same types of interactions and feedback to learners. Data from three years of the same course was collected and analyzed for the statistical analysis.

Recruitment

The researcher recruited instructors who were teaching the LT 2010 course during the summer semesters of 2014, 2015, and 2016. The instructors were contacted directly via e-mail, using their institutional e-mail account. There were no advertisements or flyers required for the enrolled students to complete the end of semester survey. Students were recruited from all sections of the LT 2010 course by sending an e-mail and making an announcement on the course news page within Desire2Learn. A reminder announcement was sent one week after the initial prompt to invite students to participate in the survey. Students that were enrolled in LT 2010 for the summer 2014-2016 semesters were provided the opportunity to complete a survey. They were given 14 days to participate in the survey. The survey was closed prior to students

receiving their final course grade. In this study, there was not feedback from the instructor or researcher if a student completed the assessment or not, because the results were completely anonymous. The instructor was not able to determine which students completed the survey, just the total number of responders, so when the reminder e-mail was sent, the students that had already completed the survey still received the reminder. The D2L system prevented users from responding more than one time while also keeping each respondent's answers completely anonymous from the instructor. The results of the data were not shared with the students.

The data from the three years were combined for a total of 166 responses. Using data from just the first summer semester only provided a sample size of 52, which did not work for the rich analysis that this study sought to address. A preliminary study, using only the first two years of data, was able to identify a set of plausible models to explain the relationships between the data, and the final round of data was used to strengthen the model through improved fit and inclusion of all five variables of interest in the study. The preliminary study did not have a large enough sample to be able to estimate all three types of presence. Students who did not wish to complete the survey had no responsibility to do so, and there was no penalty for not participating. There was no compensation or cost for participation. If a person was unable to give consent, but was still within the target population, then the student's guardian or advocate was allowed to grant permission for the student to participate (see Appendix C. Informed Consent). The study was conducted online and used a waiver of documentation of consent that users could have printed or saved for their personal use. The waiver of documentation of consent was analyzed using a Flesch-Kincaid Grade Level Score and determined to be on a tenth-grade reading level and to have a reading ease score of 49 (Flesch, 2014; Kincaid, Fishburne Jr, Rogers, & Chissom, 1975).

Ethical Considerations

Prior to conducting this study, the required Institutional Review Board (IRB) approvals were obtained. The research methodology, survey instruments, study design, and consent waivers were all reviewed and approved. Careful attention was given to the potential for participants possibly being under the age of 18, since this was a course that has been typically taken very early in a student's collegiate experience. Students were not required to complete the survey or participate in the study. Everything was voluntary and the students could stop the survey at any time. The survey was administered via the LMS, Desire2Learn, to ensure that only the students in the actual course were completing the survey. The results were anonymous, which means that there was no way for the researcher or instructor to be able to tie individual responses back to a single student. The researchers were not able to determine if a student completed the survey, but the LMS did only allow a single response from each student. The ethical considerations did have an impact on the data collected, in the fact that log data could not be tied back to individual perception data. All responses were kept confidential and stored on password-protected, university-managed information systems. There was no risk of harm for a learner participating or not participating in this study.

Research Questions

The study sought to determine the effects that students' perception of teaching, social, and cognitive presence have, directly and indirectly, on the variables of perceived interaction and satisfaction in Learning Technologies 2010. A graphical conceptual model of the hypotheses is illustrated in Figure 8. Conceptual Model. Structural equation modeling is a confirmatory statistical analysis, therefore based on the literature it was hypothesized that the perception of

presence should have had a positive relationship with interaction and satisfaction. This study sought to answer the four questions below.

In an asynchronous online mastery information literacy skills course:

1. How did students' perceptions of teaching, social, and cognitive presence affect course satisfaction?

2. How did students' perception of cognitive and social presence influence their perception of interaction?

3. Did students' perception of interaction have a positive influence on student course satisfaction?

4. Did students' perceptions of teaching presence influence cognitive presence directly and indirectly through social presence as a mediating variable?

To answer the questions there were several steps performed to develop the structural equation model. Before the analysis began the data had to be verified for accuracy, outliers, and missing responses. The preliminary study performed a confirmatory factor analysis to determine the loadings of each variable (see Appendix D. Pilot Study). The results in this study included 166 useable complete responses. First the conceptual model was developed based on a priori relationships and informed by existing literature. Step two included constructing the path diagram, where the direction of the relationships to be examined were built. Next the model was specified. In model specification, the researcher constructed the latent variables from the measured variables. During this step a measurement model was created to determine the best fitting measures to create latent variables. Modifications of which variables to use were made at this step in both the measurement and structural model. Before proceeding, the model had to be identified. In SEM, the unknown parameters such as factor loadings and path coefficients are

estimated based on the known parameters such as covariances. The final model was overidentified, which meant that there was a possible unique solution, or that there were more pieces of the model that were known than unknown. If a SEM model was underidentified it would have been of no value and the model would have to be respecified or discarded (Kenny, 2014).

Being overidentified is a positive outcome that a researcher should seek before proceeding with using SEM. According to David Kenny, a leader in the statistical method, "A model is said to be identified if there exists a unique solution for all of the model's parameters. A model may not be identified, but some of the model's parameters may be identified" (Kenny, 2014). When a model is underidentified or just identified it is said to be a problem, and where there are more unknowns than can be independently estimated from the available data, a solution is not reliable (Vogt, 2011). The results of the analysis produced two good-fitting plausible models for the data analyzed for the LT 2010 course.

Instrumentation

A new set of survey items were prepared for this study to measure the variables of teaching, social, and cognitive presence, interaction, and satisfaction. The new set of survey items was created using portions of three previously validated surveys. The instrument was tested in a pilot study using principal component analysis, then a confirmatory factor analysis to determine if the questions designed to measure each of the variables loaded correctly into each category (Appendix D. Pilot Study). The items for the survey were selected from three previously used instruments based on the variable that the original survey was designed to measure. For teaching presence there were originally 12 questions, which were repetitive, for example: "The instructor clearly communicated important course topics" and "The instructor

clearly communicated important course goals" (Garrison et al., 2000). The 12 items for teaching presence were narrowed down to six questions based on interviews with experts in the field and examining the types of activities that this study wished to use as measures of creating a perception of teaching presence. Social presence began with nine items on the original CoI questionnaire and then through interviews with experts it was narrowed down to the most relevant five items. Similarly, cognitive presence began with twelve items and was reduced to the five items most relevant to this study. Five questions from the Noel-Levitz Priorities Survey were used verbatim to measure satisfaction. The questions were designed specially to measure online courses and students' satisfaction (Noel-Levitz, 2014). The questions were similar to the questions that a student would complete for instructor evaluation in a traditional course. Students are asked to complete an end of the course survey by the university where they reported satisfaction with the class and rated their instructor, however that data was not available to include in this analysis. The course evaluations for the semester were not used for this study because it would be tied back to the individual students. For interaction, five of the six items from the DELES were utilized, dropping a single question: "Group work is a part of my activities" (Walker & Fraser, 2005). Each of the surveys had labels to specify which questions were intended to measure each of the variables. Questions from existing surveys were used to compile an initial list of 60 questions that were likely to be able to answer the research questions of interest in this study. The list of more than 60 questions was narrowed down to 30 questions for the variables, plus four demographic questions by seeking four experienced online teachers that were also researchers familiar with the CoI framework.

The survey that was distributed to the participants consisted of 30 survey items using a Likert scale of 1 to 8, and four demographic questions. The instrument was informed by using

portions of three previously validated instruments—the Noel-Levitz Priorities Survey for Online Learners™ (PSOL), the Distance Education Learning Environments Survey, and the CoI Questionnaire (B. Arbaugh et al., 2008; Garrison et al., 2000; Noel-Levitz, 2014 ; Walker & Fraser, 2005). The higher the response number, the more agreeable a student's perception was to the statement made, and there was no reverse scored questions. To minimize respondent burden, the survey was kept as short as possible, and on the same Likert scale throughout. The researcher had to decide to retain each of the instruments measurement scales as they came from, or to rescale items to ensure that they were not confusing or burdensome to the participants. Since the entire survey was not being used, previous reliability could not be claimed either, which allowed the researcher to create a new set of questions that were based on portions other surveys. Changing the scale of items from a 1 to 5 scale to a 1 to 8 scale was done for uniformity, lessening the cognitive burden of respondents trying to understand different scales, and it increased the discriminative power of the responses (Hagerty et al., 2001). Some of the surveys were originally on a different scale, but they were all converted to be on an eight-point Likert scale. The researcher had to decide between scaling 8 point items to a smaller scale or scaling 5-point or 6-point items to the larger scale. Dawes (2008) found that scales in a lower 5-point or 7-point scale produce higher mean scores than results of a 10-point scale. An 8-point scale was unlikely to create cognitive overload, since this was a survey being taken electronically, instead of something that was being read to the respondents. The author created a new set of survey items from previously validated instruments, so modifying the scales was a risk that the researcher was willing to accept, instead of transforming results after they had been collected using different scales depending on which of the three previously used surveys came from. Giving participants a survey containing different scales for many questions, and then

trying to transform the results after the data collection would not have been of any additional benefit, reliability, or validity. If the survey were to be given via telephone or in-person through an interview, then the 8-point scale could be distracting for respondents to mentally process the differences on a slightly larger scale. If the items were reduced to a 5-point scale, there would be less nuance for a respondent to indicate levels of positive or negative perceptions (Dawes, 2008). The demographic questions addressed the number of online courses that the student has taken, if they intended to continue attending the university after the semester, gender, and the grade that the student expected to achieve. Other justifications for using a modified scale included consistency with the rest of the survey, finding additional nuances between neutral and barely agreeing or disagreeing, and so that the data could be analyzed as continuous instead of categorical, which provided addition analysis benefits.

Community of Inquiry

The *Community of Inquiry Survey Instrument,* version 14, consisted of 34 questions measured on a 5-point Likert-type scale in which 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The 34 items were broken out into three different measures, including teaching, social, and cognitive presence. Within each of the three broad categories there were subcategories. Teaching presence showed four items related to design and organization, six items related to facilitation, and three for direct instruction. From the design and organization category two items were combined into a single question to create the question, "The instructor clearly communicated important course topics and goals" in place of "The instructor clearly communicated important course topics" and "The instructor clearly communicated important course goals." Items were combined for the sake of brevity and to ease the cognitive burden of survey completers trying to separate topics and goals. Also from section

one was the item, “The instructor clearly communicated important due dates/time frames for learning activities.” Moving to the second subsection of teaching presence, to get a sense of facilitation the item, “The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking” was included. Other questions from facilitation included focused on guiding the class towards understanding and keeping participants engaged. Finally, from direct instruction, there were items asking about providing feedback for the variables that were listed as *TP5* and *TP6*. For social presence, the subcategories were affective expression, open communication, and group cohesion. Two items from affective expression were selected: the first one was related to getting to know other students and the second item was forming impressions of classmates. One item from open communication, listed as “I felt comfortable interacting with other course participants,” was used. Group cohesion provided two items related to sharing point of view and developing a sense of collaboration as variables SP4 and SP5. Cognitive presence’s subcategories were a triggering event, exploration, integration, and resolution. In this study, cognitive presence could have been an elusive variable to establish since this was a mastery course of basic skills and the survey was seeking to understand perceptions. If a student perceived a task in the course to be simple and not require extensive thinking, then it the perception of cognitive presence could have been lower. Questions used to understand perceptions of cognitive presence are shown below in Table 6.

Table 6. Cognitive presence survey items

CP1	Problems posed increased my interest in course issues.
CP2	I felt motivated to explore content-related questions.
CP3	Combining new information helped me answer questions raised in course activities.
CP4	Reflection on course content and discussions helped me understand fundamental concepts in
CP5	I can apply the knowledge created in this course to my work or other non-class related

To validate the initial *Community of Inquiry Survey Instrument,* a study using 287 students from multiple institutions in the United States and Canada was used. In the preliminary study a principal components analysis was used to determine where items loaded best into teaching, social, and cognitive presence factors (see Appendix D. Pilot Study). The Cronbach's Alpha for teaching was 0.94, for social presence 0.91, and 0.95 for cognitive presence. In this same study that tested the reliability of the *Community of Inquiry Survey Instrument* the researchers explained that if they were testing just one of the variables, there might have been a different response. Since they were merging three different constructs into one instrument, investigators assumed a risk that they might be unintentionally creating new and complex phenomena from the interactions between variables (Arbaugh et al., 2008; Swan et al., 2008).

Student Course Satisfaction

Items for student course satisfaction were based on prior literature related to online course or program satisfaction. It was important for the investigator of this study to find studies or survey items that would be applicable in an online asynchronous format related to education, not job satisfaction or happiness with life in general (Aitken, 1982; J.B. Arbaugh, 2001; Bolliger, 2004; DeShields Jr et al., 2005; Gunawardena & Duphorne, 2001; Gunawardena & Zittle, 1997; Herbert, 2006; Joo, Joung, Kim, & Chung, 2012). Ultimately the study used five questions from the *Priorities Survey for Online Learners* (PSOL), which was designed specifically for online students to determine satisfaction and what is important to them. The complete PSOL consists of 74 questions, most of them on a Likert-type range from 1, meaning not important at all, to 7, very important. The respondent is also given the opportunity to respond to the 74 questions related to satisfaction, with 1 meaning not satisfied at all and 7, very satisfied. In this study the new set of survey items needed to be direct and have a likelihood of

being completed by respondents, so having them complete over 100 responses for the single latent variable of satisfaction was not plausible. After examining the literature and using a priori information about the items of most interest and usefulness, the questions shown in Table 7 were selected to measure student course satisfaction (Noel-Levitz, 2014 ; Ruffalo Noel Levitz, 2016).

Table 7. Student course satisfaction survey items

Faculty are responsive to student needs.
The quality of online instruction is excellent.
This institution responds quickly when I request information.
The frequency of student and instructor interactions is adequate.
Student-to-student collaborations are valuable to me.

The reliability of the entire PSOL has been tested many times and the survey has been used extensively throughout the world at more than 117 institutions, for quality assurance programs such as Quality Matters, and the Student Voice Inter-Institutional Research Project (Dietz-Uhler, Fisher, & Han, 2007; Herbert, 2006; Jameson, Ferrell, Kelly, Walker, & Ryan, 2006).

Student Interaction

Interaction was measured using five questions from the previously validated *Distance Education Learning Environments Survey (DELES)*. The complete DELES survey consisted of 34 questions with response choices as Always, Often, Sometimes, Seldom, and Never. The 34 items were broken out into six different measures including; instructor support, student interaction, personal relevance, authentic learning, active learning, and student autonomy. In the student interaction section, there were six items as shown in Table 8; the first five were used for this study. In a preliminary study the instrument was tested multiple times for reliability and of

the six measures included in the study, student interaction produced a Cronbach's Alpha Coefficient of .94, which was the second highest of all of the variables (Walker & Fraser, 2005).

Table 8. DELES student interaction

I work with others.
I relate my work to others' work.
I share information with other students.
I discuss my ideas with other students.
I collaborate with other students in the class.
Group work is a part of my activities.

The survey also included four questions related to active learning to allow an option to add this to the model if needed. The active learning questions are shown in Table 9. For the purposes of the preliminary study active learning questions were not used, but the information was collected prior to conducting the data analysis.

Table 9. Active learning questions

I explore my own strategies for learning.
In this class, I seek my own answers.
In this class, I solve my own problems.
In this class, I am involved in creating knowledge.

Survey Questions Included

The first draft of the new set of survey questions contained 60 questions, but after using a Delphi method with the four experts, the list was narrowed down to 34, in hopes of having a higher completion rate due to the survey taking less time to complete and not asking essentially the same question repeatedly. From the previously validated surveys a new 34-question instrument was developed for this study. There was not a single existing instrument capable of measuring the variables of teaching, social, and cognitive presence, interaction, and student

satisfaction, so the new set of questions was constructed. Using SEM to measure new relationships that have previously not been measured together, other researchers have followed the path of creating a new instrument or new set of survey items adapted from prior instruments (Igbaria, 1990). The new set of questions was converted to an eight-point Likert scale to account for the differences between the three sources for this survey. Green and Rao (1970) say that a scale between 7 and 11 is the optimal range, where reliability is at its highest. Preston and Colman (2000) conducted a study to find the best number of response categories and found that an eight-point scale is in the prime range of being "quick to use" and "allowed you to express your feelings adequately." Moving to an eight-point scale allowed the investigator to find nuanced differences between a response of neutral versus barely agreeing or barely disagreeing. The eight-point scale also made the survey consistent through the 30 Likert-type questions and made the four demographic questions easier to answer. The questions chosen were reviewed by four collegiate professors with a minimum of seven years of teaching online courses to determine if the questions selected were the most useful for the goals of this study.

Design of the Study

Students worked within their section of their LT 2010 course with their instructor to complete assignments, discussions, a paper related to communicating over the Internet, understanding how to find and use reliable information, create original work using technology, act ethically online, and contribute back to the Internet. Instructors worked with the master designer to get clarification and instruction on how to facilitate the course. The textbook used for the course was coauthored by the master course designer. Students received feedback on assignments and were required to use the discussion board. Students were required to post, but not required to interact with each other in some of the interaction activities, which may have led

to messages within the LMS being posted but never read or replied to. If students were not required to reply, then the subject matter needed to be personally interesting for a student to choose to take the time to read and reply to a comment. The course design was not changed during the three years of data collection. During the last two weeks of the semester the students were asked to complete a 34-question survey. Once the survey was completed the responses were collected from the LMS survey tool and exported to Excel. The responses from each section were combined and put into a single worksheet, then prepared to be used in SPSS and Amos (Arbuckle, 2013; IBM Corp, 2013). Surveys that were incomplete were discarded. There were no responses that were discarded that were more than half way complete. Of the 236 students surveyed, there were only four that partially completed a survey, then quit. There was not additional correspondence related to this study with the students in the courses. The responses from participants were anonymous, but limited to a maximum of one response per student enrolled in the course by utilizing the LMS survey tool to administer the survey. Log data of students' time spent in the LMS or their actual course scores was not available due to maintaining anonymity.

Conceptual Framework

The underlying conceptual framework for this study was based on the CoI model to examine students' perceptions of teaching, social, and cognitive presence in an asynchronous online course. In online courses, specifically asynchronous online courses, there was a risk of learners becoming detached from any sort of feedback or interaction with the instructor, classmates, and even active learning. The aim of this study was to identify students' perceptions of teaching, social, and cognitive presence in a course that employed instructional design strategies. The design of the course intended to develop a sense of presence in the asynchronous

online mastery information literacy course. The analysis investigated how students' perceptions of teaching, social, and cognitive presence influenced course satisfaction and interaction.

Descriptives

Limited descriptive statistics were collected for this study. When using SEM the researcher has flexibility to examine different relationships based on how the data fits with the model being examined (Chin, 1998). The descriptive statistics only included the number of online courses previously completed, gender, plans to continue beyond this semester, and which grade the responder expected to earn. Initial analysis examined mean differences and t-tests, but did not find significant differences that needed to be included in the analysis. Adding additional paths to the structural model typically requires a larger sample for the model to be over-identified and show fit (Kenny, 2016). The study did not find any of these descriptive statistics, such as prior experience and gender, to be important enough to be included in the final analysis.

Factor and Principal Component Analysis

Principal component analysis occurs when a researcher has several variables with obtained measures that can be narrowed down to a smaller number of variables known as principal components. The principal components are as predictors for analyses moving forward. It is important to understand that principal component analysis is not the same as factor analysis, even though the procedure to perform each type of analysis is very similar or identical depending on the statistical analysis software being used. In factor analysis, there is an assumption that covariation among the observed variables is due to the presence of factors, or latent variables, that wield directional influence on the observed variables. The factor analysis produced results that showed that a measure was caused or predicted by a number of factors. In a principal component analysis, there were no assumptions about causal relationships; it was only concerned

with taking several variables and condensing them down to a smaller number of variables that could be measured as a component. Principal component analysis does not consider measurement error or variance, while factor analysis does. Principal component analysis is useful to determine instrument or survey construction to overestimate the precision of measurement, while the factor analysis is one of the important steps in performing SEM (O'Rourke, Psych, & Hatcher, 2013). Principal component analysis is helpful in instrument validation, while factor analysis is helpful to create latent variables that could be used in path diagrams or SEM.

Structural equation modeling has often been described as a combination of factor analysis and regression. Some say that in SEM the factor analysis is exploratory (Ullman, 2001) and others (Schreiber, Nora, Stage, Barlow, & King, 2006) disagree with that notion, stating that the factor analysis is actually confirmatory, yet it may be used for exploratory purposes. This study agreed with and followed the assertion that a confirmatory factor analysis (CFA) was appropriate and thusly conducted a CFA not an exploratory factor analysis (EFA) for the analysis. A CFA was conducted based on theory and a priori understandings. An EFA would have been data-driven, with no specifications made in regards to the number of factors or the pattern of relationships between factors and indicators. In a CFA the researcher predicted or constrained the solution to the number of factors being produced, required strong empirical or conceptional theory, and verification of a priori predictions (Brown, 2015). The goal was to establish the number of factors and the nature of each of the distinct factors that may have explained variation and covariation among the set of indicators. The factor is not directly observable, which is why multiple influences are measured to create a new interrelated set of items forming a latent variable that was capable of being measured (Brown, 2015). One of the coefficients for each

factor was fixed to 1 to minimize the number of parameters estimated. The early portion of conducting a SEM analysis required producing a measurement model. This was the portion that was essentially the CFA, and then the researcher proceeded to produce the structural model. A major component of the CFA was to test the reliability of the observed variables, explore variables or measures that may be interrelated, remove items that did not fit, and develop the latent constructs (O'Rourke et al., 2013; Schreiber et al., 2006). The variables that load highest in the CFA or measurement model, could be different variables that ended up being used in the structural model depending on the set of relationships and modifications indices required to construct a well-fitting over-identified structural model.

Structural Equation Modeling

Structural equation modeling is slightly different from most quantitative statistical analysis in the fact that the researcher is required to create the model and paths, then typically modify it to ensure that the relationships being explored can be determined by the data present (Wright, 1921). Structural equation modeling is made up of more than one structural equation. When applied correctly, SEM has substantial advantages over just doing principal components analysis, factor analysis, or multiple regression because of the interplay between theory and data (Chin, 1998). Using SEM, the researcher may specify and estimate complex path models, with direct and indirect relationships between independent and dependent variables using measured and latent variables (Hox & Bechger, 1998). A structural equation is a theory or model representing the strength and nature of hypothesized relations between variables. SEM is a sophisticated statistical method, which was appropriate for this study that sought to explain the total direct and indirect variances of interdependent variables as a system. Measuring a relationship one at a time using regression, did not produce the same results on individual paths,

that the structural equation was capable of calculating. When an awareness of one type of presence is perceived, did that have an impact on one of the other types of presence in the system? Measuring items together allowed the exogenous variables of teaching, social, and cognitive presence to covary, but also gives a macro view of how the system worked. Statistical analysis for the most part is aimed at showing a degree of confidence that a change in one variable is correlated with change in a dependent variable. Structural equation modeling is a powerful technique that, in special cases, such as longevity studies and experimental data has the ability to demonstrate causal models (Vogt, 2011). The founding father of the method, Sewall Wright (1921), and other very early promoters of this statistical analysis considered SEM to be a mathematical tool to prove causal conclusions from testing theory and observed data (Haavelmo, 1943; Wright, 1921). The criteria to move beyond correlations, predictions, or explanations and into causations are stringent. The requirements and arguments about SEM being causal versus being only another method of predicting or explaining are divided in the literature. Sobel (2008) said that "in general the structural and causal parameters are not equal, implying that the structural parameters should not be interpreted as effect." However other prominent researchers argue that structural and causal parameters are the same thing and that SEM should always be interpreted as a causal relationship (Galles & Pearl). Three of the requirements to claim that SEM was showing causation was the assumption that variables should be measured without error, that the residuals were not intercorrelated, and that the path analysis was all completely unidirectional with no loops or covarying between variables (Schreiber et al., 2006). This study does not claim to demonstrate causation, rather it demonstrates predictions and explanations of variance when levels on one variable are reported to be perceived by students in LT 2010. The structural model showed the effect of one variable on another with a regression coefficient called

a beta weight, which was positive for some paths and negative for others. A positive significant beta weight was interpreted as for every one increase by one standard deviation from the mean, in a students' perception of one type of presence, the variable in that path would be expected to increase by the calculated beta weight of its own standard deviation from its own mean, holding everything else measured constant.

SEM can be loosely broken into five steps that are sometimes iterative depending on the data, fit, a priori relationships, literature, measurement method, latent variable construction, and modification recommendations. The five general steps begin with specifying the model, where the researcher can test whether or not variables, which could be latent variables or direct measures, are interrelated through a set of linear relationships (DeVault, 2015). Variables are classified as either exogenous, which are like independent variables, or endogenous variables, which are dependent, intermediate, or outcome variables. Typically in the layout of a model, exogenous variables appear on the left side and have no relationships pointing to them from other variables, however there are still measurement variables that construct the exogenous variables, and the exogenous variables may be covaried in the model (Schreiber et al., 2006).

Specify the model. In this study three possible models were developed as being acceptable ways to understand the data. Structural model two contained twelve indicators and five latent variables, and model one with bad fit contained 16 indicators. Structural model three was a trimmed version of model two that included few indicators and a slightly better model fit, but a decreased ability to explain relationships that were investigated in the analysis. The key here that makes SEM an extension of linear regression was that the researcher can test a set of variables instead of only a single item, and that the researcher was able to use latent variables. Latent variables have been described as phenomenal ways to measure things like feelings,

perceptions, attitudes, and other characteristics that were not easily quantified. In this first step, there were fixed and free parameters, which meant that the researcher used theory and literature to decide which relationships should be measured and in which direction. Models that do not fit the data can be respecified, but the researcher must be careful to make the paths based on what is logical, supported by literature, or to explore a theory, and not just changing paths for an improved mathematical calculation from the SEM software package. In this study the hypothesis predicted the effects of perceiving teaching, social, and cognitive presence and the effects that it had on interaction and satisfaction for learners in an asynchronous online course. The fixed parameters were fixed to the value zero and there was no path drawn between the variables. Free parameters were drawn and measured by the data (DeVault, 2015; Hoyle, 1995).

Identify the model. Structural equation modeling is in a mathematical sense a set of simultaneous linear equations. To solve the equations, the researcher needs to have enough information about some of the values or constraints to be able to estimate the values for the unknown parameters. There has to be a basis for believing that an identified solution is possible (Hanneman, 2000). A test known as the t-rule states "that we must have more known pieces of information than unknown pieces in order to find unique solutions. If this condition is not satisfied, your model is not identified. If this condition is satisfied, your model may be (but isn't necessarily) identified" (Bollen, 1989). If the degrees of freedom are negative, with more parameters being estimated than observed, then the model is underidentified, no solution is possible, and the researcher must reidentify the model or stop the analysis. Being overidentified is preferable, where there are more knowns than unknowns. Being overidentified makes the probability of finding the right solution or a plausible solution for the set of linear equations more likely. Just being overidentified does not solve all possible problems with using SEM

warns Rigdon (2015) by stating "Models that are over-identified—that have positive degrees of freedom—may not fit well, so the fact that such a model does fits well amounts to meaningful evidence in favor of the proposition that the model is indeed a reasonable representation of the phenomena in question." With model specification, the researcher cannot state with certainty that the model fits perfectly, but they are able to determine if there is a reasonable explanation of the trends in his or her data. The data may be one of many possible solutions, but identification gives the researcher confidence to proceed with the analysis with the assumption that the model is measuring what it believes it is measuring and that a solution, or set of alternative solutions, were able to converge when analyzed using sophisticated statistical analysis software, such as Amos, EQS, LISREL, or Mplus.

Estimate the model. Structural equation modeling takes finesse to determine the best-fitting model, most appropriate solutions using the data, and the type of estimation that works for the study at hand. Estimation in SEM is usually an iterative process, which is quite different than regression or ANOVA. In the iterations, the researcher makes multiple attempts to obtain estimates that result in the "best fit" to the data. Testing fit is an extremely important step in SEM (Stevens, 2009). The estimation process is intended to produce fit indices that demonstrate that the model and the data are appropriate. DeVault (2015) lists the three most common methods for estimating fit as:

- Generalized least squares (GLS) – Used for normally distributed data where factors and errors are independent.
- Maximum likelihood (ML) – Used for normally distributed data where factors and errors are independent.

- Asymptotically distribution free (ADF) Estimator – Used for non-normally distributed data but requires sample sizes over 2,500.

For the analysis in this study maximum likelihood was used as the discrepancy method and the statistical software Amos was instructed to fit the saturated and independence models to computer fit measures. It was important to use a reliable software package such as Amos to be able to go beyond the basic criteria of chi-square model test for structural equation models, to be able to evaluate the degree of fit of a model (Hox, 1995; Hox & Bechger, 1998). Maximum likelihood is a robust method that provides the ability to produce a solution with data that is smaller than the 2,500 required when using ADF. The requirements for sample size have been recommended to be at least 100 (Marsh, Hau, Balla, & Grayson, 1998), unrealistically high requirements as 20 to 1 (Tanaka, 1987) and a much more achievable goal stated to have 5 responses per 1 free parameter (Bentler & Chou, 1987; Kenny, 2014; Kenny & McCoach, 2003). Maximum likelihood estimation was the best estimation method to use with the sample size of 166 in this study. Maximum likelihood has been shown to be the second-best estimation method to deal with non-normal data, just behind ADF, which has very large sample size requirements (Boomsma & Hoogland, 2001).

Test the model. After specifying, identifying, and estimating the model the first bit of results came into play—the "fit" of the model, or the goodness of fit. A good-fitting model is reasonably consistent with the data, but showing good fit does not automatically demonstrate that the model is perfect or even valid. Along the steps of conducting a SEM analysis there were several requirements to continue at each step, however assessing whether a specified model fits the data was one of the most important steps in the process. Failure to adequately ensure fit

could cause researchers to continue where they should not or erroneously stop, where they could have proceeded with the analysis (Yuan, 2005).

Another restriction of using SEM is the ratio of sample size to free parameters. Unrealistically high requirements are 20 to 1 (Tanaka, 1987) and a much more achievable goal seeks to have 5 responses per 1 free parameter (Bentler & Chou, 1987; Kenny, 2014; Kenny & McCoach, 2003). Boomsma and Hoogland, (2001) studied issues that occurred when performing a structural equation analysis and came up with a *More is Better* conclusion, where they recommended having a sample of at least 100, and having 200 or more as better. This study, where n = 166, achieved the sample size requirements of at least 5 to 1. Having a smaller sample size makes it more difficult to demonstrate model fit, but an extremely large sample size could artificially inflate fit to show that a model is good-fitting when in reality it may not be. The literature on model fit included a few opinions that this step is not needed, or adds nothing to the analysis, that only the chi-square should be evaluated (Barrett, 2007). This study was able to find a good-fitting model that was informed by the data and theory. There were numerous fit indices to choose from, and in Table 10 below there is a listing of fit indices and their thresholds.

RMSEA was one of the model fit criterion used in this study because it is the most commonly reported with SEM studies and it favors parsimonious models such as the final three structural models presented in the results (McDonald & Ho, 2002). Chi-square was reported in the study and us particularly useful to compare models to each other. Chi-square was a reasonable fit statistic for studies with 75 to 200 cases, which this case had 166 responses. If the number of responses were greater, then chi-square may not have been a reliable measure. AIC was used as a comparative statistic to determine the better fitting model of two plausible solutions. The Normed Fit Index was reported as a way to compare multiple models, and the

Tucker Lewis Index (TLI), also sometimes known as Non-normed Fit Index (NNFI) analyzed the difference between the chi-square value of the hypothesized model and the value of the null model McDonald and Ho (2002) studied which fit indices were reported in 41 SEM studies, and found chi-square was always reported, CFI reported in 21, RMSEA in 20 of the papers, GFI in 15, and TLI in 13 of the 41 studies and that most investigators reported at least two measures.

Table 10. Fit indices and their thresholds

Fit Index	Acceptable Threshold Levels	Description
Absolute Fit Indices		
Chi-Square χ^2	Low χ^2 relative to degrees of freedom with an insignificant *p* value ($p > 0.05$)	
Relative χ^2 (χ^2/df)	2:1 (Tabachnik and Fidell, 2007) 3:1 (Kline, 2005)	Adjusts for sample size.
Root Mean Square Error of Approximation (RMSEA)	Values less than 0.07 (Steiger, 2007)	Has a known distribution. Favours parsimony. Values less than 0.03 represent excellent fit.
GFI	Values greater than 0.95	Scaled between 0 and 1, with higher values indicating better model fit. This statistic should be used with caution.
AGFI	Values greater than 0.95	Adjusts the GFI based on the number of parameters in the model. Values can fall outside the 0-1.0 range.
RMR	Good models have small RMR (Tabachnik and Fidell, 2007)	Residual based. The average squared differences between the residuals of the sample covariances and the residuals of the estimated covariances. Unstandardised.
SRMR	SRMR less than 0.08 (Hu and Bentler, 1999)	Standardised version of the RMR. Easier to interpret due to its standardised nature.
Incremental Fit Indices		
NFI	Values greater than 0.95	Assesses fit relative to a baseline model which assumes no covariances between the observed variables. Has a tendency to overestimate fit in small samples.
NNFI (TLI)	Values greater than 0.95	Non-normed, values can fall outside the 0-1 range. Favours parsimony. Performs well in simulation studies (Sharma et al, 2005; McDonald and Marsh, 1990)
CFI	Values greater than 0.95	Normed, 0-1 range.

Note. Reprinted from "Structural Equation Modelling: Guidelines for Determining Model Fit" by D. Hooper, J. Coughlan, & M. Mullen. 2008, *Electronic Journal of Business Research Methods, 6(1)*, p. 58.

In the process of finding a good model fit the researcher had several indices to review. Most statistical software packages produce a list of possible modifications to make to the model that could have led to improved fit. Modifications should be made one at a time, and the modifications should make logical sense in the model, not just be a mathematical improvement as suggested by the statistical software. The old measure of fit was chi-square to degrees of freedom, but this index left too much open to interpretation to determine good, marginal, and bad fitting models. The chi-square and degrees of freedom are often still reported in many SEM studies along with other more descriptive fit indices that allow models to be compared and have more agreed upon levels of what made a model a good, marginal, or bad fitting model. The fit indices that were used to evaluate alternative model fit in this study were Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Akaike Information Criterion (AIC) and the Normed Fit Index (NFI).

Manipulate the model. The last step in conducting a SEM analysis was to determine if a set of variances and covariances in a matrix fit the structure based on a priori theory. Criticism of modifications made without justification for deleting or covarying or respecifying a model makes a case for outright rejection of research (Chin, 1998; MacCallum, 1995). When examining model fit as a way to test the model, the researcher must also pay attention to the logic, theory, factor loadings, and the meaningfulness of the paths measured in the model. Modifications may require the researcher to use a variable that was not the highest loading in the measurement model, but it still loaded above .5 into the factor. The number of variables in the structural model can greatly impact fit and identification of the model. When developing latent variables, the researcher must make decisions on which variables work best and still measure the desired latent variables being formed (Boomsma & Hoogland, 2001). In this study, some of the

indicator variables were dropped or trimmed from the final two plausible models. Other studies utilizing SEM have also trimmed their model to fit the data by removing variables (Adams et al., 1992; Anderson & Gerbing, 1982, 1988; Boomsma & Hoogland, 2001; Chin & Todd, 1995; Joo et al., 2011; Kenny, 2014; Lei & Wu, 2007; MacCallum, 1986, 1995; Rindskopf, 1984). A final model did not indicate that this was the only and absolute solution, only that the presented solution was statistically significantly likely to be correctly measuring the set of relationships based on the data that was evaluated. The directionality of a model was only determined by the researcher specifying it. Adding in recursive or loops has shown to greatly complicate models, and having many observations with a small sample size has produced poor fit in most cases (Hooper et al., 2008). The results of the analysis were reported in standardized format in the next chapter as well as unstandardized format (see Appendix E. Unstandardized Structural Models) to show estimations of the relationships between multiple linear equations. The results of this study showed the standardized structural models as well as unstandardized estimates in a table format as well to allow easy comparison between the two good-fitting models. Reporting parameter estimates in standardized format, it was possible to compare the relative strength of the relationships, as well as determine direct and indirect effects (DeVault, 2015). Direct effects are shown as the perception of teaching presence directly and positively affecting satisfaction, and indirect effects would be teaching presence causing a change in interaction, and then interaction causing an effect on satisfaction. Direct and indirect effects are important, and it is through SEM that this type of path and measurement is possible (Kenny, 2014).

Expectations

The expectation was that all four questions would be answered affirmatively. A positive relationship between each of the measured paths was hypothesized before conducting the

analysis on the asynchronous online mastery-type course. Most of the prior research suggested that as students reported sensing presence that it had a positive explanation in increased levels of perceived interaction and satisfaction. As previously mentioned in this manuscript, there were published studies that showed mixed findings on the relationships being examined in this study. The outcome from this study found that some of the hypotheses were only partially supported. This set of relationships was never previously measured together, and there was no prior published application of the CoI framework model on an asynchronous online mastery information literacy skills course, so the results of this study adds to several areas in the literature. The research on the CoI framework has been used as a popular evaluation model for some courses, but there were no findings of it being applied to an online asynchronous mastery-type course, like LT 2010. Understanding how the design of this course affected satisfaction and interaction will provide the institution, master designer, and instructors with feedback to transform what they do in the future.

Conclusion

A confirmatory factor analysis and SEM was the most appropriate statistical procedure capable of exploring the effects of students' perceptions of teaching, social, and cognitive presence on interaction and course satisfaction. The instrumentation for this study was informed by three reliable instruments to create a new set of survey items. The participants in this study were of interest since there have been several instructional design strategies intended to produce positive outcomes in the Learning Technologies 2010 course. The institution enrolls approximately 600 learners per year in this course. The population was diverse demographically, but the students in this study did self-selected into a fully online, asynchronous mastery-type course covering information literacy. Outcomes of this study gave new insights to

instructional design strategies used in the course, which can be helpful in re-designing future learning experiences. Universities have limited resources and it is important to have a deeper understanding of what an investment in designing or facilitating a course like LT 2010 has on students. A news article detailed how an institution found success amidst large budget cuts from the state. The college decided to spend time and money as an investment in activities to retain students. That college retained students by developing methods to understand their students and meet their needs for feedback and financial support. The retention efforts helped mitigate the $40-million budget cut by creating an addition $18.9 million in revenue by retaining learners (Kirp, 2016). It is important for leaders to understand what leads to positive outcomes for the learners in courses that are becoming more and more popular. The finding of this study can inform stakeholders of the types of actions that lead to more satisfied students and serve as a tool to improve existing courses.

4 Results

Introduction

The purpose of the study was to determine if the perception of teaching, social, and cognitive presence influenced interaction and course satisfaction in an asynchronous online introductory skills mastery type course. The analysis was also able to measure the relationships between the three types of presence. The research covered a period of three years of the summer semesters at a large urban university in the Southeastern United States. Instructional design strategies were implemented in the online information literacy course, Learning Technologies 2010, that were intended to create a satisfying learning experience where students could master skills that they would need for their educational, professional, and personal goals. The research questions that were examined were:

In an asynchronous online mastery information literacy skills course:

1. How did students' perceptions of teaching, social, and cognitive presence affect course satisfaction?
2. How did students' perception of cognitive and social presence influence their perception of interaction?
3. Did students' perception of interaction have a positive influence on student course satisfaction?
4. Did students' perceptions of teaching presence influence cognitive presence directly and indirectly through social presence as a mediating variable?

To answer the questions there were several steps carried out to develop a structural equation model that fit the data. This chapter details the results of the data collected, conceptualizing the model, constructing the path diagram, model specification, modifications

and measurement models, identification results, parameter estimation, plus assessment of model fit with modifications and alternative models. Structural equation modeling was the appropriate statistical analysis for this study because it allowed a systematic view of how a combination of many activities that go on within an asynchronous online course affected interaction and satisfaction. The richness of analysis would not have been possible using just factor analysis or linear regression because it would not accommodate latent variables or the ability to explore the interdependence and directional nature of multiple relationships measured simultaneously. Using SEM allowed the researcher to explore multiple plausible solutions that fit the data in this study well. Structural equation modeling is generally thought of as a confirmatory procedure, but there are very few studies that are purely confirmatory or exploratory. In this study the focus was confirmatory for the most part, but when testing a model such as the ones in this study, there is bound to be exploratory pieces. The path between social presence and course satisfaction showed conflicted results in the literature, so that portion of the analysis was more of an exploratory step than confirmatory. The results of the study produced three different models, and based on criteria such as fit, richness of latent variables, and significance of paths, the second of three models was selected as the best model. A thorough SEM analysis often results in more than a single model solution (Rigdon, 1996).

Data Preparation and Screening

Data from three years was combined from the summer semesters of an asynchronous online mastery information literacy course. Data was collected using the Desire2Learn built-in survey tool. The data was exported to a SPSS data file and separated by section. In 2014, 52 of the 73 students that were enrolled in the LT 2010 course completed the survey for a response rate of 71.2%. In 2015, 47 of the 62 students that were enrolled in the LT 2010 course completed the

survey for a response rate of 75.8%. In 2016, 67 of the 101 students that were enrolled in the LT 2010 course completed the survey for a response rate of 66.3%. Over the three-year period there were 166 usable surveys completed for a response rate of 70.3%. With a relatively high response rate, it was likely that the sample was representative of the population. Data was only collected from the summer semesters of the course to keep the schedule, structure, and content as similar as possible between sections. In SEM, the sample size is important. The recommendations from Bentler and Chou (1987) suggest a ratio of sample size to the number of free parameters to be 5:1 or higher. The number of free parameters in the final structural models was 31, which meant that a sample size of 155 of higher was appropriate for this analysis with n=166. Though the sample size was adequate for this analysis, a larger sample may have produced an even better fitting model or found significance in paths where there was none, per the *More is Better* conclusion, which states that a larger sample size is better than a small sample size. The *More is Better* conclusion went on to state that at least a sample size of 100 would be the minimum and having over 200 would be more desirable (Boomsma and Hoogland, 2001). The first measurement model that included five latent variables with 26 measurement questions, which meant that there were 62 free parameters. The sample size in this study would have needed to be at least 310. The measurement model was revised to create a more parsimonious, yet slightly narrower in scope, than the entire body of the survey questions. Trimming a model to make it meaningful is a way that other researchers have proceeded in SEM as well (Adams et al., 1992; Anderson & Gerbing, 1982, 1988; Boomsma & Hoogland, 2001; Chin & Todd, 1995; Joo et al., 2011; Kenny, 2014; Lei & Wu, 2007; MacCallum, 1986, 1995; Rindskopf, 1984). There were no outliers in the data screening. If a survey was completed every question received a response. There were no results that showed that a responder selected all of a single value throughout the

survey. In 2014 and 2015 there was one survey from each year that was incomplete, so those two responses were dropped from the analysis. Of the 166 responses, there were no missing data or reverse scored items. A summary of the descriptive statistics is shown in Table 11. Skewness ranged from -.288 to -1.784. Kurtosis ranged from -.232 to 7.025, which indicated that one variable was at a sharper peak. For skewness and kurtosis there should only be concern when skewness exceeds 2 and kurtosis extends far beyond 7-point range, which would put the results of this study within the acceptable range (West, Finch, & Curran, 1995). The data did not violate these measures of skewness and kurtosis, but to account for the possibility of minor violations in skewness and kurtosis using the conservative limits, maximum likelihood estimation was employed to run the analysis. The maximum likelihood estimation is robust to violation of normality assumptions (Bollen, 1989; Diamantopoulos, Siguaw, & Siguaw, 2000). Benter and Chou (1987) published a review of practical issues in SEM and pointed out that a large percentage of social sciences studies contain non-normal data, and to proceed the researcher could either transform data or use an estimation method such as maximum likelihood that is robust to the non-normal data. Furthermore, Monte-Carlo experiments, where the data is randomly resampled many times, found no major difference in terms of results when the researcher used the maximum likelihood estimation on data with different levels of skewness and kurtosis (Reinartz, Haenlein, & Henseler, 2009).

In 2014 and 2015 there were four sections of the course, in 2016 there were five sections of the course. The same master-designer was used all three years of the course and the template, schedule, implementation, LMS, and content did not change during the time that this study was carried out. The course would have normally been modified between semesters, but based on this on-going research and a new version of the textbook being developed, the course remained

intact for the three years of this research. In the introductory asynchronous online information literacy course, 236 undergraduate students from a variety of majors at a large urban research university in the Southeastern United States who were enrolled in a fully asynchronous online were asked to complete the survey. Only the summer semesters were considered for this study to keep the data measuring the same type of course and learning experience. If the fall or spring semesters would have been included it could have created a difference based on the number of students, length of schedule, time permitted to complete work or several other potential issues. Future research can use the results of this study to make improvements to LT 2010 and courses like it, then measure the course on a larger scale. All participants in this study self-selected to take the online course, and the course is always offered online only.

Table 11. Descriptive Statistics

Descriptive Statistics

	N	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic
TP2	166	7.53	1.153	-1.784	7.025
TP3	166	7.31	1.137	-1.103	2.984
SP1	166	5.80	2.061	-0.356	-0.126
SP3	166	6.60	1.625	-0.659	0.811
SP4	166	6.30	1.745	-0.550	0.459
SP5	166	6.40	1.595	-0.541	0.574
CP1	166	6.25	1.778	-0.594	0.585
CP2	166	6.60	1.505	-0.555	0.561
CP3	166	7.01	1.282	-0.819	1.446
CP4	166	7.02	1.218	-0.791	1.710
SAT1	166	7.15	1.620	-1.183	2.645
SAT2	166	7.23	1.405	-1.380	4.358
SAT3	166	7.04	1.570	-1.077	2.318
SAT4	166	6.86	1.651	-0.943	1.667
INT2	166	5.82	1.840	-0.288	-0.232
INT4	166	5.61	2.179	-0.365	-0.216
Valid N (listwise)	166				

Since the design of this study included thirteen sections of one course spread across a period of three years, the researcher wanted to be able to examine and account for any effects between sections, instructors, or time. The possibility for differences should have been minimized due to the research design of having a single master course designer, utilizing the same course schedule, same interaction guidelines, and same content over the three-year period. To determine if there were any section or instructor effects a one-way ANOVA was conducted on each of the variables that could have been used for the conceivable structural models. The analysis showed that all but one of the variables did not significantly differ regardless of which section the students were in, the instructor that they had, or the year that they completed the course. The results of the one-way ANOVA are presented in Table 12. The variable TP3 was the only one that showed a difference between groups, that needed further investigation. Since the variable is shown in subsequent steps to be an important measure, additional analysis was conducted to determine if TP3 could still be used in the study. The survey item for measure TP3 was "The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking."

A Welch-type pairwise comparison was carried out using SPSS to uncover which sections were different but there were no significant differences found. Since the group sizes were not exactly equal in every section, the Welch-type test was performed because it can handle unequal group sizes, is often used with smaller sample sizes, and can accommodate unequal variances (Newsom, 2013).

Table 12. One-Way ANOVA to examine section or instructor effects

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TP2	Between Groups	17.089	12	1.424	1.077	.383
	Within Groups	202.261	153	1.322		
	Total	219.349	165			
TP3	Between Groups	27.305	12	2.275	1.871	.042
	Within Groups	186.026	153	1.216		
	Total	213.331	165			
SP1	Between Groups	82.308	12	6.859	1.696	.073
	Within Groups	618.728	153	4.044		
	Total	701.036	165			
SP3	Between Groups	13.837	12	1.153	.418	.955
	Within Groups	421.922	153	2.758		
	Total	435.759	165			
SP4	Between Groups	29.467	12	2.456	.794	.656
	Within Groups	473.069	153	3.092		
	Total	502.536	165			
CP2	Between Groups	18.360	12	1.530	.658	.789
	Within Groups	355.598	153	2.324		
	Total	373.958	165			
CP3	Between Groups	15.395	12	1.283	.768	.683
	Within Groups	255.599	153	1.671		
	Total	270.994	165			
CP4	Between Groups	11.389	12	.949	.622	.821
	Within Groups	233.557	153	1.527		
	Total	244.946	165			
SAT1	Between Groups	44.912	12	3.743	1.475	.139
	Within Groups	388.323	153	2.538		
	Total	433.235	165			
SAT2	Between Groups	34.692	12	2.891	1.519	.123
	Within Groups	291.146	153	1.903		
	Total	325.837	165			
INT2	Between Groups	61.203	12	5.100	1.569	.106
	Within Groups	497.375	153	3.251		
	Total	558.578	165			
INT4	Between Groups	75.564	12	6.297	1.361	.190
	Within Groups	707.761	153	4.626		
	Total	783.325	165			

The next post-hoc analysis to determine if the difference in TP3 was significant was a Scheffe-test. Scheffe was appropriate since it could consider the number of different groups, which was 13, then compute a new critical value to compare groups to each other. The results of the Scheffe post-hoc analysis did not uncover any significant difference in the means (Keselman & Rogan, 1978). Examining the descriptive statistics, it was found that section 16 had a lower mean score (6.42) for TP3 than section 23 (7.85). The pairwise comparison test, Scheffe, and Bonferroni post-hoc test found no difference between section 16 and the other sections. The only post-hoc analysis to find a significant difference between section 16 and other sections of the course was the least significance difference (LSD) test, however it has been criticized for not sufficiently controlling for Type I errors (Saville, 1990). The data for TP3 forced the researcher to reject the hypothesis that variances were equal in the data. With the hypothesis that the variances were equal, the study could not discriminate between sections, on the variable TP3.

The study did not seek to determine differences that sections made in the results, so the analysis could continue. If the size of the sample was slightly larger it would have been possible that there would not have been a difference between the sections even using the Welch pairwise comparison. Descriptive statistics were generated to determine the means, standard deviation, and sample size for section 16 versus the other sections. The descriptive statistics for TP3, shown in Table 13, show that the mean for section 16 was the lowest of all the courses at 6.42 and the standard deviation was one of the highest out of the sections. Although the one-way ANOVA suggested that there may have been a difference for the single variable of TP3 an exhaustive post-hoc analysis did not uncover any differences that would preclude the variable from being included in the analysis.

Table 13. Descriptive Statistics for TP3

Descriptives

TP3

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
5	16	7.50	.730	.183	7.11	7.89	6	8
6	16	6.94	.998	.249	6.41	7.47	5	8
7	12	7.67	.651	.188	7.25	8.08	6	8
10	13	7.54	.660	.183	7.14	7.94	6	8
11	10	6.70	1.947	.616	5.31	8.09	2	8
12	15	7.53	.743	.192	7.12	7.94	6	8
15	13	7.62	.768	.213	7.15	8.08	6	8
16	12	6.42	1.881	.543	5.22	7.61	2	8
17	15	7.40	.986	.254	6.85	7.95	5	8
20	10	6.80	1.751	.554	5.55	8.05	3	8
21	9	7.56	.527	.176	7.15	7.96	7	8
23	13	7.85	.376	.104	7.62	8.07	7	8
25	12	7.25	1.357	.392	6.39	8.11	4	8
Total	166	7.31	1.137	.088	7.13	7.48	2	8

To further illustrate the issue with the variable TP3 a means plot is shown in Figure 9, where it becomes visible the difference in section 16 versus the other sections.

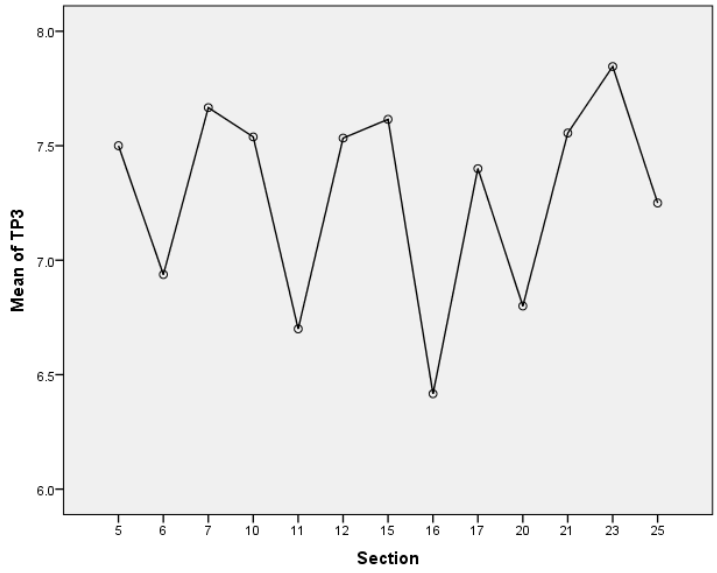

Figure 9. Means plot for TP3

The results from the ANOVA and post-hoc analyses allowed the research to proceed under the assumption that the course was the same regardless of which section, year, or instructor

facilitated the course. The data screening indicated that there may have been a very slight difference between sections for TP3, but the post-hoc analysis ruled out that the difference was significant. With the data screened and accounted for, the next step involved creating the conceptual model.

Conceptual Model

This analysis set out to understand the relationships between students' perception of teaching, social, and cognitive presence along with interaction and satisfaction. The conceptual model displayed in Figure 10 demonstrates the series of relationships, along with the paths that were measured.

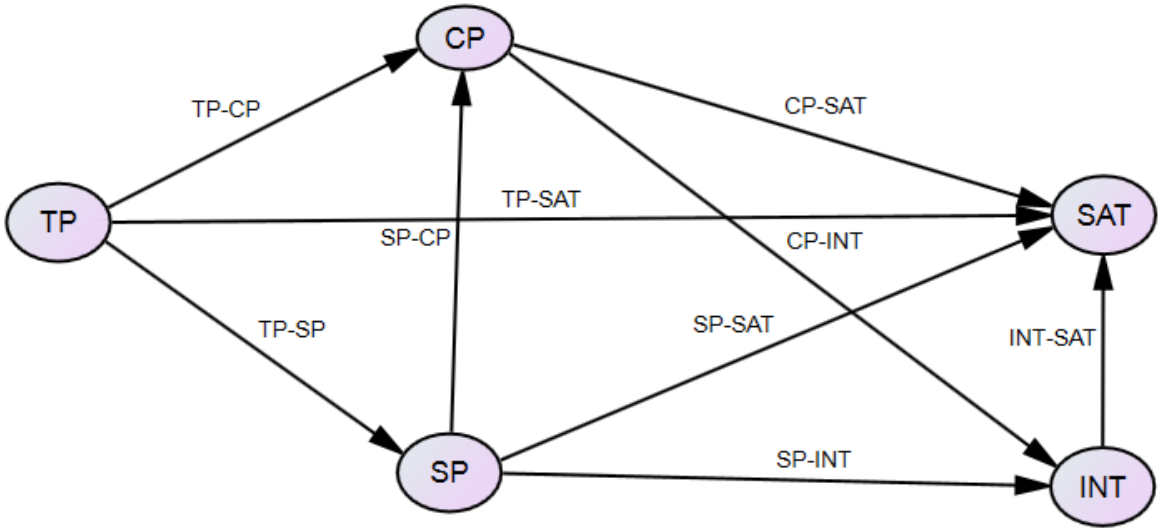

Figure 10. Conceptual Model

Later steps explored alternative models and minor modifications to some of the measured variables. The model as shown in Figure 10 measured how an increased perception of teaching presence affected the perception of cognitive presence and separately how it affected student course satisfaction. The paths were formed by creating the latent variables and drawing directional arrows in Amos version 22, to answer the research questions in this study. In the

conceptual model, there were direct effects such as teaching presence on satisfaction as well as indirect effects such as teaching presence on satisfaction indirectly via social and cognitive presence. An additional benefit of SEM is that total effects are reported in addition to the direct influence of the measured paths. Indirect effects can strengthen or weaken a relationship when mediated from one variable to the next. If the path coefficients supported the notion that teaching presence significantly affected cognitive presence and that cognitive presence significantly affected satisfaction, then the researcher could conclude that teaching presence directly and indirectly affected satisfaction. In the conceptual model shown in Figure 10, there were nine paths being estimated.

Model Specification and Confirmatory Factor Analysis

In SEM, the measurement model represents the loadings or appropriateness of using each of the survey items into theoretical constructs. Structural equation modeling extends the possibility of just doing a confirmatory factor analysis (CFA) by examining the relationships among latent variables to produce a measurement model, which is essentially the CFA and the structural model (Schreiber et al., 2006). Some researchers have called this step a restricted analysis instead of confirmatory or exploratory factor analysis (Anderson & Gerbing, 1988). The initial measurement model was conducted prior to establishing a structural model to ensure that the variables that were utilized properly loaded into the factors that they were expected to, based on the survey instruments that the questions were informed by. This portion of the analysis was done as a confirmatory factor analysis, where there was no causation being examined, instead only correlations between the latent variables.

The steps following the initial measurement model created a second and third measurement model as revisions were implemented. Two of the questions that were intended to

measure the latent variables did not load into the latent variable that it was expected to load into, so a second measurement model was calculated. The latent variables were broad and the number of parameters to be estimated was higher than the sample size of 166 would support, so a third measurement model was developed. The third model confirmed that the indicator variables loaded cleanly into one of five factors and was adequate for this study with n = 166. The measurement model tested relationships of the measured variables to the underlying latent variables specified by the researcher (Anderson and Gerbing, 1988). To develop the measurement model, the researcher used Amos 22.0 to first draw the five latent variables of teacher, social, cognitive presence, interaction, and satisfaction using the 26 items collected from the instrument (see Appendix F. Modified Survey for this Study*)*. The ability to create the directional paths utilizing a graphical user interface was one of the benefits of using Amos instead one of the other popular SEM software packages like LISREL or EQS (Hox, 1995; Hox & Bechger, 1998). The scale of each independent variable was fixed to 1 by constraining one of the measured variables regression coefficient in each latent variable. Each measured variable was given an error term to account for any random or unmeasured variance in the specific relationship between the measured item and the latent variable. All five of the latent variables were allowed to covary in order to determine if the variables were related. With the complexity of SEM, it is common that the initial model is returned with poor fit (Hooper et al., 2008). If the initial model shows poor fit, then modifications should be undertaken.

The initial measurement model shown in Figure 11*,* did suffer from poor fit criteria with a RMSEA of .113 and CFI of .826. Modifications were made if they made logical sense, such as dropping a measure on a latent variable, and did not allow one measure intended to measure one variable to be loaded into a factor that was not supported by the literature (Hooper et al., 2008).

While modifying the model the latent variables could not be narrowed down to less than two items, and regardless of the number of items included in the latent variables, the make-up of the variable had to still be able to explain what it was attempting measure. In the process of performing the confirmatory factor analysis, items loading below .60 were dropped as they were less good fitting in the model.

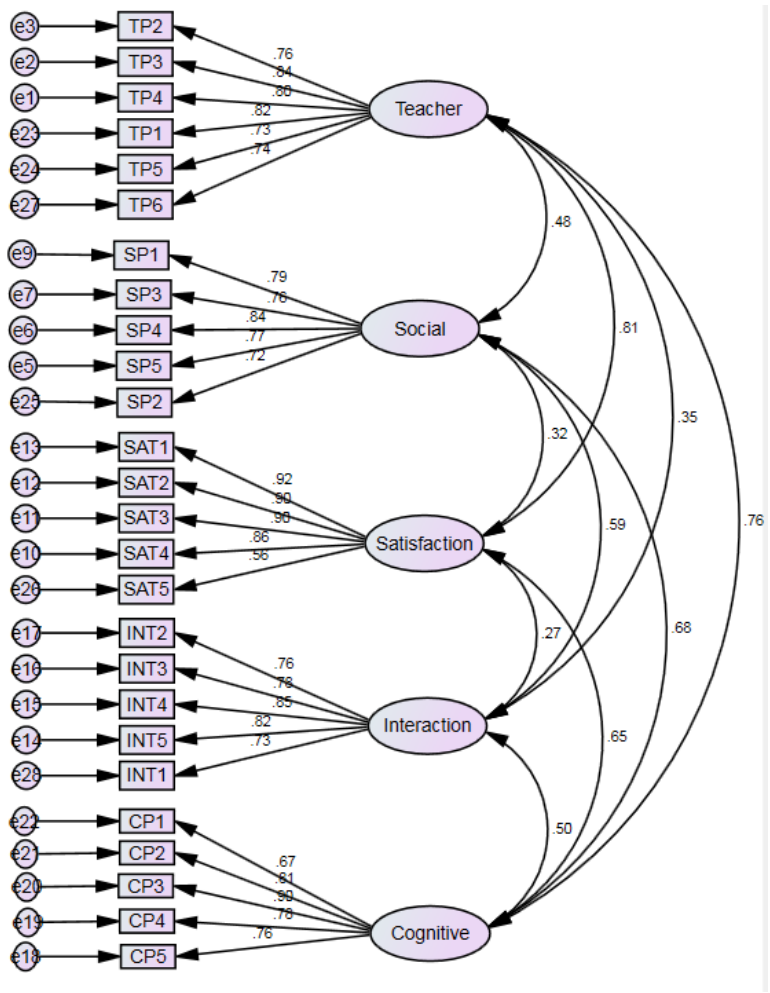

Figure 11. Initial measurement model

Measures such as survey question CP5 loaded above .60, but was identified by Amos as a variable that caused a significant decline in the ability for the model to fit the data. The variable was examined along with the other variables that made up the latent variable of cognitive

presence, and it was determined that the item could be excluded from this analysis. The other retained questions carried enough of what would have been measured in CP5, that the researcher could trim the indicator from the analysis and proceed with confidence that there would not be a left out variable error. Excluding a variable from the analysis had positive effects of being able to converge a model and answer the research questions with a meaningful solution, but it did have a negative effect that the latent variables became slightly less broad in the items that they were measuring. The researcher accepted that focusing the latent variables as an acceptable method than several other published studies and experts in the methodology have utilized (Adams et al., 1992; Anderson & Gerbing, 1982, 1988; Boomsma & Hoogland, 2001; Chin & Todd, 1995; Joo et al., 2011; Kenny, 2014; Lei & Wu, 2007; MacCallum, 1986, 1995; Rindskopf, 1984). Further efforts were carried out to identify repetitive or superfluous survey items that could be trimmed to create a tighter more parsimonious model. The ten items that were dropped from the original analysis were TP1, TP4, TP5, TP6, INT1, INT3, INT5, SAT5, CP5, and SP2. By trimming the model, the researcher narrowed the depth of the latent variables slightly, but the questions that were retained were carefully examined to determine which measures captured the important characteristics of each of the latent variables. The variables TP5 and TP6 were loading on the satisfaction variable higher than they were loading on the teaching presence variable, so that was justification to eliminate the measures from this study. The highest loading factor was SAT1 loading into satisfaction and the lowest measure retained was CP1 loading into cognitive presence. The resulting measurement model left 13 variables that were available to use to develop the structural model. The regression weights for each measured variables' loading into each factor is shown in Table 14.

Table 14. Standardized Regression Weights (Measurement model)

			Estimate
CP1	<---	Cognitive	0.694
CP2	<---	Cognitive	0.830
CP3	<---	Cognitive	0.875
CP4	<---	Cognitive	0.779
INT2	<---	Interaction	0.806
INT4	<---	Interaction	0.802
SAT1	<---	Satisfaction	0.887
SAT2	<---	Satisfaction	0.937
SP1	<---	Social	0.739
SP3	<---	Social	0.763
SP4	<---	Social	0.896
TP2	<---	Teacher	0.763
TP3	<---	Teacher	0.902

In the measurement model all measures were confirmed to load into a factor, then all factors were set to correlate. In the development of the measurement model, there were steps to remove the items that loaded low until a workable model was achieved with factors that clearly loaded into a single factor. The cut-off of the composite reliability of the coefficients in the revised model for this study was 0.60.

Using fit indices of RMSEA and CFI, the measurement model fit was found to be acceptable with a RMSEA of .078 and a CFI of .950. The revised model produced a more parsimonious model and a better overall model fit, which indicated that the measures were appropriate. In the accepted measurement model, there were five latent variables, and 16 indicators for the constructs. Two error terms were allowed to correlate to improve model fit as indicated by modification indices in Amos 22. The two items were SP4 and SP5. The prompts in these two measures were: "I felt that my point of view was acknowledged by other course participants." and "Online discussions help me to develop a sense of collaboration." The error terms, that is the part that is unexplained by each of these two measures, are correlated.

Something not measured in SP4 and SP5 is similar between the two questions, therefore based on mathematical recommendations and the logical likelihood that there was a similarity between these two error terms, they were allowed to correlate. The revised measurement model is presented in Figure 12.

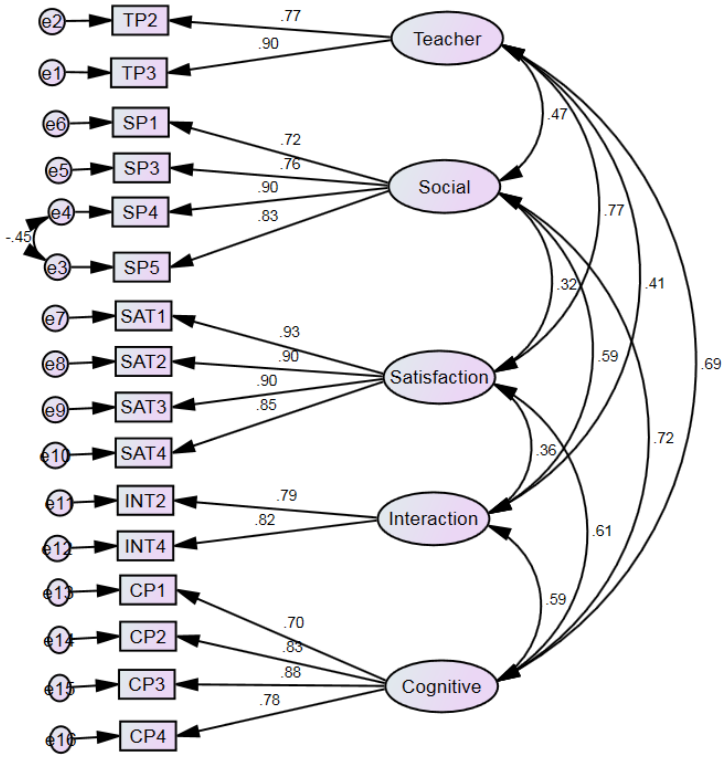

Figure 12. Measurement Model Two

In Measurement Model Two, there were 43 parameters to be estimated, with 93 degrees of freedom in the model, which allowed this measurement model to be acceptable based on fit, (RMSEA = .077, CFI = .940) but still beyond the recommendations for sample size of at least 5 to 1 ratio of responses to the number of free parameters being estimated (Bentler & Chou, 1987; Kenny, 2014; Kenny & McCoach, 2003). To include all the variables presented in Measurement Model Two the sample size would need to be at least 215. A latent variable consists of multiple

measured variables, therefore at least two indicators are desired (Anderson and Gerbing, 1988). All factor loadings and correlations between variables were statistically significant.

A third post-hoc measurement model was developed after more parsimonious Structural Model Two was measured. In the third and final measurement model, the fit was even better with 31 parameters to be estimated, 55 degrees of freedom, and a chi-square of 86.735. Every loading was significant and loaded at .69 to .94 as shown in Figure 13. The RMSEA for measurement model three was .059 versus .078 for measurement model two. AIC for model two was 272.507 versus 158.735, which also suggests that the post-hoc measurement model was a better fitting model. The measurement model also met all other fit criteria, CFI = .975, NFI = .936.

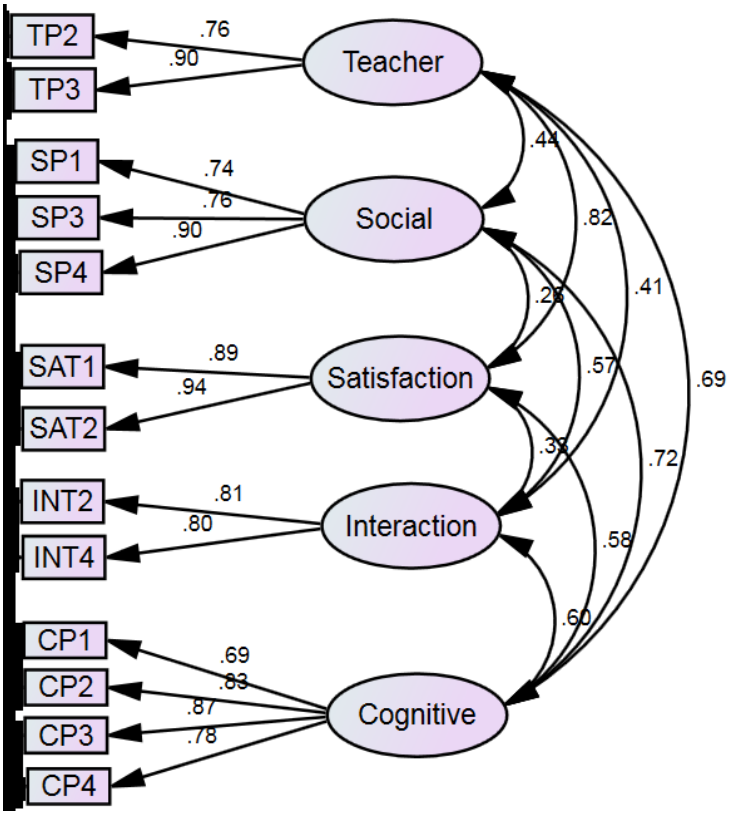

Figure 13. Measurement Model Three

Model Identification

Model identification was a crucial step of the analysis. When the number of pieces of data is greater than the number of parameters that are estimated then the model is "over identified," and the analysis can proceed. This paper presents an initial model that needed modifications and then a good-fitting structural equation model that is used for identification in Figure *14*. Identification was calculated by counting the seven regression paths (*W1-W7*), plus the 17 variances (*V1-V17*), and the nine variances between the latent variables being measured. As shown in *Figure 14*, the total number of free parameters to be estimated was 32.

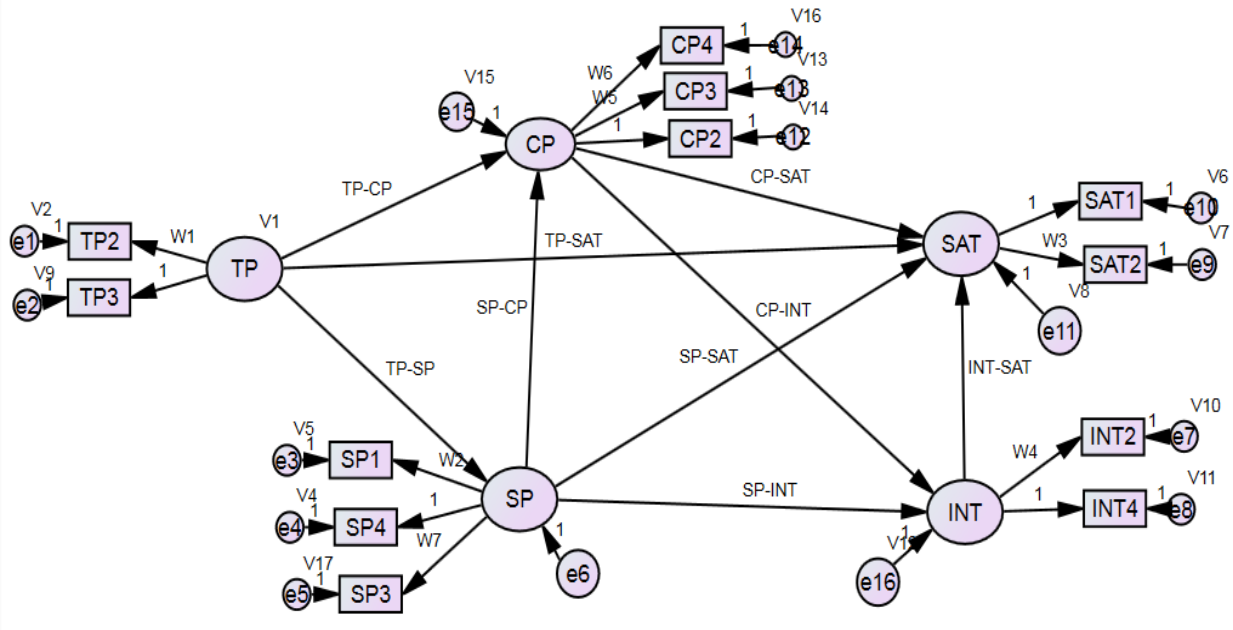

Figure 14. Model Identification

To calculate the number of distinct sample moments, or possible parameters, the researcher used the formula $k^* = k\,(k + 1)/2$ where k was the number of variables and k^* was the number of data points. In this study, $k = 12$, meaning that there were 12 known parameters and the number of known values was 78. The difference between known (78) and unknown (33) provided the degrees of freedom for the model, $df = 45$. The model was statistically significantly

overidentified (u = 78, t= 33), which meant that there are fewer parameters to be estimated than unique pieces of information in the variance or covariance matrix. Once the model was found to be significantly overidentified the next step was to test structural models using Amos. Over-identification allowed the analysis to proceed with the results being tested to show reliability.

Structural Model

As indicated in the measurement model process, the sample size would have needed to be at least 310 to be able to include all 26 indicators. Recommendations to form latent variables state that two indicators are needed for each latent variable, three is ideal, and more than that is considered extra (Kenny, 2016). The structural model that included all 26 indicator variables in the initial measurement model did not show good fit with RMSEA= .103, CFI = .864. The fit criterion RMSEA is a standardized measure not tied to scales of measured variable and approximate distributional properties. A value between .07 and up to .10 indicates mediocre fit. When mediocre or poor fit is found, it is suggested to modify the model (Kenny, 2016). This initial model would be considered poor fit using all the popular fit criteria (RMSEA, CFI, NFI, and TLI). It is common for researchers to collect more questions than are usable in the final structural models (Joo, Lim, & Kim, 2011). A way to create a better fitting model includes examining the paths and directions to look for modifications or to trim variables that can be accounted for by other variables (Lei & Wu, 2007). For transparency and explanatory effects, the initial model is presented as Figure 15. Initial Structural Model including all measures. This initial model was a beginning step in the process to eventually present a good-fitting plausible solution to the data in this study.

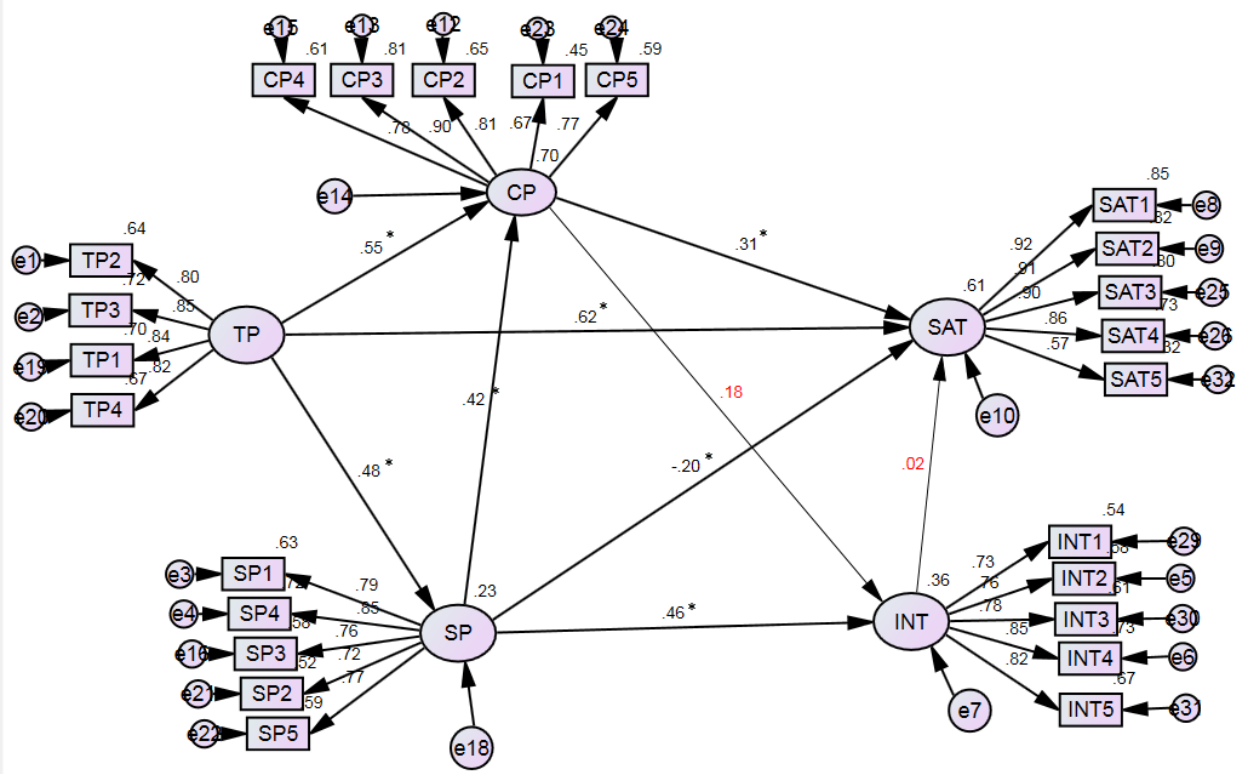

Figure 15. Initial Structural Model including all measures
Note: An asterisk (*) indicates a significant path coefficient.

The initial model was trimmed to include 16 indicator variables and estimate 41 parameters, which would have called for a sample size of at least 205 per the Bentler and Chou (1987) N: q criteria. The structural model one consisted of the model previously over-identified model in

Figure *14*. Once the acceptable fitting measurement model was developed, the structural model was tested using Amos version 22.0. The model is mathematically a set of relationships between the parameters that form each latent variable, as a set of equations to be measured as a system. Figure 16. Structural Model One used Maximum Likelihood Estimation and met the goodness-of-fit criteria for RMSEA being .094 to be considered mediocre fit, but failed others such as CFI = .924, which was below the recommendation of .95 or higher. Ideally the RMSEA

fit would be below .07 to be considered a good fitting model, but as high as .10 could be considered mediocre fit.

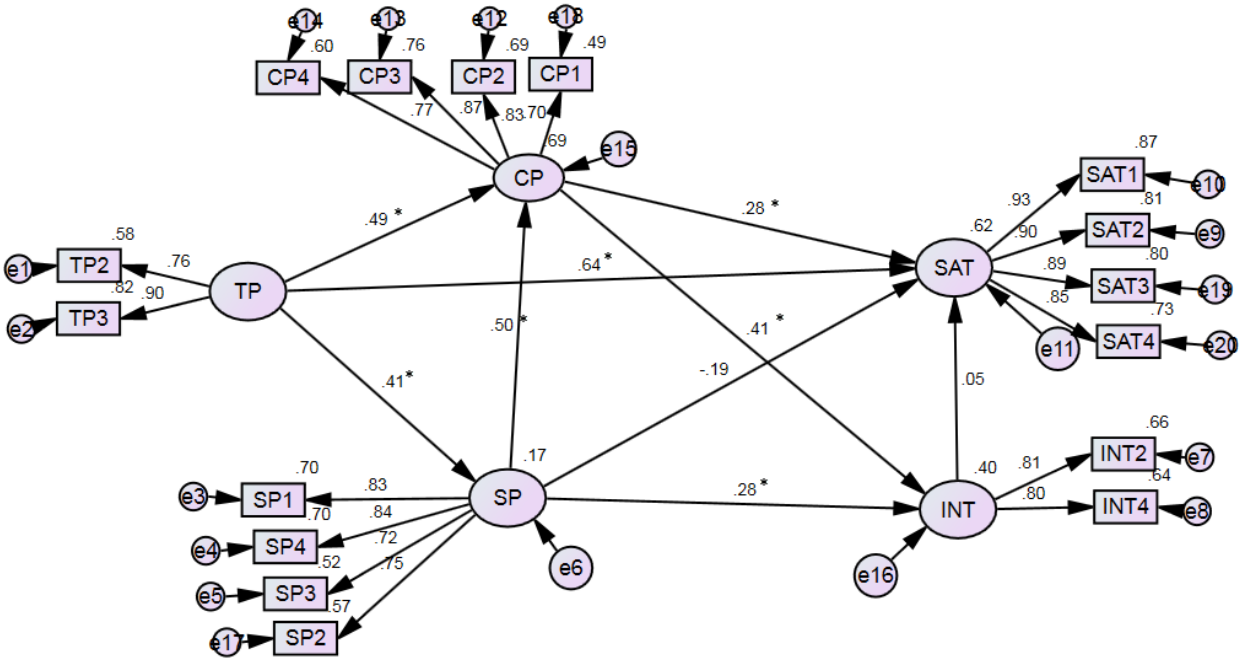

Figure 16. Structural Model One

Structural model one was not the best fitting model for this data, so modifications needed to be made. In structural model one the Chi-square = 234.914 and the degrees of freedom was 95, n=166. Table 15. Structural Model One Fit shows that the model fit was marginal and needed to be modified. Model modification can be done by releasing constraints, removing variables, or changing paths. One path that was found not significant, interaction to satisfaction was explored as a possible path to change in the pursuit to create a better fitting model, however changing the path did not provide any improvement to the model (Chou & Bentler, 2002). Other methods to respecifying a model include adding or dropping entire factors, which in this study did not make logical sense or agree with the theoretical CoI framework. If satisfaction or interaction were dropped from the study, it would have significantly changed the scope of this research to understand how perceptions of presence correlate with those two areas of interest.

Correlating errors was a possible solution, but the benefit of error correlations did not achieve much of a difference. Finally, evaluating measures and dropping or trimming them has been another method that has been utilized to calculate a better overall fitting model and more parsimonious latent variables (Adams et al., 1992; Anderson & Gerbing, 1982, 1988; Boomsma & Hoogland, 2001; Chin & Todd, 1995; Joo et al., 2011; Kenny, 2014; Lei & Wu, 2007; MacCallum, 1986, 1995; Rindskopf, 1984). Furthermore, a more parsimonious model with fewer parameters to estimate would mean that the sample size met recommendations.

Table 15. Structural Model One Fit

Fit Index	Cut-off	Model One
RMSEA	< 0.07	0.094
CFI	> 0.95	0.926
TLI	> 0.95	0.907
NFI	>0.90	0.883
AIC		316.91

Through a series of modifications recommended by the Amos software, informed by existing literature, and restricted by the sample size the model was streamlined by removing some of the measures. Structural model one contained sixteen measured responses to create the five latent variables. A post-hoc revision aimed at improving the model first analyzed the paths and it was determined that each path was important to the study and meaningful, so no paths were removed or changed. Next error covariances were investigated to determine if any error terms on the measured items could improve the model and its likelihood of being a plausible explanation between the set of variables that were being measured, but there were no errors that needed to covary within a single latent variable. Post-hoc inclusion of correlated measurement errors is not preferred by some researchers because if the error terms do not logically make sense to correlate then it may be an instance of just making changes to meet the mathematical

calculations. Amos did recommend error covariances between different latent variables, but that would not have made logical sense to allow terms from different variables to covary. To create a more parsimonious model, variables were individually examined to determine which items were required to remain because it was the best measure of the latent variable. It was determined that two measures from social presence could be removed, one from cognitive presence, and two from satisfaction, which resulted in structural model two (see Figure 17).

The disadvantage of removing measures was that there may have been some explanatory value in the indicators that were being removed, but the advantage was that the power and fit of the model were improved to a point where the researcher could conclude that the solution proposed was one viable outcome. Latent variables should contain at least two indicators or measures. Teaching presence and interaction was already represented by two indicators. Social presence was initially represented by four indicators, SP1, SP2, SP3, and SP4, which are shown in Table 16. Instead of simply examining the loading strengths to determine which indicators to trim, the actual questions were reexamined. In this study the focus was on the students' perceptions of presence, not on belonging or forming distinct impressions of participants, so variable SP2 was omitted from the second revision of the structural model. The improved model trimmed the number of weights being examined in structural model one from 41 down to 33 in Structural Model Two. With structural model two estimating 33 parameters, the sample size requirement decreased to 155.

Table 16. Social Presence survey items

SP1	Getting to know other course participants gave me a sense of belonging in the course.
SP2	I was able to form distinct impressions of some course participants.
SP3	I felt comfortable interacting with other course participants.
SP4	I felt that my point of view was acknowledged by other course participants.

Next cognitive presence was examined to determine if any variables could be trimmed. In the second iteration of the structural model CP1, "Problems posed increased my interest in course issues" was identified as one of the questions that could be omitted. CP1 had the lowest factor loading in structural model one, at 0.70. The indicator CP1 and CP3 were both considered as the most likely to be removed. Alternative models explored changing CP1 for CP3. All four measures seem appropriate to measure cognitive presence so this latent variable consisted of three measures, due to its more complex, more difficult to measure characteristics in the asynchronous online mastery type course. Retaining indicators CP1 and CP3 created a problem within the model. The two variables showed that they were measuring the same thing and that one item needed to be trimmed. The other survey items were unique enough that retaining CP2 and Cp4 were important to define the latent variable.

To focus the latent variable items SAT3 and SAT4 were identified as the best candidates to be omitted. Table 17 shows the indicator items that were used to measure student satisfaction in the asynchronous online mastery-type course. The measure of SAT3 was focused on criteria beyond this specific course and SAT4 was more a measure of number of interactions, rather than a reporting of actual satisfaction. SAT2 seemed to be the best measure of student course satisfaction, SAT3 was more related to the time period, and SAT4 focused more on frequency of contact rather than satisfaction. The resulting model parsimonious model that required a sample size of 155 was created, as shown in Figure 17. Structural Model Two.

Table 17. Satisfaction survey items

SAT1	My professor was responsive to my needs.
SAT2	The quality of online instruction is satisfactory.
SAT3	In regards to this courses, the institution responds in a satisfactorily time period when I request information.
SAT4	The frequency of student and instructor interactions is adequate.

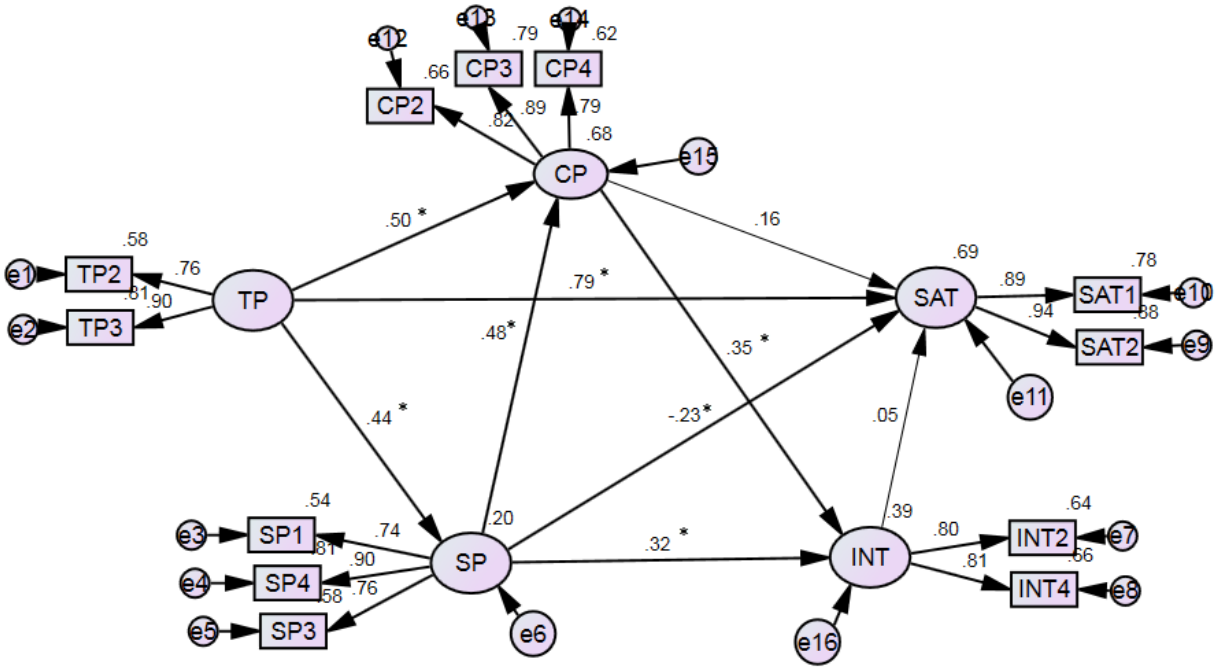

Figure 17. Structural Model Two

There were no modifications made to paths since they could not have been justifiable theoretically or logically. The revised model contained 33 total variables, 12 of those were observed, 21 unobserved. There were 17 exogenous variables and 16 endogenous. There were no covariance paths included in structural model two. There were 17 variances measured. The indicators loaded between .74 to .94 into their respective latent variables. The Chi-square = 68.703 and the degrees of freedom was 45, n=166. Seven of the nine paths were significant, with the exceptions being between interaction to satisfaction (p = .556) and cognitive presence to satisfaction (p = .261). Structural model two was an appropriately fitting model with fit indices demonstrating that the model measured the relationships that it was attempting to measure. Table 18. Structural Model Two Fit, shows that the four most commonly reported fit indices demonstrated good fit and the comparison fit indices demonstrated that structural model two was superior to structural mode one. It is common for different fit indices to show slightly different statistical appropriateness of fit. This study reports many fit indices for full transparency and to

show that the reported indices were not cherry-picked to show only results that support the findings that the researcher wished to present.

Table 18. Structural Model Two Fit

Fit Index	Cut-off	Model One	Model Two
RMSEA	< 0.07	0.094	0.057
CFI	> 0.95	0.926	0.980
TLI	> 0.95	0.907	0.971
NFI	>0.90	0.883	0.945
AIC		316.91	134.703
χ^2		240.00	68.70

The fit criteria improved vastly from structural model one to structural model two. In model two there were two path coefficients that were not statistically significant. Using Structural model two, the paths from interaction to satisfaction and the path from cognitive presence to satisfaction were not statistically significant, meaning that these paths were not significant predictors in this model. A summary of the path coefficients is provided in Table 19. Structural Model Two Regression Weights. Of the paths that were significant, all but one was positive. In structural model one, which suffered from poor model fit, the path from CP to SAT was just barely significantly positive ($\beta = .28$, $p = .049$), but that same path coefficient was not significant when calculated in structural model two. The trade-off, in model one the path between SP and SAT was not significant, but in model two, the path was significant. Both models estimated the path to contain a negative covariance between social presence and satisfaction, but only in model two, the relationship was significant. In Table 19, which is output from the SEM analysis measured in Amos, the first column describes the direction of the path along with the latent variables being measured. The estimate is an unstandardized measure

stating that as the first variable went up by 1, the second one changed by the value in the estimate column.

Table 19. Structural Model Two Regression Weights

			Estimate	S.E.	C.R.	P	Label
SP	<---	TP	0.677	0.134	5.049	***	TP-SP
CP	<---	SP	0.375	0.061	6.117	***	SP-CP
CP	<---	TP	0.593	0.096	6.15	***	TP-CP
INT	<---	SP	0.362	0.143	2.536	0.011*	SP-INT
INT	<---	CP	0.506	0.181	2.797	0.005*	CP-INT
SAT	<---	TP	1.101	0.173	6.352	***	TP-SAT
SAT	<---	SP	-0.207	0.093	-2.236	0.025*	SP-SAT
SAT	<---	INT	0.041	0.07	***0.588***	***0.556***	INT-SAT
SAT	<---	CP	0.186	0.165	***1.124***	***0.261***	CP-SAT

When comparing across groups or groups with different variances the unstandardized comparisons provide useful information, while the standardized coefficients can assist in determining strength on a known scale of -1 to 1. Estimates and path coefficients can be positive or negative, which would indicate an increase or decrease. The value of the estimate or coefficient indicates the strength of the relationship between the two variables. The Standard Error is an estimate of how much error may exist in measuring the path. The critical ratio and p-value determine is the relationship is statistically significant. The critical ratio was calculated by dividing the regression weight estimate by the standard error, which produces a number that is essentially a z-score. A z-score is a measure of how many standard deviations below or above the population mean a raw score is. For the path of cognitive presence to interaction z = .506/.181 = 2.797, which is interpreted as, the regression weight estimate is 2.797 standard errors above zero. At an alpha level of .05 and a critical ratio of greater than 1.96, the results showed that all but two of the paths in structural model two were statistically significant.

The path from teaching presence to satisfaction was the largest effect in the analysis (β =.79, p < .001). Path coefficients are interpreted as follows: for every one increase by one standard deviation from the mean, in a students' perception of teaching presence, student course satisfaction would be expected to increase by 0.79 of its own standard deviation from its own mean, holding everything else measured constant. Values above .50 are said to be large effects, values around .30 are medium effects, and lower values around .10 would be considered a small effect (Suhr, 2006b). For example, an increase of 1 in cognitive presence resulted in a positive change of 0.352 in interaction (β =.35, p = .005), but the relationship between CP and SAT was not significant (β =.16, p = 0.261). Finding a non-significant result does not necessarily mean that there were no effects, just that the relationship was not significantly different from no relationship. At this time the results could not conclude that the direct path from cognitive presence to satisfaction was significant, but including it in the structural model did have an influence on indirect and total effects, so it was retained. Some researchers would remove non-significant paths and estimate the model again, but that was not appropriate in this analysis because the researcher were interested in the paths CP to SAT and INT to SAT which did not show significance. Each of the paths were positive, but not significant. Structural model two shown in Figure 17. Structural Model Two, is the standardized model. The results in Table 19. Structural Model Two Regression Weights are unstandardized, and an unstandardized version of structural models two and three is available in Appendix E. Unstandardized Structural Models. In structural model two, there was a large path coefficient between the perception of teaching presence and students' satisfaction.

All four of the latent variables in the analysis included direct and indirect paths to course satisfaction. The total relative variance of student satisfaction explained by contributing jointly

variables perceptions of teaching presence, social presence, cognitive presence and interaction had $R^2 = 0.69$. During the process of modifying the model, the removal of the path from cognitive presence to satisfaction was considered, which raised the satisfaction R^2 results slightly to 0.71. Model fit with that path removes showed an improved RMSEA by .01 and chi-square decreased by 1. The difference was not meaningful enough to be considered as an alternative model to be included in the results. Modifying the path between interaction and satisfaction did not change the explanatory value of the paths leading to satisfaction or the model fit. The total relative variance of interaction explained by jointly contributing variables social presence and cognitive presence had $R^2 = 0.41$. Interpretation of the results is presented in chapter five of this manuscript. The path from teaching presence to social presence resulted in $R^2 = 0.20$. The direct path on cognitive presence from teaching presence ($\beta = .50$, $p < .001$) and mediated through social presence ($\beta = .48$, $p < .001$) calculated $R^2 = 0.68$. The covariance matrix is available in Appendix G. Covariance Matrices. The covariance matrix has a row and column for each parameter of the model. Each off-diagonal in the matrix provides an estimated covariance between the parameters. The correlation of estimates is included in this study (see Appendix H. Correlations of Estimates) The correlation of estimates gives an estimate of the correlation between two parameter estimates, but does not show significance levels.

Alternative Models and Fit

One of the foundational principals of SEM states that there are often alternative models that fit to a similar degree (Chin, 1998). George Box, a pessimistic British statistician was quoted as stating "all models are wrong but some are useful" (1976). Seeking to explore model equivalence tends to be an overlooked practice in publishing research using the complex SEM (Henley, Shook, & Peterson, 2006). Part of a thorough analysis includes seeking alternative or

equivalent models. After examination of estimates and fit indices, further analysis was conducted to examine modifications to the model that were within the theoretical constructs, changes that made logical sense, and possibly provided a better fitting or more parsimonious model. One modification between structural model one and structural model two that was revisited was the composition of the cognitive presence latent variable. In forming structural model two, CP1, as shown in Table 20, was selected as the one measure to remove due to it having the lowest factor loading, removing CP1 helped to create a more parsimonious model, and reduced the unexplained variance of the overall latent variable. The removal of CP1 was done under the logical and statistical understanding that variables of CP2, CP3, and CP4 all adequately created a reliable measure for cognitive presence.

Table 20. Cognitive Presence survey items

CP1	Problems posed increased my interest in course issues.
CP2	I felt motivated to explore content related questions.
CP3	Combining new information helped me answer questions raised in course activities.
CP4	Reflection on course content and discussions helped me understand fundamental concepts in this class.

In the process of scrutinizing the model for improvements, structural model two was examined using CP1 in place of CP3 to create an alternative model that is titled in this study as structural model three. All the previous paths remained constant. In the alternative structural model three, the measure CP1 loaded well into the latent variable of cognitive presence as 0.72, but this was below the loading of 0.82 for CP3 shown in structural model two. Including both measures created a worse fitting model, so the analysis proceeded with replacing CP1 with CP3. The new model showed some interesting changes. The difference between structural model two and structural model three did not stop at the factor loadings of the measure, there was also a significant change in overall model fit and the statistical significance of the paths being

measured. In structural model two there were two paths that were not significant, which were cognitive presence leading to satisfaction and interaction leading to satisfaction. In the alternative structural model three there were three paths that did not indicate statistical significance, which were the same two paths in structural model two plus the path between social presence and interaction (β =.13, p = .346). Structural model three is shown in Figure 18. The third model created a slightly better fitting model, but found less paths to be significant.

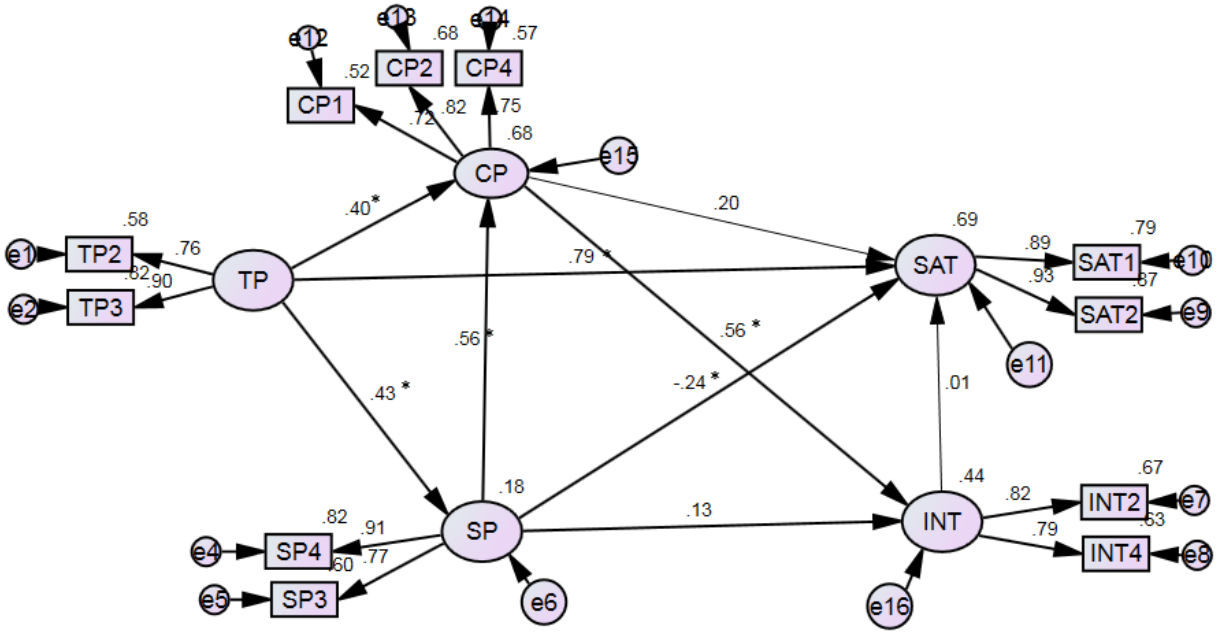

Figure 18. Structural Model Three

Besides the path between social presence and interaction being not statistically significant, the direction of the relationships was unchanged, but the strengths were altered as summarized in Table 21. There were 16 variances measured and a single covariance between social presence and teaching presence. The Chi-square = 49.978 and the degrees of freedom was 36, n=166, probability level = .061. In both models, there was a negative coefficient between social presence and satisfaction (model two, β = -.23, p = .025; model three β = -.24, p = .034). In both models, there was a large positive effect of 0.79, between teaching presence and

satisfaction. In structural model three the path between cognitive presence to interaction was stronger than it was in structural model two (model two, β = .35, p = .005; model three β = .56, p < .000. The total relative variance of interaction explained by contributing variables jointly social presence and cognitive presence had $R^2 = 0.44$ in model three and $R^2 = 0.39$ in model two. The total relative variance of student satisfaction explained by jointly contributing variables perceptions of teaching presence, social presence, cognitive presence and interaction had $R^2 = 0.69$ for both models.

Table 21. Structural Model Three Regression Weights

			Estimate	S.E.	C.R.	P	Label
SP	<---	TP	0.656	0.136	4.834	***	TP-SP
CP	<---	SP	0.457	0.078	5.868	***	SP-CP
CP	<---	TP	0.502	0.106	4.732	***	TP-CP
INT	<---	SP	0.143	0.152	**0.942**	**0.346**	SP-INT
INT	<---	CP	0.757	0.205	3.699	***	CP-INT
SAT	<---	TP	1.104	0.16	6.912	***	TP-SAT
SAT	<---	SP	-0.217	0.103	-2.115	0.034*	SP-SAT
SAT	<---	INT	0.008	0.079	**0.096**	**0.923**	INT-SAT
SAT	<---	CP	0.221	0.181	**1.22**	**0.222**	CP-SAT

Structural model three was another possible solution of how the variables were interrelated to each other. One reason that structural model three was worth examining as a plausible solution was slightly improved model fit. Structural models one, two, and three fit indices are compared in Table 22. In each of the fit indices model three was a better fitting model when compared to the other models. Akaike Information Criterion (AIC) is a comparative measure of fit that was useful only to compare multiple models. The lower the AIC value and lower chi-square indicated a better fit (Kenny, 2016). Other than slightly improved model fit, model two was the model with the most information to use. Models that show good fit but have estimated parameters that are not significantly different from zero do not produce a

valid model (Kenny, 2016). While models two and three were both good-fitting and valid, model two was better at estimating the relationships that were of interest in this study.

Table 22. Structural Model Three Fit

Fit Index	Cut-off	Model One	Model Two	Model Three
RMSEA	< 0.07	0.094	0.057	0.045
CFI	> 0.95	0.926	0.980	0.988
TLI	> 0.95	0.907	0.971	0.981
NFI	>0.95	0.883	0.945	0.955
AIC		316.91	134.703	108.934
χ^2		240.00	68.70	46.93

Summary

The results of this analysis produced two good-fitting structural models that explained the interdependent relationships of how students' perception of teaching, social, and cognitive presence affected their perception of interaction and satisfaction in the LT 2010 course. The models answered the four research questions, but the possible answers varied slightly depending on if structural model two or three was accepted. All possible solutions found teaching presence to be the highest path coefficient leading to student course satisfaction in the asynchronous online mastery-type skills course. This finding was in line with most prior research examining non-mastery type courses. Regardless of either good-fitting model two or three, there was no significant path coefficient from cognitive presence to satisfaction or from interaction to satisfaction. In structural model two, the path from social presence to interaction was significant and positive, yet in model three this path was calculated to just barely not be significant. The relationship between the three types of presence were positive between each latent variable regardless of model. Model three had slightly better fit than structural model two, but structural model two had the benefit of being a good-fitting model, it retained broader latent variable

constructs, and supported significant relationships in seven of the nine paths. Model fit is important, but context should be applied as well, in this case the fit was just slightly better in model three than model two. The literature cautions against rejecting a good-fitting model based solely on the best model fit only (Chin, 1998). Structural equation model three was narrower and only capable of showing significant paths in six of the measured paths. The discussion and interpretation of the results are presented in the following chapter.

5 Discussion and Analysis

Introduction

This study sought to investigate the impact of perceptions of teaching, social, and cognitive presence in Learning Technologies 2010 on interaction and learner satisfaction. The analysis also included measuring the influence of teaching presence directly on cognitive presence as well as through social presence as a mediating variable. The goal of conducting a structural equation model analysis was to determine if the course was producing the desirable outcomes as measured by students' perceptions of presence and to understand the interdependent nature of the all the variables included in the study. Considerable time on course development and instructional design occurred prior to this study, and this analysis was an opportunity to evaluate the results of the investment in resources. The CoI theoretical model consists of three interdependent variables of teaching, social, and cognitive presence. These items do not work alone in a vacuum, rather they are achieved through many activities, planning, interacting, and facilitating the course, so measuring how they worked together in this online asynchronous mastery-type course was of interest. Although the CoI model has been researched in the past, there has not been a study that examined a mastery-type course, included satisfaction and interaction, or utilized SEM on this specific set of variables. Using SEM allowed the researcher to measure the three types of presence working together in a single analysis, rather than a series of separate regression analyses. Using SEM also allowed the researcher to use rich complex latent variables based on two or more measured items, understand the patterns of correlations among the latent variables, and explain up to 69 percent of the variance in satisfaction and 39 percent for interaction with a good-fitting structural model. Good fitting models, such as structural models two and three suggested that the hypothesized relations among the latent

variables were reliably measured. A mediocre fitting model, such as structural model one, resulted in a higher likelihood to reject the plausibility of the model. Structural model one was retained in the manuscript to demonstrate a larger model with more observed variables that make up the latent variables. Although structural model one may be useful in future research, the data included in this analysis was not able to meet recommended fit criteria. The choice to refine the model was made based on the ability to have a more parsimonious and better fitting model while retaining the characteristics of the latent variables that were important to the study. Model one can be used in future studies with larger sample sizes to determine if having the additional measured items creates a richer, more meaningful latent variable that reveals new path coefficients. Model two was a good-fitting model that was the most appropriate solution to answer the research questions. The benefit of model two was finding significance in seven of the nine paths, where the slightly better fitting models three was not able to establish significance in three of the paths. This chapter discusses and interprets the results in relation to the existing literature and expectations. Finally, implications of the findings are presented.

Discussion and Interpretation of Results

To ensure that the results of this study were appropriate the sample size had to meet the criteria to be used. This study, where n = 166, achieved the sample size requirements of at least 5 to 1 ratio of responses to the number of free parameters being estimated for structural models two and three (Bentler & Chou, 1987; Kenny, 2014; Kenny & McCoach, 2003). The model was then conceptualized to hypothesize the paths and directions of variables, data was screened to ensure it was correct and appropriate for usage, the model was specified to ensure that the measures were actually measuring what they were intended to measure, the model was identified to ensure that there were fewer parameters to be estimated than unique pieces of information in

the variance, then the structural model was examined and alternative models were explored to complete the analysis. There were four research questions that were addressed within this investigation. In the following section, each question is stated and represented graphically based on the results from structural equation model two.

Research question One

How did students' perceptions of teaching, social, and cognitive presence affect course satisfaction?

The expectation was that students' perceptions of teaching and cognitive presence would have a direct positive relationship to student course satisfaction. The literature was conflicted on the relationship between social presence and satisfaction, so the path was measured with no expectation. The results shown in Figure 19 show that only teaching presence, of the three hypothesized relationships was significantly positive, social presence was significantly negative, and cognitive presence was not significant.

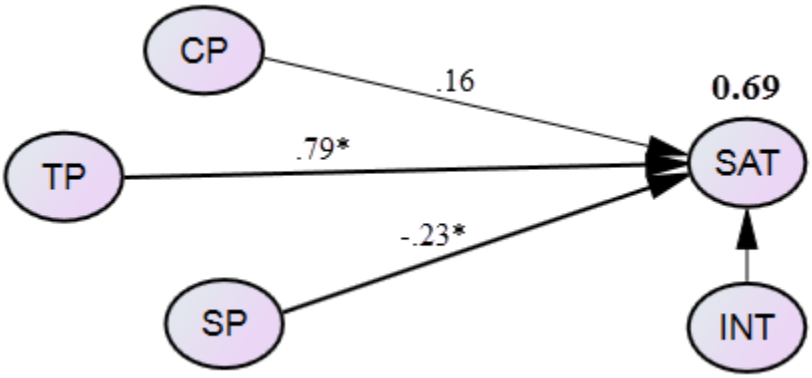

Figure 19. Results of Research Question One Graphically (partial model)

The total relative variance of student satisfaction explained by jointly contributing variables, perceptions of teaching presence, social presence, cognitive presence and interaction

had a $R^2 = 0.693$, as shown in Table 23. The significant relative direct effects suggested that 69.3 percent of students' course satisfaction was accounted for by perceptions of teaching presence, social presence, cognitive presence and interaction. The error variance of satisfaction is approximated 30.7 percent of the variance of satisfaction itself. A subsequent model modification explored removing the path from interaction and the results did not change the R-square value, therefore the explanatory value was not attributed to interaction. Being able to account for 69.3 percent of the variance of student course satisfaction suggests that this is a strong model with good predictive power.

Table 23. Squared Multiple Correlations (Structural Model Two)

	Estimate
SP	0.196
CP	0.684
INT	0.386
SAT	0.693

Note: This table shows the estimated percent of variance explained by the predictors in the model. It is the correlation between the variable's values and the best predictions that can be computed linearly from the predictive variables. The results are reported as R^2 values.

The first path analyzed in research question one was examined the positive direct path from teaching presence to satisfaction, $\beta = .79$ *($z = 6.352$, $n=166$, $p < .001$)*. The standardized direct effects are summarized in Table 24. It is important to clarify that SEM allows for causal modeling, but does not prove causation. The path coefficient is not a correlation coefficient. To further interpret the findings, as students' perception of teaching presence increases by one standard deviation from the mean, students' course satisfaction would be expected to increase by 0.79 its own standard deviation from its own mean while holding the other measured relationships constant (Bullmore et al., 2000). The unstandardized effect was 1.10 as shown in Table 25. As previously shown in Figure 17. Structural Model Two and Figure 18. Structural Model Three, teaching presence was the largest predictor of satisfaction out of all the paths

tested. As shown in Table 27 Amos calculated the standardized total direct and indirect effects of teaching presence on satisfaction as .818. The direct effect was .786 and the indirect or mediated effects were .032, as shown in Table 26. To develop or encourage students to perceive teaching presence the instructor should do things like clearly communicate topics, goals, and due dates as well as guide learners understanding using feedback. Other studies have also found teaching presence to be one of the highest correlated measures of the CoI model and satisfaction (Grady, 2013; Joo et al., 2011; Kim et al., 2014; Richardson & Swan, 2003). The findings for the relationship between teaching presence and satisfaction in Learning Technologies 2010 fall in line with the majority of the literature and suggests that the activities in the course that develop the sense of teaching presence were working as intended in the course.

Table 24. Standardized Direct Effects (Structural Model Two)

	TP	SP	CP	INT	SAT
SP	0.442	0	0	0	0
CP	0.495	0.479	0	0	0
INT	0	0.321	0.352	0	0
SAT	0.786	-0.226	0.159	0.051	0

Table 25. Unstandardized Direct Effects (Structural Model Two)

	TP	SP	CP	INT	SAT
SP	0.677	0	0	0	0
CP	0.593	0.375	0	0	0
INT	0	0.362	0.506	0	0
SAT	1.101	-0.207	0.186	0.041	0

Table 26. Standardized Indirect Effects (Structural Model Two)

	TP	SP	CP	INT	SAT
SP	0	0	0	0	0
CP	0.212	0	0	0	0
INT	0.391	0.169	0	0	0
SAT	0.032	0.101	0.018	0	0

The literature on social presence was conflicted, and in this study, there was a negative path coefficient found between students' perceptions of social presence and course satisfaction. Structural model two estimated the standardized path coefficient as significantly negative with a $\beta = -.226$ ($z = -2.236$, $p = 0.025$). This means that as students' perception of social presence increased, their satisfaction with the course decreased by 0.23 of its own standard deviation from the mean. The literature presented in chapter two of this manuscript on social presence and satisfaction was mixed, with some research showing a positive relationship and other research showing either no significance or a negative relationship. In the LT 2010 there was intentional planning on having students do activities that would engage them with each other, such as creating blogs that each student would read and comment on. The designer of the course designed the activities to create a rich meaningful learning experience, but did not specifically take student satisfaction into account while designing the activities. The stakeholders of this course will need to better understand how the activities affect learners. Perhaps the social component of learning is more important than every aspect of the online course being satisfying, or perhaps there could be better or more meaningful ways to encourage social presence. The total direct effects included some mediating effects that lessened the decrease in satisfaction from -.23 to -.125. This suggests that some of what is not satisfying to learners in the form of social presence can be made up for in other areas such as teaching presence.

Table 27. Standardized Total Effects (Structural Model Two)

	TP	SP	CP	INT	SAT
SP	0.442	0	0	0	0
CP	0.707	0.479	0	0	0
INT	0.391	0.49	0.352	0	0
SAT	0.818	-0.125	0.177	0.051	0

Upon finding the negative relationship between social presence and satisfaction, the researcher sought to gain a deeper understanding of possible explanations. The study design did not allow for interviewing subjects or reporting identifiable information such as a students' responses to the indicator items and the activities that they actually did. However, the course and artifacts remain in the university managed LMS and triangulation could help provide a possible explanation for the results. Methodological triangulation consists of looking at multiple sources of data to look across the quantitative data like the results of the SEM analysis and qualitative data such as the activities within the course design that were intended to develop the sense of social presence (Bekhet & Zauszniewski, 2012). Cohen and Manion (1986) defined triangulation as "an attempt to map out, or explain more fully, the richness and complexity of human behavior by studying it from more than one standpoint" (p. 254). While conducting the analysis, the researcher evaluated eight of the thirteen sections of course, and discovered an oversight in design intended to create a social connection between learners. The online discussion board was not utilized in the manner that the course designer had planned for. Most of the units in the course had a requirement to participate in an online discussion post. There was a prompt from the instructor for the student to create a response, and then students had the option to start a new thread, or they could click on another students' response to read it, think about what was presented, and then interact. One example from a 2016 section, unit 5 had a prompt that stated: "Write a post here about Internet privacy. Do you feel that this kind of information should be made available publicly? How do tools like Spokeo find this kind of information? What should we expect regarding privacy when online? Should there be legal protection for online privacy?" In this section, thirteen students responded to the prompt from the instructor. Twelve out of the thirteen responses had zero replies and zero views. The instructor

viewed their responses and replied to them in a graded forum, but the rest of the class could not see the instructor's interaction. One of the thirteen had two views and one reply. The prompt or instructions did not force students into interacting, rather it was simply answering a question or completing a task, rather than gaining and sharing insight. In another online discussion in that same course the prompt did require replies to at least two of their classmates, and there was a game involved where students posted three examples of appropriate online behaviors and three examples of inappropriate behaviors, and then guessed each other's good and bad behaviors. In one section of the course, this series of discussions began with sixteen original posts and a total of 49 threaded discussion interactions. Thirteen of the sixteen discussions had at least two views and up to eleven. Of the thirteen, all had between one to three replies. Interestingly the instructor graded the message and provided lengthy feedback, privately, to each student. The private feedback likely helped the student having perception of the teacher being involved, but with no other students actually reading or replying, the exercise may have felt pointless or not satisfying to the learners. The replies however, were still very superficial with only a very short listing of numbers trying to guess which examples were appropriate online behavior and which of the original posting suggestions were inappropriate behaviors. So, one possible reason for the negative correlation between social presence and satisfaction could be the lack of importance or relevance. Prior findings suggest that learners do not value spending time and effort on an activity that does not seem relevant to their learning and the expectations are unclear. When the initial post and responses are shallow and brief, it can be interpreted as busy work instead of deep or meaningful learning (Morrison, 2014). The LT 2010 course in this study was conducted in a seven-week summer semester, where students did not spend very much time forming social connections beyond the requirements for the course. Vaughan (2004) found that affective and

open communication needed to be established before a sense of community was perceived by students. Once the group spent time establishing their social presence in the online community, they were able to shift focus to academic pursuits and engage each other, that did not seem to be the case in this study (Vaughan, 2004). The prompt and requirement for responses did not reward deeper thinking. In the second example, there were expectations, but the responses were still insincere. There was no genuine interaction by guessing which three behaviors were good and which were bad. It was a starting point, but in this particular asynchronous online mastery-type course, the students were aware that others were in the course, but just knowing that there are other people enrolled in the same section of the same course did not lead to an increase in satisfaction. The findings of this path uncovered an opportunity for facilitation and possibly design on LT 2010 to be improved. Conducting the triangulation provided greater insight to the possibly cause for the relationship between social presence and satisfaction to be negative.

The third part of research question one was investigating the path between students' perception of cognitive presence and their satisfaction with the course. The path coefficient in this data, although positive, was not significant. The standardized path coefficient was not significant with a $\beta = .16$ ($z = 1.124$, $p = 0.261$). Each of the attributes of the learning experience could create a challenge to engage students cognitively. Being online and asynchronous could create a disconnect that may be mitigated if the course were in person and physically discussing and thinking about the lessons. However, the total direct and indirect effect of cognitive presence on satisfaction was .207, as shown in Table 24. There is not a significance test in SEM to state if the total or indirect effects are significant, but when there is a difference between the direct and total effects, that is typically interpreted as a meaningful or significant effect. The total effect calculation suggests that there is at least a small positive effect

on satisfaction when cognitive presence increases. The skills in this course were introductory and it was possible that the activities, such as learning how they can use their mobile device to access college-related content, did not necessarily increase their interest in the course. Cognitive presence was measured as how useful the discussions were to help learners understand fundamental concepts in the course. If the discussions were not actually being facilitated the way that the course designer intended, then it makes sense that learners did not report a higher level of perceptions of cognitive presence. The findings of this path between cognitive presence and satisfaction could be enhanced by changes to find ways to continue allowing learners to master skills, but also seek activities that may be more challenging if the perception of cognitive presence is to be strengthened.

Of the three paths to course satisfaction, teaching presence was positive, social presence was negative, and cognitive presence was not directly significant. Without conducting this study, the opportunities for improvement would likely have not been uncovered. Reviewing the artifacts of the course shed some light on areas to make some immediate improvements, such as changing the requirements for interacting and attempting to find more meaningful ways to allow learners to cognitively engage in their studies more.

Research question Two

How did students' perception of cognitive and social presence influence their perception of interaction?

The expectation was that all both types of students' perception of presence would have a direct and positive relationship to interaction. The results shown in Figure 20 show that both paths were positive and significant as hypothesized.

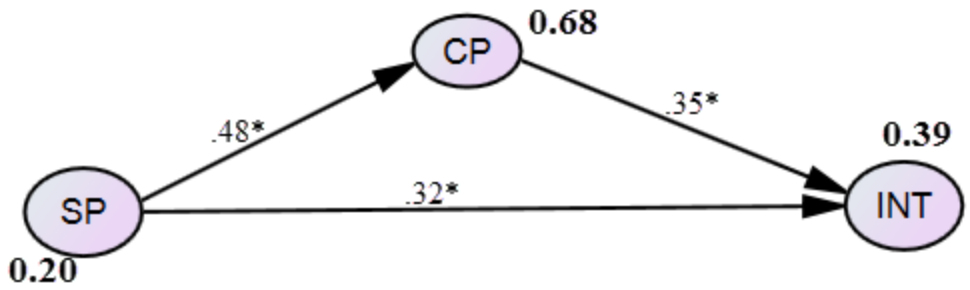

Figure 20. Results of Research Question Two Graphically (partial model)

Social presence had a medium sized direct effect (β = .321, p = .011). The total standardized effect from social presence to interaction was .352, as shown in Table 27. Research question two also estimated the relationship from cognitive presence to interaction to be a medium positive direct effect (β = .352, p = .005). The total effect was no different than the direct effect, so cognitive presence was not a mediating variable for interaction. The results show that both social and cognitive presence had a positive effect on students' perceptions of interaction within the LT 2010 course. All three of the variables depicted in Figure 20 were endogenous variables, meaning that there was a dependence and explanation from the paths that led to it. Endogenous variables include coefficients of multiple correlations or r-squared values to measure the variance of its predictors. The paths leading to interaction in structural model two explained 38.6 percent of the variance (as shown in Table 23).

In research question one, the findings showed that cognitive presence was not a significant predictor of satisfaction, but question two shows that it had a direct and positive relationship with interaction. One of the questions measuring cognitive presence included CP4: "Reflection on course content and discussions helped me understand fundamental concepts in this class" which could justify having a positive relationship with interaction which was measured with questions about relating to others in the class and sharing information.

The total relative variance of interaction explained by jointly contributing variables social presence and cognitive presence had $R^2 = 0.39$ in structural model two and $R^2 = 0.44$ in model three. There is 56-61% of the variance of students' sense of interaction that was not explained by the model. This suggests that the variables are important, but there are also other factors beyond this model that could predict how students perceive interaction in this online asynchronous mastery type course. The hypothesized relationships about how social and cognitive presence would influence interaction were supported by the finding in the SEM analysis for the LT 2010 course.

Research question Three

Did students' perception of interaction have a positive influence on student course satisfaction?

The expectation was that higher levels of interaction would lead to an increase in satisfaction. The results shown in Figure 21 show that, in the LT 2010 course, interaction was not a significant predictor for satisfaction.

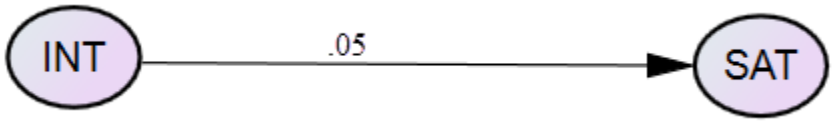

Figure 21. Results of Research Question Three Graphically (partial model)

In research question three the positive direct path from cognitive presence to interaction was, $\beta = .05$ *(z= .588, n=166, p = .556)*. Alternative models did not find any improvement in changing the direction of the path to determine if satisfaction influenced interaction either. This was a surprising finding that indicated that students were not satisfied by interacting in their online course. More investigations will need to be done to determine if this is an important relationship to the outcomes of the course or if this is something that course designers expect to

have a useful relationship between. In the beginning of online education, interacting with other real people was an impressive use of technology that many people enjoyed and found satisfaction in. Today interaction online in ubiquitous and much easier and satisfying outside of a learning management system. The interactions in Learning Technologies 2010 were mostly through text-heavy discussion boards, with many postings not actually having a great deal of interaction. The majority of interactions in the online asynchronous course came from the instructor giving feedback to the student and then most of the time, there was no true feedback loop, the student did something then the instructors provided some sort of feedback, then most of the time that was the end of the interaction. In an online course, the schedule and learning objectives often required that interactions are task based, and once one task is completed or a new learning module is released, the focus is shifted to the next item. The results of this analysis suggest that interaction in the learners' course does not do anything to increase or decrease satisfaction with the course. A limitation of measuring interaction in this study was that it was focused on interacting with other students and their work in the class, interaction could be examined more broadly to include learner-content, learner-teacher, learner-learner, learner-interface, and learner-community (Leh, Kouba, & Davis, 2005). Perhaps another explanation is that the course was asynchronous and online which could impede immediate interactions which has been in other studies, exacerbated by the use of low media communications like text (Chou & Min, 2009; Miranda & Saunders, 2003). The length of time that students were in the course was only seven weeks, which could also be a contributing factor to the not significant path between interaction and satisfaction (Akyol & Garrison, 2008). The purpose of this research question was to determine if interaction, which has been a desirable outcome often linked with engagement and active learning, affected satisfaction, and in this study, it did not. Interaction will remain as a

positive outcome, but the design and implementation may need to be revised if interaction is going to lead to an increase in satisfaction.

Research question Four

Did students' perceptions of teaching presence influence cognitive presence directly and indirectly through social presence as a mediating variable?

The expectation was that the relationships measured would be significantly positive. There have only been a few studies that have measured the relationships using SEM (Garrison et al., 2010; Shea & Bidjerano, 2009). Each of the prior studies found that teaching presence effected cognitive and social presence directly, while social presence influenced cognitive presence. The results of this analysis are shown for structural model two in Figure 22.

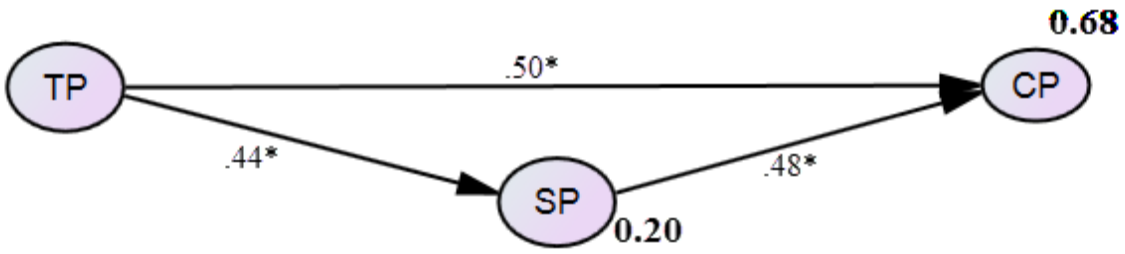

Figure 22. Results of Research Question Four Graphically (partial model)

Teaching presence had a medium sized direct effect on social presence ($\beta = .442$, $p < .000$). As previously displayed in Table 26, the total standardized effect from teaching presence to social presence was no different than the direct effect. Teaching presence had a medium sized direct effect on cognitive presence ($\beta = .495$, $p < .000$). The total standardized effect from teaching presence to cognitive presence was a large effect of .707. The indirect standardized effect, through social presence as a mediating variable was .212, as shown in Table 26. Social presence had a medium sized direct effect on cognitive presence ($\beta = .479$, $p < .000$). There were no indirect effects between social and cognitive presence.

The total relative variance of cognitive presence explained by jointly contributing variables, perceptions of teaching presence and social presence had a $R^2 = 0.68$. The significant relative direct effects suggested that 68 percent of students' perception of cognitive presence was accounted for by perceptions of teaching presence and social presence. The findings in this study with teaching and social presence account for 68 percent of the variance fall very close in line with one of the two prior studies that found 70 percent of the variance explained (Shea & Bidjerano, 2009). The variance of social presence was relatively small with $R^2 = 0.20$. This indicates that only about 20 percent of social presence is predicted by teaching presence. This r-squared value was not reported in other studies, possibly because it was not the primary interest of the investigation.

While testing alternative paths for improved model fit, the same paths presented in Shea & Bidjerano's (2009) study and Garrison et al. (2010) analysis revealed similar results. In this study the two variables accounted for 68 percent of cognitive presence, in the prior studies, not using a mastery-type course, one study found that 70 percent of variance accounted for by the direct path from teaching presence and social presence to cognitive presence (Shea & Bidjerano, 2009) and the other study found 63 percent accounted for (Garrison et al., 2010). Each of the paths in this study were significant just as they were in the prior studies and as they were hypothesized for research question four. A comparison of the path coefficients from this study and the two prior studies examining how the three types of presence directly affect each other is shown in Table 28. The results in the table shows that the findings of this study were consistent with the literature.

Table 28. Path Coefficients Between CoI Presence Variables

	This study (2017)	Shea & Bidjerano (2009)	Garrison, Cleveland-Innes, Fung (2010)
SP-CP	0.48	0.47	0.40
TP-CP	0.44	0.49	0.51
TP-SP	0.50	0.52	0.52
R^2 of CP	.68	.70	.63

Limitations

The data in this analysis came from 166 students taking LT 2010 as an online asynchronous course at a large research university in the Southeastern United States. The study has limitations on how generalizable the findings are to all learners or beyond online courses. Other studies have grouped many different classes into a larger dataset, which aided in generalizability, but there were many effects that could have to do with the subject, instructor, technology, the learners, or a number of other issues. In this study, the data was collected from a much more defined population taking a single mastery-type class on introductory information skills, so caution must be utilized when attempting to generalize the findings of this study to larger populations that are not similar. In Joo et al. (2011) study, the researchers did not describe the course as a mastery-type course, but the achievement in the course was mostly measured by open-book tests and learning progress, which could have been similar.

The entire survey was self-reported, and the questions were from three different previously validated surveys. The previously validated surveys did make it very clear on which survey questions were used to measure each of the latent variables, but this was still a new instrument that was simply based on questions that had worked in prior studies. The new instrument scale was converted to an 8-point Likert scale for uniformity and respondent convenience, but the additional level of detail of transitioning some questions from a 5-point

scale up to an 8-point scale could have introduced differences that this study was not seeking to address.

The analysis was based on students' perceptions, which although very common, especially in social sciences, sometimes participants are not qualified to judge or inaccurately report what would be found if the response was based on an actual observation or measurement. Relying only on perceptions made it conceivable for interpretive errors to be possible (Leech & Onwuegbuzie, 2007). One way to possibly improve a future examination may find ways to include actual log data from the learning management system and possibly achievement as another desirable outcome. The questions included in the analysis are different, but similar in nature to the end-of-semester instructor evaluation that students complete for the university, in the future that data could be compared or included in an analysis. Measuring the frequency of contact and time spent on different tasks that could be categorized into one of the variables from the study would be a less subjective examination.

Last of the limitations of this study was the development of the structural model by trimming some of the variables. Model trimming has been an acceptable procedure to find better fitting or more parsimonious models (Lei & Wu, 2007). When a model is trimmed, there is a possibility for left out variable error to occur. This was hopefully controlled by examining alternative models in the analysis. When the trimming variables, the researcher must make decisions to determine if the retained variables still adequately measure the latent variable (Mauro, 1990). The researcher should determine if the retained variables carry the explanatory values of the trimmed variable. In this study, the assumption was met that the trimmed variables were still accounted for in the retained values. When developing latent variables, the researcher must make decisions on which variables work best and still measure the desired latent variables

being formed. Other studies utilizing SEM have also trimmed their model to fit the data by removing variables (Adams et al., 1992; Anderson & Gerbing, 1982, 1988; Boomsma & Hoogland, 2001; Chin & Todd, 1995; Joo et al., 2011; Kenny, 2014; Lei & Wu, 2007; MacCallum, 1986, 1995; Rindskopf, 1984). To further decide if this was an acceptable method to develop the model, experts from *The Structural Equation Modeling Discussion Network* were consulted and two experts in the method of SEM, one from New York and the other from Amsterdam, agreed that the methods utilized to develop the model in this study were, although not perfect, found to be acceptable (Rigdon & Ferguson 2017).

Future Research

This study produced two good-fitting models with slightly different outcomes. If selecting the best model, models three was superior to model two in fit, but model two was still a good fitting model with greater explanatory value. The second model was selected as the most appropriate solution to measure the data in this study. Adding in non-perception based data could provide new findings or strengthen the findings in this research. The length of time that the course lasted may be a variable to change in future studies as well as a deeper look into how interaction should be planned, implemented, and valued as a positive outcome for the learning experience.

The Learning Technologies 2010 course studied in this analysis lasted seven weeks over a summer semester, instead of sixteen weeks, which is the length of a full fall or spring semester. In a study investigating the development of the CoI over time, results showed that the longer the course went on, the more that group cohesion and interaction began to form (Akyol & Garrison, 2008). Conducting this same type of study on a full-length semester could provide different results. Measuring students' perceptions along with data collection throughout a semester may

be able to provide a deeper understanding of how time affects students' perceptions of presence, interaction, and satisfaction.

The findings of this study may suggest that students did not find satisfaction in work together in online asynchronous courses. Conducting a search for online learning and group work, reveals dozens of papers and methods of how to get learners to work in groups. Educators have often found themselves coercing learners to work together because it is a useful skill for today's economy, new flat connected world, plus findings that group work increases learning and retention (Mannix & Neale, 2005; Tinto, 1998). There has been a great bit of research that focuses on the positive outcomes by compelling the students to cooperate, but new research is finding that students report frustration with group work, especially in online asynchronous courses, due to communication difficulties, students not feeling like they are equally contributing, lack of shared goals, imbalance level of commitment and quality, and excess time required to work in a group (Capdeferro & Romero, 2012). One of the challenges with interaction in an online asynchronous course is that there is an assumption made that the students have a shared goal, are ready to engage, and that they have the knowledge and competencies to contribute in group work (Haynie, 2014). If learners do not meet these assumptions, then it could have a negative impact on interaction. If there was not a shared goal or commitment, then the interaction could have felt unnecessary. Future research may investigate how to harness the known benefits of group work online and uncover a better understanding of the frustrating components, or determine if learners can get the same types of advantages of collaborating without all of the negative associations that seem to be increasingly reported in blogs, news articles, social media, and magazines. A study on what makes interaction and connectedness feel

organic or genuine may shed additional light on how to make the learning experiences and skills of collaborating more satisfying.

Other opportunities for future research that were missing in the literature review were examining the variables in this study on younger populations to determine the viability of the model. More K-12 students are taking online courses, yet they are not studied as often, possibly because of studying a more vulnerable population or that in the past this was a relatively small population. This study was conducted only using the Desire2Learn learning management system. Future research may also center on examining how the LMS can affect students' perceptions.

Conclusion

This study examined relationships between teaching presence, social presence, cognitive presence, interaction, and satisfaction in an online asynchronous mastery-type computer skills course using SEM. Each of the paths in the final structural models were important to the research. All except one of the hypothesized paths were supported by the findings. The path from interaction to satisfaction was not significant, yet it was expected to be. The path from social presence to satisfaction did not have an expectation to be positive or negative based on the conflicted literature. Estimating the path in this study found that there was a significant negative influence on satisfaction as students' perception of social presence increased.

When developing the structural models, each path was carefully analyzed to determine if the directionality was correct and if the paths could be changed or deleted. Omitted paths between variables such as teaching presence to interaction was not included because there was no expectation that the relationship would have any effect. Other researchers faced with this challenge have removed an important path from their model, but still described the results, such

as Joo et al. (2011), when they found that social presence did not have a significant positive effect on learner satisfaction. Removing or respecifying a path may change the other paths and results of the analysis, in this study the models evaluated all important paths, even though some calculated to not be significant, it was still important to add to the literature that in this case, the relationship was measured, but not significant.

With this study, the stakeholders of this course will be able to evaluate the results and find areas to enhance the course. Another evaluation of the course should be completed to understand if the enhancements implemented as a result of this study, had any effect on the learners' perceptions in the course. Social presence and interaction in the course are the main areas that should be targeted for enhancement. Teaching presence should be evaluated to gain a better understanding on the design and facilitation that was working very well as designed. The decision makers must try to understand how to keep the positive aspects of the course such as the high level of interaction between the teacher and the learner while also determining what should be done with interactions. One possible solution is that interaction is not a goal of the course and therefore it does not matter if the perception of interaction has no influence on course satisfaction. Another solution is that there is a problem with the way that interaction has been facilitated, there needs to be more focus on finding a way to have students gain value by interacting with each other.

This study adds to the existing body of literature on the CoI model as a framework to measure students' perceptions of a satisfying learning experience through the development of the three types of presence, especially suited for distance learning. The directional relationships between the three types of presence were in line with two prior studies to strengthen the literature (Garrison et al., 2010; Shea & Bidjerano, 2009). The results of this study can help improve this

specific Learning Technologies 2010 course and other learning experiences like it, with a new understanding about the relationships between presence, interaction, and satisfaction. There were some limitations and areas for future research that can be utilized to continue to increase the knowledge of how mastery-type asynchronous online courses can bring about a myriad of desirable outcomes, including learners being satisfied with their experiences in a course. As the results of this study are reviewed, course designers and teachers will have a better understanding of how particular activities actually manifest in students' perceptions. This study can inform future design and facilitation of online education for LT 2010 and other similar courses.

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APPENDICES

Appendix A. Course Syllabus

LT 2010:
Computer Skills for the Information Age
Summer 2014
CRN: 52528

Syllabus*

*** The course syllabus provides a general plan for the course; deviations may be necessary.**

Location: Online
Instructor: Professor
Email: email@gsu.edu
Office Hours: By appointment

Course Goal and Objectives

This is a completely online course that is designed to help you help yourself on the road to becoming a more efficient and more confident technology user, especially when it comes to your university studies.

After completing the course, you should be able to:

- Demonstrate a functional knowledge of basic information-age terminology and concepts relevant to university and professional settings;
- Fearlessly and confidently use information technology to enhance your work in a university or job setting;
- Navigate your technology-enhanced university studies in a safe and ethical manner;
- Demonstrate competence in using productivity software to process, manage, and present information; and
- Demonstrate an entry-level proficiency in designing, developing, and maintaining a personal Web presence.

Delivery Mode

This course will be conducted asynchronously and entirely online. That means we will not meet live as a group or in person. You will complete activities and submit assignments within given time frames at a rate of about one assignment per week. All assignments can be found, and should be turned in via **Desire2Learn** unless otherwise specified.

Textbook

Required book: You ***must*** Purchase the book, *Computer Skills for the Information Age: An Early College Students' Primer* ISBN: 978-1-4652-0891-0. You can purchase a hard copy online (it may take a few days to be shipped to you): https://www.kendallhunt.com/store-product.aspx?id=36354

OR

You can also purchase an eBook version. An eBook version is immediately available after you make your purchase (you will need a personal computer or tablet on which to view the eBook, however): https://www.kendallhunt.com/store-product.aspx?id=41640

Assessment

You will need to complete 13 course assignments. The total of your assignment grades adds up to 100 possible points you can earn. The course grading scale is below.

A+ 98-100

A	94-97	B+	88-89	B-	80-83	C	74-77	D+	68-69	D-	60-63
A-	90-93	B	84-87	C+	78-79	C-	70-73	D	64-67	F	0-59

Assignment availability and due dates and times are listed on your course schedule.

- Detailed descriptions of each assignment will be made available to you within Desire2Learn at 1AM on the date specified in your schedule below.
- All assignments must be submitted within Desire2Learn on or before the due date specified on your schedule by 11:59 PM.
- **It is your responsibility to submit assignments on time.** If you encounter any issues while taking this course, you will need to contact the instructor instead of simply disappearing.
- **The submission box within Desire2Learn closes after the specified due date and time, at which point you lose your opportunity to receive full credit.** For every day that your assignment is late, one point will be deducted.

Course Schedule

Activity	Available	Topic	Assignment Due Date
Activity 1 (8pts)	6/09	Web Communications	6/12
Activity 2 (7pts)	6/12	Information Literacy 1	6/16
Activity 3 (7pts)	6/16	Information Literacy 2	6/19
Activity 4 (8pts)	6/19	Word Processing 1	6/23
Activity 5 (8pts)	6/23	Word Processing 2	6/26
Activity 6 (7pts)	6/26	Cyber Ethics 1	6/30

Activity 7 (7pts)	6/30	Cyber Ethics 2	7/3
Activity 8 (8pts)	7/3	Spreadsheets 1	7/7
Activity 9 (8pts)	7/7	Spreadsheets 2	7/10
Activity 10 (7pts)	7/10	Visual Design	7/14
Activity 11 (8pts)	7/14	Digital Presentations	7/17
Activity 12 (8pts)	7/17	Web Design and Development 1	7/21
Activity 13 (9pts)	7/21	Web Design and Development 2	7/28*

*You have been allotted extra time to do a thorough job on this assignment.

Course Policies

1. Students are expected to **submit assignments on time**.
2. Students are expected to **conduct themselves in a professional manner**. Professionalism includes, but is not limited to, the following behaviors:
    - Participating in interactions and class activities in a positive manner;
    - Treating classmates, colleagues, and the instructor with respect in and out of the classroom;
    - Producing original work – it is serious offense to submit work that includes plagiarism, academic fraud, or has been previously turned in for another course, including courses outside of GSU*; and
    - Producing work (especially public work such as web materials) that is not harmful or offensive to others. For more details on this, please see the GSU student code of conduct.

    *Please see the GSU Policy on Academic Honesty (section 409) here: http://www2.gsu.edu/~wwwfhb/sec400.html
1. **Students with Disabilities:** Pursuant to the provisions of Section 504 of the Rehabilitation Act and the Americans with Disabilities Act, it is the responsibility of the instructor to make reasonable accommodations for students who have disabilities. If any conditions are present which influence the ability to learn or to participate in class activities, it is the student's responsibility to register with the Office of Disability Services at Georgia State before an instructor can modify instruction or expectations. The Office of Disability Services may be contacted at 404-413-1560. Any student with a disability who may require special accommodations is requested to make an appointment with the instructor at the beginning of the semester. Students must self-identify so that arrangements can be made according to the University's policies and guidelines provided by the Office of Disability Services.
2. **Hardship withdrawals** may be granted to students who experience non-academic emergencies that interfere or prevent the completion of their coursework. Typically,

hardships (non-academic emergencies) tend to fall into one of three categories: medical, personal, and financial. Georgia State University's Office of the Dean of Students and/or the Hardship Withdrawal Committee are very selective in granting partial hardship withdrawals. Students are solely responsible for the hardship withdrawal application. For more information, see http://www2.gsu.edu/~wwwdos/hardship.html

3. **Student Evaluation of Instruction:** Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take the time to fill out the online course evaluation.

Appendix B. Original Survey Items

Appendix B.1 Community of Inquiry Questionnaire

CoI QUESTIONNAIRE

	1	2	3	4	5	6	7	8
Teaching Presence	Very Strongly Disagree	Strongly disagree	Disagree	Barely Disagree	Barely Agree	Agree	Strongly Agree	Very Strongly Agree
The instructor clearly communicated important course topics.								
The instructor clearly communicated important course goals.								
The instructor clearly communicated important due dates/time frames for learning activities.								
The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.								
The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.								
The instructor helped to keep course participants engaged and participating in productive dialogue.								
The instructor helped keep the course participants on task in a way that helped me to learn.								
The instructor encouraged course participants to explore new concepts in this course.								
Instructor actions reinforced the development of a sense of community among course participants.								
The instructor helped to focus discussion on relevant issues in a way that helped me to learn.								
The instructor provided feedback that helped me understand my strengths and weaknesses.								
The instructor provided feedback in a timely fashion.								
Social Presence								
Getting to know other course participants gave me a sense of belonging in the course.								

I was able to form distinct impressions of some course participants.								
Online or web-based communication is an excellent medium for social interaction.								
I felt comfortable conversing through the online medium.								
I felt comfortable participating in the course discussions.								
I felt comfortable interacting with other course participants.								
I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.								
I felt that my point of view was acknowledged by other course participants.								
Online discussions help me to develop a sense of collaboration.								
Cognitive Presence								
Problems posed increased my interest in course issues.								
Course activities piqued my curiosity.								
I felt motivated to explore content related questions.								
I utilized a variety of information sources to explore problems posed in this course.								
Brainstorming and finding relevant information helped me resolve content related questions.								
Online discussions were valuable in helping me appreciate different perspectives.								
Combining new information helped me answer questions raised in course activities.								
Learning activities helped me construct explanations/solutions.								
Reflection on course content and discussions helped me understand fundamental concepts in this class.								
I can describe ways to test and apply the knowledge created in this course.								
I have developed solutions to course problems that can be applied in practice.								

I can apply the knowledge created in this course to my work or other non-class related activities.								
Satisfaction								
Overall, I was satisfied with this course								
Learning								
I learned much in this course.								

Appendix B.2 Noel-Levitz Priorities Survey for Online Learners™ (PSOL)

Noel-Levitz Priorities Survey for Online Learners™ (PSOL)								
Course Instructor								
Age								
Gender	Male		Female					
Approximate number of college credits completed								
Online Experience								
This was my first online course								
I have taken two online courses including this course								
I have taken more than two online courses.								
Your responses to the following questions should reflect your online experience overall for this particular course. For the following questions please circle the number which best reflects your opinion in the answer column to the left of the question								
	1	2	3	4	5	6	7	8
	Very Strongly Disagree	Strongly disagree	Disagree	Barely Disagree	Barely Agree	Agree	Strongly Agree	Very Strongly Agree
Faculty are responsive to student needs.								
The quality of online instruction is excellent.								
This institution responds quickly when I request information.								
The frequency of student and instructor interactions is adequate.								
Student-to-student collaborations are valuable to me.								

Appendix B.3 Distance Education Learning Environments Survey

DISTANCE EDUCATION LEARNING ENVIRONMENTS SURVEY								
	1	2	3	4	5	6	7	8
In this class... .	Very Strongly Disagree	Strongly disagree	Disagree	Barely Disagree	Barely Agree	Agree	Strongly Agree	Very Strongly Agree
Student interaction and collaboration								
I work with others.								
I relate my work to others' work.								
I share information with other students.								
I discuss my ideas with other students.								
I collaborate with other students in the class.								
Group work is a part of my activities.								
Active learning								
I explore my own strategies for learning.								
I seek my own answers.								
I solve my own problems.								

Appendix C. Informed Consent

Georgia State University
Department of Learning Technologies
INFORMED CONSENT

Title: An Analysis of Presence in an Asynchronous Online University Course Using Structural Equation Modeling

Principal Investigators: Dr. Brendan Calandra
Johnathan Yerby (Ph.D. Candidate)

I. Purpose:

You are invited to participate in a research study. The purpose of the study is to investigate instructional design methods and students' perception of teacher, social, and cognitive presence. The study seeks to determine if higher levels of student perceived presence correlates with higher levels of achievement and retention. You are invited to participate because you are a student in an online asynchronous course. A total of 150 participants will be recruited for this study from five sections of the LT 2010 online asynchronous course, but due to participant attrition the final number of participants could be less than 150. Participation will require five to twenty minutes of your time over the final two weeks of the summer 2014, 2015 or 2016 semester.

II. Procedures:

If you decide to participate, you will be asked to complete an online survey within the Desire2Learn online course management system. You will not have any additional requirements to interact with any additional people by volunteering to participate in this study. The survey will be administered one time, online, and should take approximately five to twenty minutes to complete.

III. Risks:

In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:

Participation in this study may benefit you personally. You will be contributing to knowledge about the design of future online asynchronous courses that you and future students may take. After we have finished data collection, we also can provide you with more detailed information about the purposes of the study and the research findings.

The results of the study will be used for scholarly purposes. The results from the study will be presented in educational settings and at professional conferences, and the results might be published in a professional journal in the field of instructional technology.

V. Voluntary Participation and Withdrawal:

Participation in research is voluntary. You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may stop participating at any time. There is no penalty for not completing the survey. If you do not click on the "submit" button at the end of the survey, your answers and participation will not be recorded.

VI. Confidentiality:

We will keep your records private to the extent allowed by law. Dr. B. Calandra and J. Yerby (Ph.D. Candidate) will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board, the Office for Human Research Protection (OHRP). We will not use your name on study records. The information you provide will be stored in the Desire2Learn course management

system that is managed by the University. Your name and other facts that might point to you will not appear when we present this study or publish its results. The findings will be summarized and reported in group form. You will not be identified personally.

VII. Contact Persons:

Contact Dr. B. Calandra and J. Yerby (Ph.D. Candidate) at 478-471-2809 or jyerby1@student.gsu.edu if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, offer input, obtain information, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

VIII. Copy of Consent Form to Subject:

You may print or save a copy of this consent form to keep.

If you agree to participate in this research, please click the CONTINUE button. If you do not agree to participate in this research you may exit now.

< CONTINUE>

Appendix D. Pilot Study

Exploratory analysis of presence in an asynchronous online undergraduate course using structural equation modeling

Author-Y [a]*, Author -C [b]

[a] Dept- Univ –State
[b] Dept- Univ –State

ARTICLE INFO

Keywords:
Community of Inquiry
online learning
presence
course satisfaction

ABSTRACT

This study sought to explore the effects of teacher presence and social presence in an online asynchronous course on students' interactions and students' course satisfaction. Two years of data were collected using an existing validated survey based on the community of inquiry (CoI) model (Arbaugh et al., 2008; D. R. Garrison, Anderson, & Archer, 2000), The Noel-Levitz Priorities Survey for Online Learners (Ruffalo Noel Levitz, 2016) and the Distance Education Learning Environments Survey (S. L. Walker & B. J. Fraser, 2005). Results were estimated using confirmatory factor analysis and structural equation modeling (Shea & Bidjerano, 2009). The study demonstrated strong positive relationships from teacher presence on the other variables measured, but social presence only showed to effect interaction. The effects for interaction and social presence were not significant. This study is meant to add to the literature on asynchronous online learning, but also serve as a model for future research and development.

1. Introduction and problem statement

A recent report revealed that more than 7.1 million learners have taken one or more online courses, and the number has likely increased by the time this article will be read (Allen & Seaman, 2014). Although there has also been a notable increase in administrative confidence in online course delivery, some barriers to successful implementation of quality online teaching and learning still persist (Allen & Seaman, 2014; Jones, 2013; K. Moore, Bartkovich, Fetzner, & Ison, 2003). For example, retention of students in online courses is a growing concern that colleges and governing bodies are aiming to improve (Allen & Seaman, 2014; Jones, 2013; Moore, Bartkovich, Fetzner, & Ison, 2003). Moreover, student course satisfaction has been shown to be highly correlated with student retention in numerous studies (Aitken, 1982; DeShields Jr, Kara, & Kaynak, 2005; Herbert, 2006; Nguyen & LeBlanc, 2001; Ranaweera & Prabhu, 2003; Rosenstein, 2002).

In the past, there has been a tendency for some institutions of higher education to be lured by financial and logistical advantages of online learning, such as conserving classroom space and providing access to students anytime anyplace, but without making the proper investments in the time, work, planning, and instructional design expertise necessary to make online courses effective (Ouzts, 2006). This has led to hasty and often ineffective designs that include strategies like posting copious written course materials, lengthy video or audio recorded lectures, and long tests, but without providing opportunities for meaningful interaction. Wimbish (2001) described students in such a course feeling, isolated from faculty and peers, and lost in cyberspace. In other words these students were not satisfied, and thus potentially at risk of dropping the course.

While some online courses like the one described above tend to lack student-student and student-instructor interaction, some evidence from the literature shows that a sense of community can help mitigate the potential for online learners to feel disconnected, and that this community *can* be created in an online environment (Rovai, 2002; Thompson & MacDonald, 2005; Zydney, deNoyelles, & Seo, 2012). Moreover, as online learning continues to evolve and instructors continue to seek the best methods to engage learners, there has been a paradigm shift towards collaborative technologies that encourage and even force interaction among the community of learners. Shea (2006) listed three of these changes that include: a) a philosophical shift from objectivism to more constructivist based teaching, b) a theoretical change from behaviorism to socio-cognitive interpretations of education, and c) more teachers moving beyond direct instruction to include more facilitation of collaborative learning in their courses.

In order to extend this line of inquiry, the current study sought to examine how students' perceived sense of community in an asynchronous online course affected both their perceived levels of interaction and their course satisfaction. Our definition of community is based on the well-known and heavily cited community of inquiry framework (CoI) first developed by Garrison, Archer, & Anderson in 2000. CoI focuses on the process of creating a deep and meaningful learning experience through the interdependent elements of teacher, social, and cognitive presence (Akyol, 2012; Akyol & Garrison, 2008).

2. Literature Review

2.1 Teacher presence

Teacher presence has shown to be a significant determinant to student course satisfaction, perceived learning, and sense of community (R. Garrison & Arbaugh, 2007). Teacher immediacy behaviors and related learning outcomes have been well researched in the face-to-face environment (Christophel, 1990; Gorham, 1988; Madden & Carli, 1981). These immediacy behaviors include verbal actions such as giving praise, feedback, soliciting opinions from students and non-verbal interactions such as eye contact, facial expressions, and gestures. The literature shows that developing teacher immediacy helps to lessen the psychological distance between instructors and students, which is positively correlated with greater learning (Chesebro & McCroskey, 2000; Christophel, 1990; Gorham, 1988; Kelley & Gorham, 1988). In Kelley's 1988 paper the authors continue on to give a definition of 'greater learning' as increased perceptions of having learned from the course (LeFebvre & Allen, 2014). Teacher presence in Garrison, Anderson, & Archer's (2000) original Community of Inquiry (CoI) model includes practical actions, similar to teacher immediacy behaviors, which instructors can objectively measure or complete such as: stating topics and goals, clearly explaining due dates for assessments, engaging learners in dialog, providing timely feedback to students, and supporting open and purposeful communication. Taking the time to design a course with teacher immediacy and teacher presence built into the design could correlate with several other desirable outcomes such as more satisfied learners and an increased perception of learning from the student.

2.2 Social presence

Social presence, as defined in the CoI model, allows learners to project their personal characteristics into an online course community, thereby conveying that each person in the class is a real and present person. Research has shown that a feeling of social presence can increase student course satisfaction as well as positive student perceptions of the learning experience (Joo, Lim, & Kim, 2011; A. Moore, Masterson, Christophel, & Shea, 1996; Schutt, Allen, & Laumakis, 2009). What's more, creating social presence in online courses is much more possible today with modern learning management systems and uses of internet technologies that allow users to not only consume, but also contribute. Having tools available within a LMS or on the web does not automatically mean that students will use them, there has to be some sort of guide, teaching, or incentive to use the tools. The instructor or designer must use tools for education's sake, not just the sake of using the technology. Instructional design should direct designers and instructors use of technologies, poor design with the best socially interactive technology alone will not obscure poor design (Horton, 2011). Online courses with increased levels of teacher and social presence are those in which the instructor transcends the role of being a lecturer to becoming a facilitator, while students become more active participants (Harasim, Hiltz, Teles, & Turoff, 1995). Online teachers aiming to increase social presence in an asynchronous course must pay careful attention to the following three criteria: 1. The course must include activities that learners are motivated to participate in with the appropriate learning technologies that assist rather than hinder interaction. 2. The professor in the online course must develop meaningful activities in which learners develop a sense of realness with the other students in their class by collaborating or discussing with. 3. The asynchronous class must still have accountability and interactions from the professor to the student.

2.3 Cognitive presence

Cognitive presence (CP) is characterized by learners developing interest in a course, and by the desire to explore related to what they are learning. Gaining new perspectives on knowledge and skills that may be applied to the student's life or real-world problems is also a part of cognitive presence (Garrison, Anderson, & Archer, 2000). Some cognitive theories are based on the idea that academic learning is mostly a cognitive activity and a student's motivation is heavily influenced by what leaners perceive as important, and what they believe they can accomplish (McMillan & Forsyth, 1991). Taking careful attention to the three recommendations should have a significant positive impact on social presence, but just because students are interacting it does not guarantee that learners are cognitively engaged in an academically meaningful manner (R. Garrison & Cleveland-Innes, 2005). Garrison and Cleveland-Innes refer to

an 1998 article by Kanuka and Anderson in which learners are using discussion tools robustly, but the discussions are either just social in nature or on a very low level of actually thinking about the course. Achieving higher perceptions of cognitive presence is often the most difficult to achieve because it requires instructors to create activities that are structured in design and led by either the professor or other learners in the class that will mean something to all of the students in the class (R. Garrison, 2011). There is a need for discourse and clear instructions on expectations of length, content, and timeliness. Probes to learners must be carefully constructed to be engaging, interesting to the learners, challenging, and direct attention from a person must monitor and spur on appropriate discourse to achieve improved levels of cognitive presence.

3. Research questions

By increasing or providing a richer sense of presence in this way, the goal is to increase course quality, which should have a positive correlation with student achievement and retention. The current study hence sought to determine how teacher presence (TP) and social presence (SP) as defined in the CoI model correlated with student perceptions of interaction, collaboration and course satisfaction in an online asynchronous course.

The hypotheses were as follows:

- H1: Increase in students' perception of TP and SP has a positive direct effect on student course satisfaction
- H2: Increase in students' perception of TP and SP has a positive effect on student perception of interaction and collaboration
- H3: Increase in students' perception of interaction and collaboration has a positive effect on student course satisfaction

4. Method

The purpose of this study was to determine the direct and indirect correlations between student perceptions of teacher presence, social presence, interaction, and satisfaction in an asynchronous online course.

4.1 Context

Participants for the study were undergraduate university students taking a completely online a course designed to enable students to be more efficient, competent, and confident users of technological resources, specifically related to their academic career. University freshman level students from a variety of academic majors and prior knowledge typically take the 3 credit hour course. The course is delivered asynchronously using a university supported learning management system that enables several interactive functions such as: chat, email, discussion boards, assignment drop boxes with feedback options, and various social media plugins. Students in the course are given 15 hands on course activities to complete with detailed instructions provided for each activity, and multiple opportunities for detailed instructor feedback and peer interaction. The scheduling and pacing of the course are intentional in order to keep students and the instructor present and communicating throughout the semester. This course was also intentionally designed based on mastery learning. As an example, if a student submits unsatisfactory work and/or has difficulties with a particular assessment, the instructor often contacts the student and offers feedback and guidance on how the student can improve their submission. It is expected, however, that students put forth the effort required to complete their assignments, and in a timely fashion. Because of the fact that there are no face-to-face meetings, the researchers deemed it of great importance to gauge student perceptions of presence, which one might assume is an element of an asynchronous online course that could be lacking.

4.2 Participants

One hundred thirty five undergraduate students from a variety of majors at a large urban research university in the southeastern United States who were enrolled in the course in question were asked to complete the survey. Participants were recruited from eight sections of the course that contained between 6 to 23 students per section over a time period of two years. All participants in this study had self-selected to take the course. The sample showed mixed levels of participants' prior experience with online courses. See Table 1. Table 2 shows that most of the participants expected to do well in the course.

Table 1. Prior experience taking online courses

This was my first online course	37.4%
I have taken two online courses including this course.	27.3
I have taken 3-5 online courses, including this course.	27.3
I have taken more than 5 online courses, including this course.	8.0

Table 2. Expected grade in the online course

A	78.8%
B	18.2
C	2
D	1
F	0

Due to privacy-related issues, limited demographic data for each participant in our sample was

collected. However, general characteristics of the undergraduate population at the university in question around the time this study was conducted are available in Table 3. There were no missing values, univariate, or multivariate outliers from the 99 usable responses. Response rate for the survey was 73.3%.

Table 3. Characteristics of Undergraduate Population at the time this study was conducted

Demographic	number	%
Gender		
Women	14,186	59%
Men	9,913	41%
Race/Ethnicity		
American Indian / Alaskan Native	53	<1%
Asian	2,503	11%
African American / Black	9,117	38%
Hispanic	1,835	8%
Hawaiian or Other Pacific Islander	49	<1%
White	8,740	36%
Two or More Races	831	3%
International	429	2%

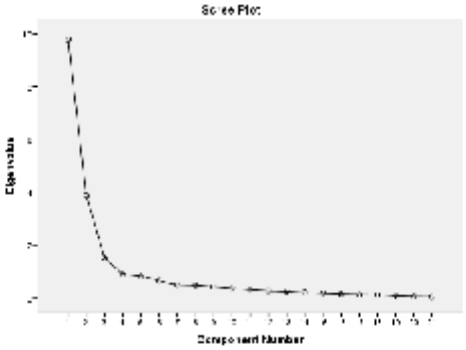
4.3 Instrument

A modification of three previously validated instruments was used in this study to assess students' perceptions of teacher presence, social presence, interaction and satisfaction. The instruments included the Noel-Levitz Priorities Survey for Online Learners™ (PSOL), Distance Education Learning Environments Survey, and the CoI Questionnaire (Arbaugh et al., 2008; D. R. Garrison et al., 2000; Noel-Levitz, 2014 ; Ruffalo Noel Levitz, 2016; S. Walker & B. Fraser, 2005). A confirmatory factor analysis was used to determine whether the questions designed to measure each of the variables loaded correctly into each category. Initially, the instrument consisted of 30 survey items using a Likert scale of 1 to 8, and 4 demographic questions. Prior to conducting the factor analysis, variables related to active learning and cognitive presence were dropped because they were no longer relevant to this study. The final factor analysis covered 21 questions using the Likert scale of 1 to 8. The higher the response meant that the student perception was more agreeable to the statements. There were no reverse-scored questions.

5. Analysis and Results

A factor analysis was conducted using SPSS version 22. Structural equation model development was carried out using Amos 22.0. The principal component analysis used Varimax rotation with Kaiser Normalization produced a four-factor solution as shown in the scree plot Figure 1 and Table 4.

Figure 1. Scree plot of the eigenvalues



The four-factor solution accounted for 46.6% of the variance in the data. To ensure that the variables were not measuring the same thing, a Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) score was calculated in SPSS as 0.863. In order to support the notion that a factor analysis was appropriate, Bartlett's Test of Sphericity was used and produced 0.0. Structural Equation Modeling can be conducted with as few as 5 cases per parameter, so this sample size, n = 99, is sufficient to proceed with analysis (Bentler & Chou, 1987).

Through factor loadings, optimizing model fit, and following the theoretical a priori models and modification indices recommended by Amos 22.0, ten items were used to form the four latent variables of Teacher Presence (TP2 & TP3), Social Presence (SP3 & SP4), Interaction and Collaboration (INT2 & INT4), and Satisfaction (SAT1, SAT2, SAT3, & SAT4). Maximum Likelihood Estimation was used to perform the structural equation model measurement.

5

Table 4. Factor analysis component matrix

Rotated Component Matrix[a]

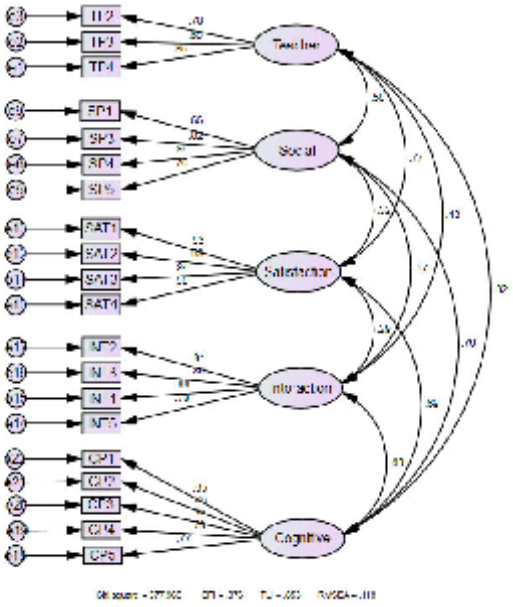
	Component			
	1	2	3	4
TP1				.709
TP2				.769
TP3	.989			.585
TP4				.887
TP5	.887			
SP1		.962		
SP2		.841		
SP3		.521		
SP4		.888		
SP5		.572		
SAT1	.877			
SAT2	.985			.575
SAT3	.743			
SAT4	.772			
SAT5		.537		
INT1		.807	.649	
INT2			.775	
INT3			.844	
INT4			.831	
INT5			.801	
CP5	.884			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

In structural equation modeling with latent variables, the researcher must map variables onto theoretical constructs. The measurement model, which comes before the structural equation model with path analysis, is first estimated and the correlations or covariance matrix between factors then serves as input to estimate the structural coefficients between constructs or latent variables. Before a researcher can proceed with a structural model, the measurement model must be established and show that the data fits, using fit statistics provided by the analysis (Kenny, 2014). The measurement model examines the relationship between the latent variables and the items that are intended to make-up the latent variables, the structural model that follows is the relationship between the latent variables. If the measurement model doesn't measure what the researcher is seeking to measure, then the structural model is meaningless.

Because the survey in this study asked questions that addressed all elements of the CoI framework, the initial measurement model included teacher presence (TP), social presence (SP), and cognitive presence (CP). This version of the model did show factors loading adequately with .65 being the smallest loading in figure 2 and .54 being the lowest loading in figure 3, but in each case the model fit needed improvement. Although there was a nearly acceptable fit (CFI = 876; RMSEA = .118), it was not adequate to proceed. The researchers next considered narrowing the scope of what the data from this mastery course could measure and ran a second measurement model without cognitive presence.

Figure 2. Initial measurement model



Based on modification indices recommended by Amos 22.0, error terms for SAT1 and TP5 were allowed to co-vary, However, The loading for the second measurement model with co-varying error terms was still not good fit (CFI = .844, RMSEA = .131).

6

Figure 3. Second Measurement Model without CP

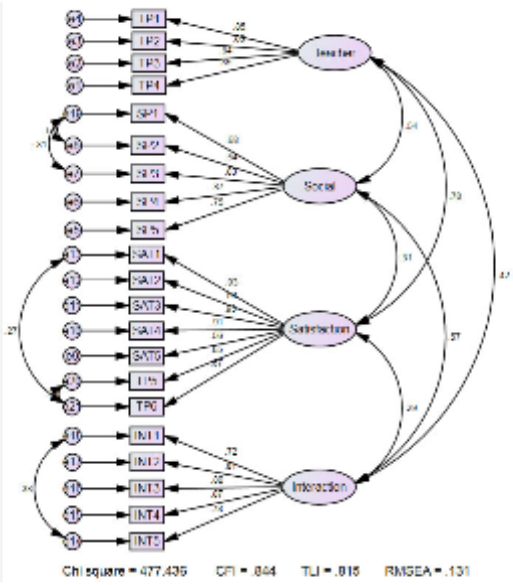
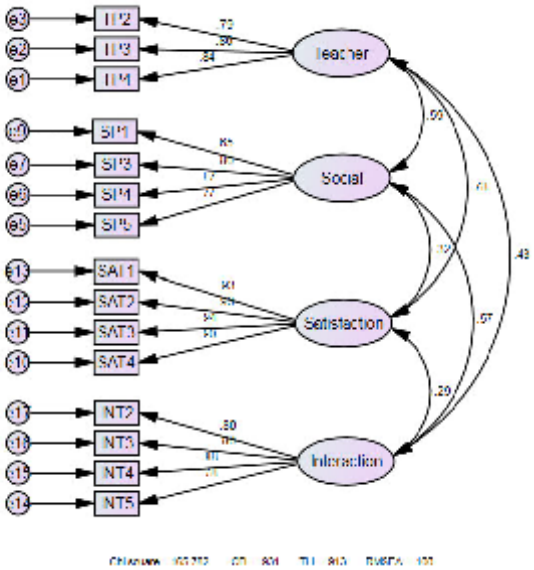


Figure 4. Revised Measurement model



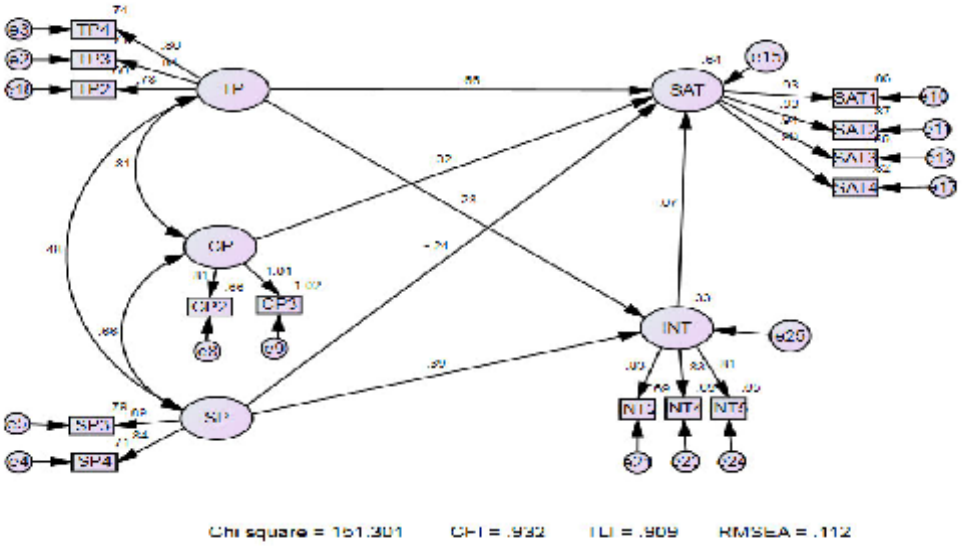
Next the variables TP5 and TP6, which were loading into Satisfaction instead of Teacher Presence as they were intended, were dropped from the model. The question for TP5 was "The instructor provided feedback that helped me understand my strengths and weaknesses." The question for TP6 was "The instructor provided feedback in a timely fashion." In the original Community of Inquiry Questionnaire these two questions were listed in the category of Teaching Presence as two of twelve total questions thought to measure Teaching Presence. In this study the data showed that these two questions had a higher loading with learner satisfaction, which is a variable that was measured with a single question, "Overall, I was satisfied with this course," the original CoI Questionnaire (Arbaugh et al., 2008; D. R. Garrison et al., 2000; Swan et al., 2008). In this study the learner satisfaction questions were garnered from the Noel-Levitz Priorities Survey for Online Learners (Noel-Levitz, 2014). Combining multiple previously validated instruments in this study showed that two questions that were intended to measure one thing (teacher presence) actually measured another better (learner satisfaction). The revised model shown in Figure 4 shows an acceptable fit, (CFI = .931, RMSEA = .100) which allowed the researcher to proceed with structural equation modeling based on the interpretation of the literature.

The structural model analysis was conducted using the variables that were carried forward from the measurement model. In the results this paper discusses three of the proposed models and explains how the researchers arrived at the final model. The first structural model used 14 of the 21 measures to create a structural model using five latent variables of, Teaching, Social, and Cognitive Presence as exogenous independent variables and Interaction and Collaboration and Satisfaction as the endogenous variables that the researchers were attempting to measure. This first structural model shown below in figure 5, did not have the best fit (CFI = .932; RMSEA = .112) so the researchers continued examining relationships that could be determined with the data from this study.

The modifications possible using the first structural model shown in figure 5 had several recommendations from Amos 22.0 for items in cognitive presence to cross-load onto other variables or to have the error terms co-vary with other latent variable error terms that simply did not make logical sense. The modification indices recommended several items that were shown to load higher into cognitive presence to have covariance to other variables. It would not make sense to have measures from cognitive presence to co-vary with other latent variables such as interaction or satisfaction, so the researchers conducted further analysis without the inclusion of cognitive presence.

7

Figure 5. First Structural Model with 17 measures



The second structural model, shown in figure 6, using 17 of the 21 measures related to the four latent variables produced a model with fit that was still beyond the commonly acceptable fit and worse than the measurement model (CFI = .894, RMSEA = .116). The second model excluded cognitive presence as one of the latent variables since it had so many issues in the first structural model. The modifications possible and recommended in the second structural model gave the researchers possibilities to improve fit and be able to produce a model that would be appropriate to use path analysis and structural equation modeling with the data collected in this study.

In the models TP is teacher presence, SP is social, CP is cognitive presence, INT is interaction and collaboration, and SAT is learner's satisfaction.

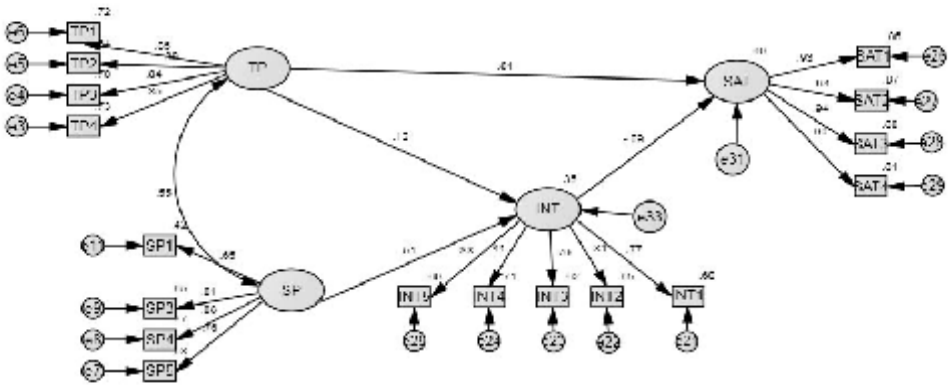
Structural equation modeling using all of the variables created an issue of trying to measure too many measures, which caused poor fit. One method that the researchers were able to employ was to reduce the number of measures. Through recommendations using Amos 22.0 the model was modified to include two measures for the exogenous variables of perceived teacher and social presence, plus two variables for the latent variable of interaction, then the exogenous variable of perceived learner satisfaction was measured using four variables that loaded highly into the factor and allowed the model to have the best fit. The variables that produced a lower chi-square value and increase the parameters were formed using modifications one step at a time until a good fitting model informed by theory and statistical analysis was achieved. The results of the modifications in the second structural model produced a third and final structural equation model with very good fit. In the final model the paths make theoretical sense, the measures included make sense and load highly into the latent variables. The structural model showed good fit as reported in table 5.

Table 5. Model fit statistics for structural model

Structural Model Fit statistics (n= 99)				
CMIN	df	TLI	CFI	RMSEA (90% CI)
1.29	29	0.989	0.989	0.055

8

Figure 6. Second Structural Model without Cognitive Presence



The results of the final structural equation model are shown in Figure 7. Hypothesis one was partly supported with the direct effects of student's perceived teacher presence on satisfaction β = .88 (p = .000) and social presence as β = -.14 (p = 172). This would indicate that teaching presence did have a fairly strong, significant positive effect on satisfaction. The path from social presence to satisfaction was negative, but it was not statistically significant. The relationship from social presence to learner satisfaction was not as hypothesized. Other studies that have explored social presence and satisfaction did not investigate this relationship (Joo et al., 2011; So & Brush, 2008). One study explored this relationship and found that there was a strong positive relationship between SP and Satisfaction, only when participants used emoticons to communicate their feelings within a text-based medium (Gunawardena & Zittle, 1997). When the researchers discovered this finding they decided to reevaluate the instructional design of the course being surveyed.

The introductory online asynchronous course has been carefully designed to implement best practices of learning that aim to achieve multiple opportunities for detailed instructor feedback and peer interaction. The initial design of the course requires students to use the learning management system and other current web technologies to share their experiences and opinions. One of the goal of sharing is not only to increase perceived social and teacher presence, but also foster civil discourse. The discourse component has been used in other community of Inquiry studies (Arbaugh et al., 2008). In multiple sections of the course the researchers were able to find areas where using online tools such as the discussion board in the LMS or blogs supported by the university was less robust than intended. Some of the discussion activities designed to spark a sharing of ideas and hopefully multiple responses at times received no response or very straight-forward single word answers like "Acceptable" or even worse no response at all. In some sections of the course there were posts made by students that was viewed only by the instructor. The second hypothesis was fully supported at an alpha level of .05, with the analysis revealing that teacher presence had a positive correlation on interaction (β = .351, p = 032) and social presence as β = .266 (p = .046). The third hypothesis was rejected, the model did not produce a significant path from perception of interaction and collaboration on student course satisfaction (β = -.016, p = .879). The standardized and unstandardized paths plus the level of significance is displayed in Table 6.

9

Figure 7. Final Structural equation model using Amos 22.0

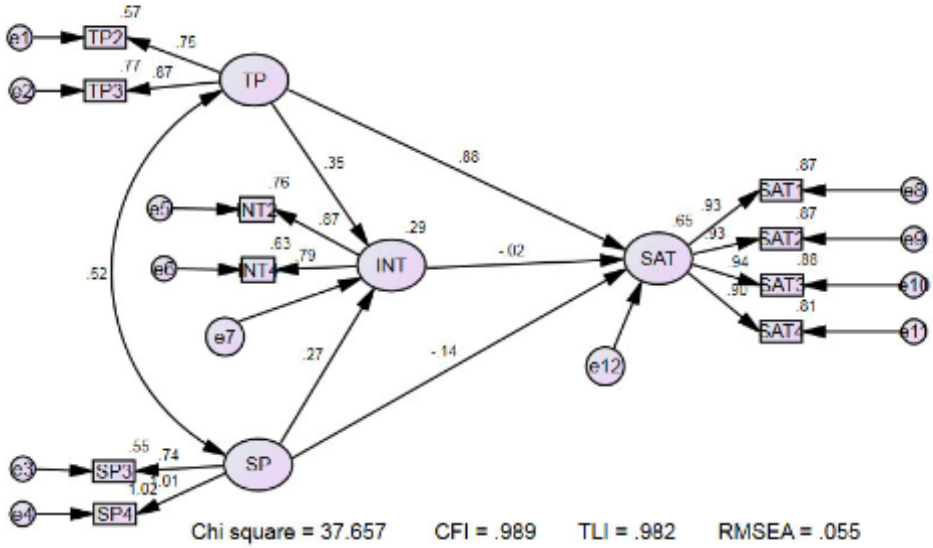


Table 6. Regression Weights: (Final Structural equation model)

			Unstandardized Estimate	Standardized Estimate	S.E.	C.R.	P
INT	<---	SP	0.264	0.266	0.13	1.993	0.046
INT	<---	TP	0.582	0.351	0.27	2.14	0.032
SAT	<---	TP	1.321	0.876	0.37	3.556	***
SAT	<---	SP	-0.125	-0.138	0.09	-1.367	0.17
SAT	<---	INT	-0.015	-0.016	0.1	-0.152	0.88
TP2	<---	TP	0.927	0.752	0.23	3.958	***
SP4	<---	SP	1	1.011			
SP3	<---	SP	0.708	0.742	0.12	5.852	***
SAT1	<---	SAT	1	0.934			
SAT2	<---	SAT	0.939	0.931	0.05	17.392	***
SAT3	<---	SAT	0.979	0.938	0.06	17.881	***
SAT4	<---	SAT	0.914	0.901	0.06	15.59	***
INT2	<---	INT	0.931	0.873	0.17	5.47	***
INT4	<---	INT	1	0.794			
TP3	<---	TP	1.021	0.875	0.24	4.181	***

6. Limitations

Attempting to study the entire community of inquiry model alongside student perceived interaction and satisfaction created a statistical model with a lesser degree of fit or appropriateness than a modified model that focused more on teacher and social presence. The introductory computer skills course is designed as a mastery type course where learners are allowed to revise work after receiving feedback. The course does not discourage cognitive presence as a part of the instructional technology design methods, but there is certainly a greater emphasis placed on teacher and social presence. With this online asynchronous course being a mastery-type course, in which students are given opportunities to revise their work in an effort to master skills rather than earn a grade, satisfaction was chosen to be a more desirable and researchable outcome in lieu of retention in the course or achievement as measured by course grade. As shown in the grades that learners expected to earn in the course, 78% expecting an A, the course grades were skewed positively, with the majority of learners taking the opportunities to master skills and therefore earn a higher grade. For this reason, a similar study on a more traditional course may produce different results. The sample size for this study was 99, using a larger sample size with the statistical procedures

could show significance in some paths that were not significant in this study.

7. Conclusion

This study was designed to continue the theoretical development of how presence as defined in the CoI model affects various online learning outcomes. This study adds to the body of knowledge in that student participant perceptions of teacher presence had a strong direct effect on learner satisfaction. This finding supports the idea that online instructors should find methods to actively engage with their students in online courses. This finding also supports the current design aspects of the online course in question that are meant to increase teacher presence such as offering frequent and varied forms of feedback. While social presence did significantly correlate with interaction in the current model, there was no direct or indirect correlation to learner satisfaction. This might suggest that the designers of the course in question should develop more meaningful and deeper levels of interaction amongst learners. An increase in student-student interaction thus may affect the findings of future studies. The results of this study indicate that the course designers need to revisit the requirements of learners to determine if there are methods to increase the deepness or quality of social interactions amongst learners in the online asynchronous course.

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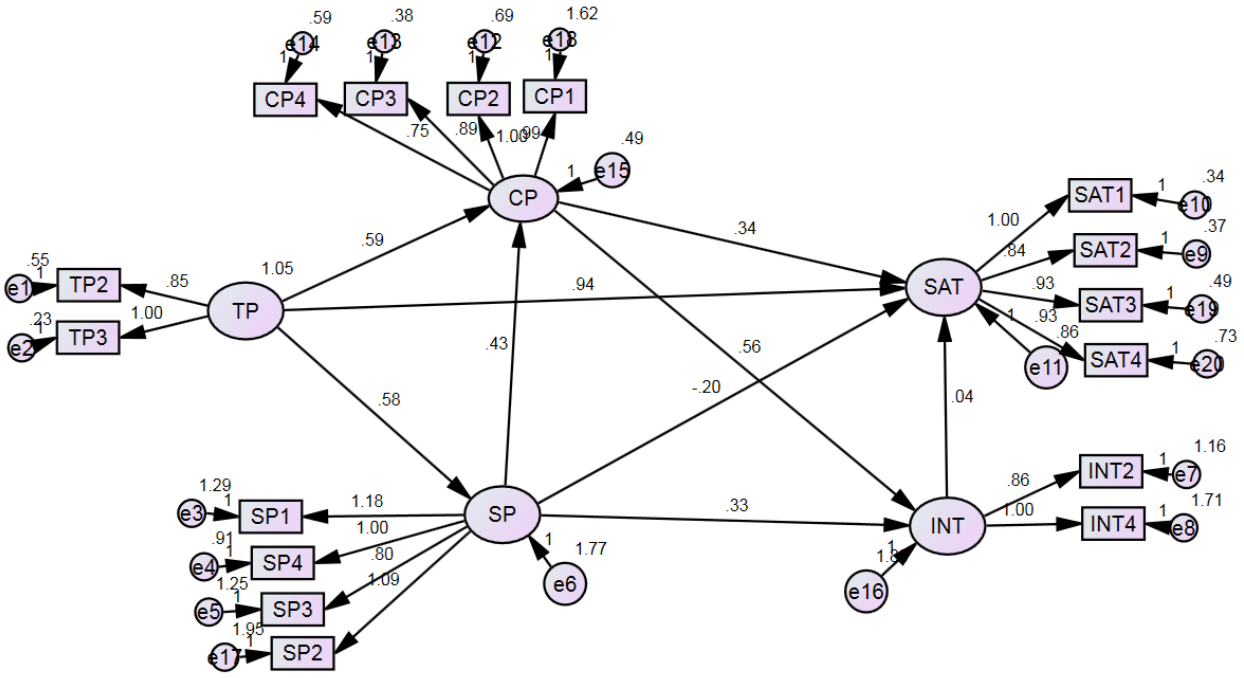
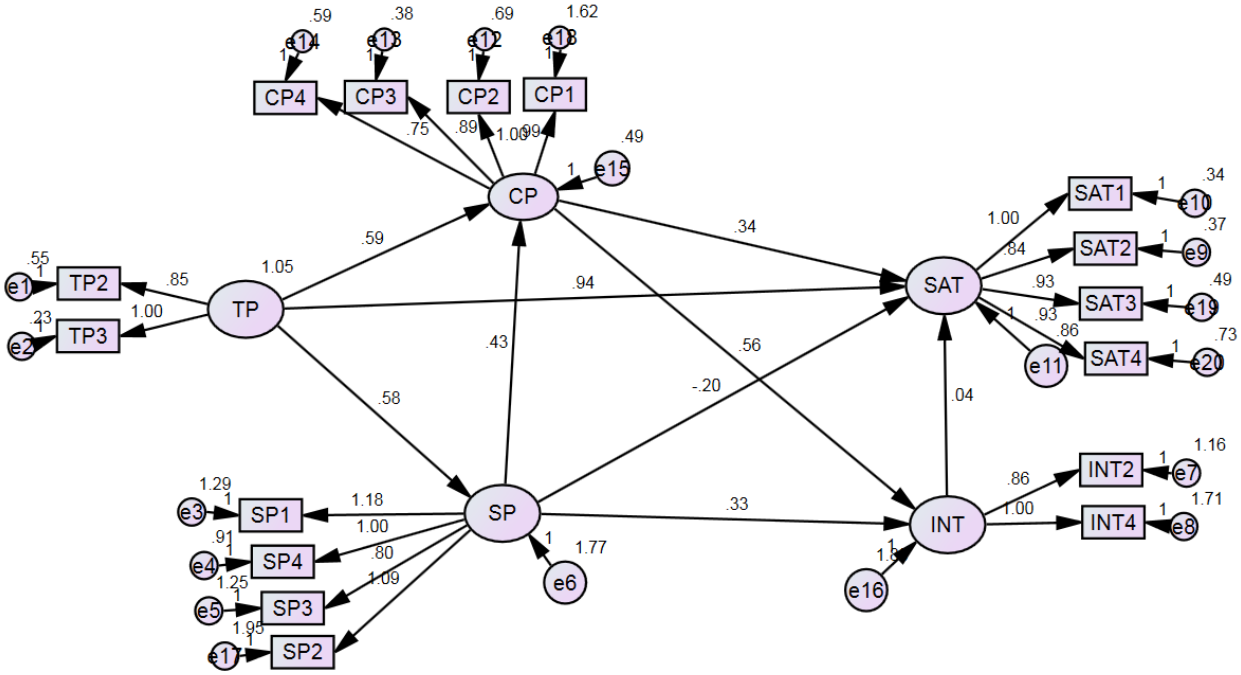
Appendix E. Unstandardized Structural Models

Structural Model One Unstandardized Estimates

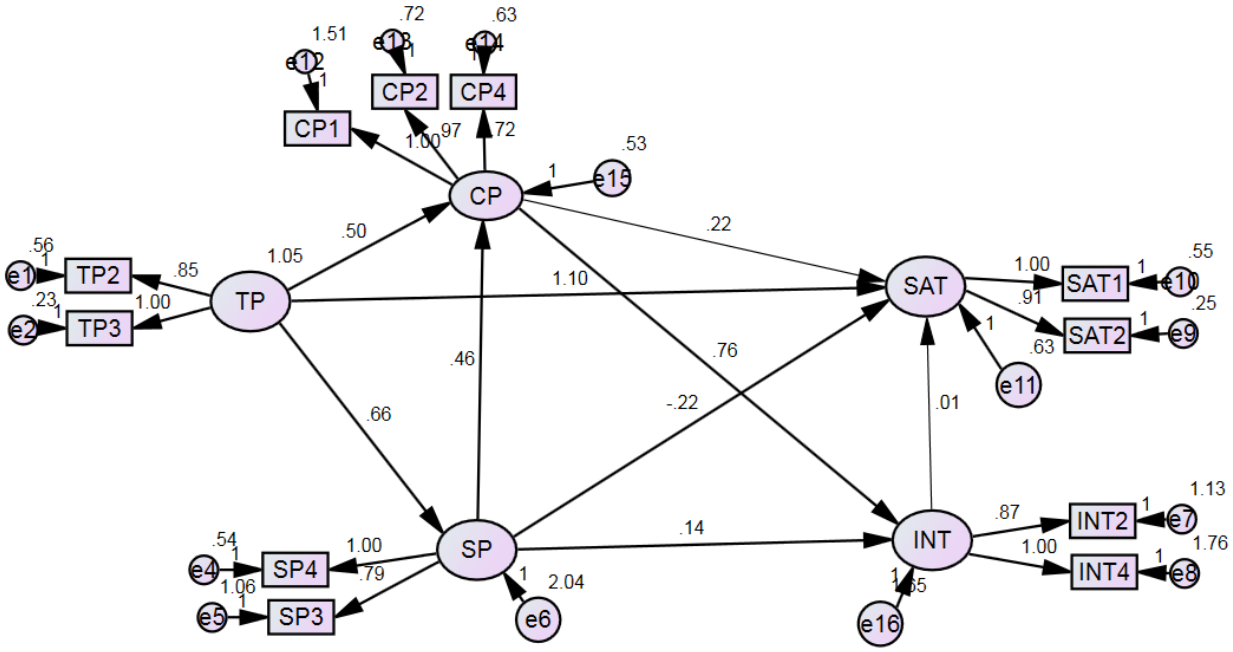


Structural Model Two Unstandardized Estimates



Chi square = 234.914 CFI = .926 TLI = .907 RMSEA = .094

Structural Model Three Unstandardized Estimates



Chi square = 46.934 CFI = .988 TLI = .981 RMSEA = .045

Appendix F. Modified Survey for this Study

ASSESSMENT OF PRESENCE AND SATISFACTION

#	Type	Label	Question
1	MC		Online course experience:
2	MC		Your gender:
3	MC	EN1	Do you plan to continue attending college after this semester?
4	MC	GR1	What grade do you expect that you will make in this course?
5	LIK	TP1	The instructor clearly communicated important course topics and goals.
6	LIK	TP2	The instructor clearly communicated important due dates/time frames for learning activities.
7	LIK	TP3	The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.
8	LIK	TP4	The instructor helped to keep course participants engaged and participating in productive dialogue.
9	LIK	TP5	The instructor provided feedback that helped me understand my strengths and weaknesses.
10	LIK	TP6	The instructor provided feedback in a timely fashion.
11	LIK	SP1	Getting to know other course participants gave me a sense of belonging in the course.
12	LIK	SP2	I was able to form distinct impressions of some course participants.
13	LIK	SP3	I felt comfortable interacting with other course participants.
14	LIK	SP4	I felt that my point of view was acknowledged by other course participants.
15	LIK	SP5	Online discussions help me to develop a sense of collaboration.
16	LIK	CP1	Problems posed increased my interest in course issues.
17	LIK	CP2	I felt motivated to explore content related questions.
18	LIK	CP3	Combining new information helped me answer questions raised in course activities.
19	LIK	CP4	Reflection on course content and discussions helped me understand fundamental concepts in this class.
20	LIK	CP5	I can apply the knowledge created in this course to my work or other non-class related activities.
21	LIK	SAT1	My professor was responsive to my needs.
22	LIK	SAT2	The quality of online instruction is satisfactory.
23	LIK	SAT3	In regards to this courses, the institution responds in a satisfactorily time period when I request information.
24	LIK	SAT4	The frequency of student and instructor interactions is adequate.
25	LIK	SAT5	Student-to-student collaborations are satisfying to me.
26	LIK	INT1	In this class, I work with others.
27	LIK	INT2	In this class, I relate my work to others' work.
28	LIK	INT3	In this class, I share information with other students.

29	LIK	INT4	In this class, I discuss my ideas with other students.
30	LIK	INT5	In this class, I collaborate with other students in the class.
31	LIK	ACL1	I explore my own strategies for learning.
32	LIK	ACL2	In this class, I seek my own answers.
33	LIK	ACL3	In this class, I solve my own problems.
34	LIK	ACL4	In this class, I am involved in creating knowledge.

Appendix G. Covariance Matrices

Structural Model Two Variance-Covariance Matrix of Estimates

	W1	W2	W3	TP-SAT	SP-SAT	W4	INT-SAT	SP-INT	W5	CP-INT	CP-SAT	SP-CP	TP-CP	W6	W7	TP-SP	V1	V2	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	par_33
W1	0.006																																
W2	0	0.008																															
W3	0	0	0.004																														
TP-SAT	0.004	0	-0.003	0.03																													
SP-SAT	0	-0.001	0.001	0.002	0.009																												
W4	0	0	0	0	0	0.013																											
INT-SAT	0	0	0	0	-0.002	0	0.005																										
SP-INT	0	0.001	0	0	-0.001	-0.003	0.001	0.02																									
W5	0	0	0	0	0	0	0	0	0.005																								
CP-INT	0	0	0	0	0.001	-0.004	-0.001	-0.018	0.002	0.033																							
CP-SAT	-0.001	0	0	-0.019	-0.008	0	-0.003	0	0.001	0.001	0.027																						
SP-CP	0	0.001	0	-0.002	-0.001	0	0	0	-0.001	-0.001	0.001	0.004																					
TP-CP	0.002	0	0	0.005	0.001	0	0	0	-0.002	-0.001	-0.005	-0.002	0.009																				
W6	0	0	0	0	0	0	0	0	0.003	0.001	0.001	-0.001	-0.002	0.005																			
W7	0	0.002	0	0	-0.001	0	0	0.001	0	0	0	0.001	0	0	0.005																		
TP-SP	0.002	-0.001	0	0.006	-0.001	0	0	0	0	-0.001	-0.002	-0.001	0.001	0	-0.001	0.018																	
V1	-0.005	0	0	-0.009	0	0	0	0	0	0	0.003	0	-0.004	0	0	-0.004	0.023																
V2	-0.002	0	0	-0.001	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.006															
V4	0	0.005	0	0	-0.002	0	0	0.003	0	-0.002	0.001	0.002	-0.001	0	0.004	-0.001	0	0	0.022														
V5	0	-0.006	0	0	0	0	0	-0.001	0	0	0	-0.001	0	0	-0.001	0.001	0	0	-0.008	0.066													
V6	0	0	0.003	-0.003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.012												
V7	0	0	-0.003	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.005	0.006											
V8	-0.001	0	-0.002	-0.006	0	0	0	0	0	0	0.004	0	-0.002	0	0	-0.002	0.003	0	0	0	-0.001	0	0.018										
V9	0.002	0	0	0.006	0	0	0	0	0	0	-0.003	0	0.002	0	0	0.002	-0.004	-0.001	0	0	0	0	-0.003	0.004									
V10	0	0	0	0	0	-0.021	0	0.004	0	0.006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.081								
V11	0	0	0	0	0	0.03	0.001	-0.006	0	-0.009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.066	0.162							
V12	0	0	0	0	0	-0.029	-0.002	0.005	0	0.008	0	0	0	0	0	0	0	0	-0.001	0	0	0	0	0	0.037	-0.088	0.173						
V13	0	0	0	0	0	0	0	0	-0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.004					
V14	0	0	0	0	0	0	0	0	0.002	0.001	0	-0.001	-0.001	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.001	0.012				
V15	0	0	0	-0.002	0	0	0	0	-0.003	-0.002	0.001	0.001	0	-0.003	0	0	0.001	0	-0.001	0	0	0	0.001	-0.001	0	0	0	0	-0.002	0.01			
V16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.001	0	0	0.006		
V17	0	-0.001	0	0	0	0	0	-0.001	0	0	0	-0.001	0	0	-0.003	0.001	0	0	-0.006	0.001	0	0	0	0	0	0	0	0	0	0	0	0.023	
par_33	0	-0.01	0	-0.004	0.005	0	0	-0.005	0	0.003	0	-0.003	0.001	0	-0.008	-0.001	0.001	0	-0.016	0.007	0	0	0.002	-0.001	0	0	0.001	0	0	0.001	0	0.005	0.092

Structural Model Three Variance-Covariance Matrix of Estimates

	W1	W3	TP-SAT	SP-SAT	W4	INT-SAT	SP-INT	W5	CP-INT	CP-SAT	SP-CP	TP-CP	W6	W7	TP-SP	V1	V2	V4	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	par_31
W1	0.006																														
W3	0	0.003																													
TP-SAT	0.004	-0.003	0.026																												
SP-SAT	0	0.001	0.003	0.011																											
W4	0	0	0	0	0.013																										
INT-SAT	0	0	0.001	0	0	0.006																									
SP-INT	0	0	0	0	-0.001	0.002	0.023																								
W5	0	0	0	0	0	0	0	0.01																							
CP-INT	0	0	0	0	-0.006	-0.002	-0.023	0.005	0.042																						
CP-SAT	-0.001	-0.001	-0.016	-0.012	0	-0.007	-0.002	0.001	0.004	0.033																					
SP-CP	0	0	-0.001	-0.002	0	0	0	-0.003	-0.002	0.002	0.006																				
TP-CP	0.002	0	0.004	0.002	0	0	0.001	-0.003	-0.003	-0.005	-0.002	0.011																			
W6	0	0	0	0	0	0	0	0.005	0.004	0.001	-0.002	-0.002	0.006																		
W7	0	0	0	-0.002	0	0	0.001	0	-0.001	0.001	0.002	-0.001	0	0.007																	
TP-SP	0.002	0	0.005	-0.001	0	0	0	0	0	-0.001	-0.001	0.001	0	-0.001	0.018																
V1	-0.005	0	-0.009	0	0	0	0	0	0	0.003	0	-0.003	0	0	-0.004	0.023															
V2	-0.002	0	-0.001	0	0	0	0	0	0	0	0	0	0	0	-0.001	0.001	0.006														
V4	0	0	-0.001	-0.005	0	0	0.003	0	-0.003	0.004	0.007	-0.003	0	0.011	-0.002	0	0	0.044													
V6	0	0.003	-0.003	0	0	0	0	0	0	-0.001	0	0	0	0	0	0	0	0	0.012												
V7	0	-0.003	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.005	0.006											
V8	-0.002	-0.002	-0.005	0.001	0	0	0	0	0	0.001	0	-0.001	0	0	-0.002	0.003	0	-0.001	-0.002	0	0.019										
V9	0.002	0	0.006	0	0	0	0	0	0	-0.003	0	0.002	0	0	0.002	-0.004	-0.001	0	0	0	-0.003	0.005									
V10	0	0	0	0	-0.02	0	0.002	0	0.009	0	0	0	0	0	0	0	0	0	0	0	0	0	0.076								
V11	0	0	0	0	0.027	0	-0.002	0	-0.013	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.057	0.144							
V12	0	0	0	0	-0.024	0.001	0.007	0	0.003	-0.001	0	0	0	0	0	0	0	-0.001	0	0	0	0	0.024	-0.063	0.139						
V13	0	0	-0.001	-0.001	0	0	-0.002	-0.003	0.002	0.001	0.001	0.001	0	0	0	0	0	0	0	0	0	0	0	0	-0.001	0.014					
V14	0	0	0	0	0	0	-0.001	0.004	0.004	0.002	-0.001	-0.002	0.003	0	0	0	0	0	0	0	0	0	0	0	-0.001	-0.002	0.04				
V15	0	0	0	0.001	0	0	0.002	-0.007	-0.008	-0.002	0.001	0.003	-0.005	-0.001	0	0.001	0	-0.005	0	0	0.001	-0.001	0	0	0	-0.001	-0.005	0.019			
V16	0	0	0	0	0	0	-0.001	0	0.001	0	0	0	-0.001	0	0	0	0	0	0	0	0	0	0	0	0	-0.001	-0.001	0	0.008		
V17	0	0	0	0.002	0	0	-0.001	0	0.001	-0.001	-0.003	0.001	0	-0.007	0.001	0	0	-0.019	0	0	0	0	0	0	0	0	0	0.002	0	0.03	
par_31	-0.001	0	-0.003	0.008	0	0	-0.004	0	0.003	-0.003	-0.008	0.004	0	-0.014	-0.001	0.001	0	-0.038	0	0	0.002	-0.001	0	0	0	0	0	0.005	0	0.017	0.115

Appendix H. Correlations of Estimates

Structural Model Two – Correlation of Estimates

	W1	W2	W3	TP-SAT	SP-SAT	W4	INT-SAT	SP-INT	W5	CP-INT	CP-SAT	SP-CP	TP-CP	W6	W7	TP-SP	V1	V2	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	par_33
W1	1																																
W2	0	1																															
W3	0	0	1																														
TP-SAT	0.313	-0.003	-0.273	1																													
SP-SAT	0.021	-0.089	0.096	0.151	1																												
W4	0	0	0	0	-0.001	1																											
INT-SAT	0	0.011	-0.025	0.037	-0.294	0.042	1																										
SP-INT	0	0.097	0	0.003	-0.073	-0.166	0.1	1																									
W5	0	0	0	0.006	0.005	0	0.005	0.009	1																								
CP-INT	0	-0.026	0	-0.004	0.055	-0.183	-0.113	-0.702	0.127	1																							
CP-SAT	-0.117	0.016	-0.048	-0.668	-0.542	-0.001	-0.243	-0.008	0.045	0.017	1																						
SP-CP	-0.047	0.201	0	-0.144	-0.089	0	0.008	0.041	-0.306	-0.081	0.137	1																					
TP-CP	0.239	-0.025	0	0.312	0.129	0	-0.003	-0.007	-0.307	-0.045	-0.291	-0.34	1																				
W6	0	0	0	0	0	0	0	0	0.53	0.114	0.046	-0.247	-0.248	1																			
W7	0	0.349	0	-0.003	-0.094	0	0.012	0.102	0	-0.028	0.017	0.213	-0.027	0	1																		
TP-SP	0.18	-0.118	0	0.24	-0.09	0	0	-0.011	0	-0.021	-0.076	-0.154	0.099	0	-0.125	1																	
V1	-0.397	0	0	-0.343	-0.024	0	0	0	0	0	0.133	0.053	-0.26	0	0	-0.195	1																
V2	-0.271	0	0	-0.065	-0.003	0	0	0	0	0	0.018	0.007	-0.053	0	0	-0.041	0.097	1															
V4	0	0.385	0	-0.008	-0.135	0	0.032	0.141	0	-0.073	0.045	0.251	-0.07	0	0.414	-0.072	0	0	1														
V5	0	-0.252	0	0	0.019	0	-0.002	-0.021	0	0.004	-0.003	-0.044	0.004	0	-0.078	0.029	0	0	-0.206	1													
V6	0	0	0.489	-0.134	0.047	0	-0.012	0	0	0	-0.024	0	0	0	0	0	0	0	0	0	1												
V7	0	0	-0.562	0.154	-0.054	0	0.014	0	0	0	0.027	0	0	0	0	0	0	0	0	0	-0.591	1											
V8	-0.126	-0.006	-0.271	-0.278	0.033	0	-0.024	-0.005	0.001	0.004	0.187	0.045	-0.119	0	-0.006	-0.099	0.143	0.02	-0.017	0.001	-0.103	-0.033	1										
V9	0.416	0	0	0.505	0.054	0	0	0	0	0	-0.304	-0.121	0.322	0	0	0.222	-0.366	-0.222	0	0	0	0	-0.328	1									
V10	0	0	0	0	-0.003	-0.657	-0.015	0.109	0	0.12	-0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	1								
V11	0	0	0	0	-0.005	0.667	0.042	-0.111	0	-0.122	-0.004	0	0	0	0	0	0	0	0	0	0	0	-0.001	0	-0.579	1							
V12	0	-0.006	0	0.001	0.011	-0.621	-0.052	0.078	0.002	0.102	0.005	-0.005	0.002	0	-0.006	0.003	0	0	-0.017	0.001	0	0	0.001	0	0.315	-0.527	1						
V13	0	0	0	-0.026	-0.023	0	-0.023	-0.04	-0.303	0.024	0.035	0.077	0.073	-0.008	0	-0.002	0	0	0.001	0	0	0	-0.004	0	0	0	-0.009	1					
V14	0	0	0	-0.006	-0.005	0	-0.005	-0.009	0.243	0.049	0.026	-0.079	-0.081	0.174	0	0	0	0	0	0	0	0	-0.001	0	0	0	-0.002	-0.171	1				
V15	-0.048	-0.026	0	-0.099	-0.04	0	0.004	0.018	-0.424	-0.099	0.065	0.094	0.034	-0.377	-0.028	-0.016	0.055	0.008	-0.073	0.004	0	0	0.047	-0.125	0	0	0.002	-0.063	-0.16	1			
V16	0	0	0	-0.004	-0.004	0	-0.004	-0.007	0.029	0.004	0.006	0.013	0.012	-0.165	0	0	0	0	0	0	0	0	-0.001	0	0	0	-0.002	-0.13	-0.029	-0.011	1		
V17	0	-0.091	0	0.001	0.023	0	-0.002	-0.025	0	0.005	-0.003	-0.055	0.005	0	-0.291	0.035	0	0	-0.253	0.015	0	0	0.001	0	0	0	0.001	0	0	0.005	0	1	
par_33	-0.021	-0.363	0	-0.067	0.181	0	-0.016	-0.122	0	0.049	-0.005	-0.183	0.032	0	-0.385	-0.029	0.024	0.003	-0.358	0.084	0	0	0.038	-0.055	0	0	0.007	0.001	0	0.034	0	0.103	1

Structural Model Three – Correlation of Estimates

	W1	W3	TP-SAT	SP-SAT	W4	INT-SAT	SP-INT	W5	CP-INT	CP-SAT	SP-CP	TP-CP	W6	W7	TP-SP	V1	V2	V4	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	par_31
W1	1																														
W3	0	1																													
TP-SAT	0.332	-0.289	1																												
SP-SAT	0.02	0.089	0.178	1																											
W4	0	0	0	0	1																										
INT-SAT	0	-0.004	0.08	-0.024	0.006	1																									
SP-INT	0	0	0.013	-0.003	-0.066	0.151	1																								
W5	0	0	0.006	0.008	0	0.008	0.015	1																							
CP-INT	0	0	-0.014	-0.004	-0.261	-0.15	-0.742	0.233	1																						
CP-SAT	-0.094	-0.051	-0.561	-0.657	0	-0.459	-0.075	0.07	0.104	1																					
SP-CP	-0.034	0	-0.099	-0.202	0	0.001	-0.041	-0.401	-0.107	0.122	1																				
TP-CP	0.191	0	0.227	0.189	0	0.006	0.042	-0.321	-0.15	-0.263	-0.27	1																			
W6	0	0	0.001	0.001	0	0.001	0.002	0.587	0.225	0.073	-0.361	-0.291	1																		
W7	0	0	-0.011	-0.186	0	0.017	0.08	0	-0.038	0.066	0.349	-0.096	0	1																	
TP-SP	0.178	0	0.243	-0.075	0	-0.001	-0.006	0	-0.006	-0.056	-0.117	0.047	0	-0.123	1																
V1	-0.401	0	-0.353	-0.021	0	0	0	0	0	0.1	0.036	-0.203	0	0	-0.19	1															
V2	-0.29	0	-0.095	-0.006	0	0	0	0	0	0.027	0.01	-0.055	0	0	-0.051	0.116	1														
V4	0	0	-0.017	-0.249	0	0.028	0.107	0	-0.061	0.107	0.42	-0.155	0	0.638	-0.078	0	0	1													
V6	0	0.498	-0.144	0.044	0	-0.002	0	0	0	-0.025	0	0	0	0	0	0	0	0	1												
V7	0	-0.562	0.163	-0.05	0	0.002	0	0	0	0.029	0	0	0	0	0	0	0	0	-0.594	1											
V8	-0.145	-0.27	-0.238	0.084	0	0.03	0.001	0.002	-0.003	0.056	0.009	-0.079	0	-0.024	-0.101	0.154	0.041	-0.039	-0.116	-0.019	1										
V9	0.446	0	0.504	0.047	0	0	0	0	0	-0.224	-0.08	0.258	0	0	0.224	-0.384	-0.258	0	0	0	-0.344	1									
V10	0	0	0	0	-0.643	-0.001	0.043	0	0.168	-0.001	0	0	0	0	0	0	0	0	0	0	0	0	1								
V11	0	0	0	0	0.619	0.005	-0.041	0	-0.162	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.54	1							
V12	0	0	0.003	0.002	-0.573	0.041	0.117	0.005	0.034	-0.022	-0.007	0.011	0.001	-0.004	0.002	0	0	-0.007	0	0	0.002	0	0.231	-0.446	1						
V13	0	0	-0.033	-0.044	0	-0.046	-0.086	-0.255	0.063	0.061	0.077	0.048	0.005	0.001	-0.002	0	0	0.001	0	0	-0.01	0	0	0	-0.029	1					
V14	0	0	-0.011	-0.015	0	-0.016	-0.029	0.21	0.097	0.046	-0.094	-0.081	0.184	0	-0.001	0	0	0	0	0	-0.003	0	0	0	-0.01	-0.074	1				
V15	-0.029	0	-0.015	0.063	0	0.023	0.102	-0.486	-0.272	-0.091	0.085	0.17	-0.462	-0.105	0.006	0.031	0.008	-0.17	0	0	0.034	-0.07	0	0	0.009	-0.082	-0.183	1			
V16	0	0	-0.015	-0.02	0	-0.021	-0.039	0.017	0.028	0.027	0.035	0.021	-0.193	0	-0.001	0	0	0	0	0	-0.004	0	0	0	-0.013	-0.097	-0.033	-0.037	1		
V17	0	0	0.007	0.114	0	-0.011	-0.049	0	0.025	-0.044	-0.206	0.064	0	-0.488	0.06	0	0	-0.514	0	0	0.016	0	0	0	0.003	0	0	0.07	0	1	
par_31	-0.021	0	-0.055	0.24	0	-0.017	-0.081	0	0.041	-0.055	-0.315	0.109	0	-0.509	-0.022	0.022	0.006	-0.526	0	0	0.05	-0.049	0	0	0.003	0	0	0.096	0	0.285	1