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# Community of Inquiry Framework and Learning Outcomes

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# COMMUNITY OF INQUIRY FRAMEWORK AND LEARNING OUTCOMES

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**ABSTRACT**

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First described by Garrison, Anderson, and Archer (2000), the Community of Inquiry (CoI) framework suggests social presence, teaching presence, and cognitive presence are essential elements to foster successful educational experiences in computer-mediated higher education distance learning environments. While hundreds of CoI-based articles have been published since 2000, those critical of the framework and related research suggested a lack of empirical evidence to support the framework's central claim that a CoI leads to deep and meaningful learning outcomes (Rourke & Kanuka, 2009). The current study, conducted with 51 graduate students in five distance education courses at the same university, compared the students' responses to a CoI perception survey with three measures of learning achievement as assessed by the course instructors.

While significant positive relationships were indicated among social, teaching, and cognitive presences, as well as between each of these presences and perceived learning in the course, no relationship was suggested between the CoI composite score and any of the three instructor-assessed learning achievement measures. Only the cognitive presence subscale was found to be significantly positively correlated ($r^2 = .08$) with one instructor-assessed achievement measure, the significant project score, but no presences were correlated with the other two instructor-assessed measures of learning achievement. However, when controlled for other course features, social, teaching, and cognitive presences were not predictors of any of the three instructor-assessed measures of learning, but were instead significantly correlated with course satisfaction.

With no relationship suggested between the CoI framework and objective measures of learning, the value of the CoI framework as an educational process model remains challenged. In addition, results of this study suggested that CoI survey-based measures and student self-reports of learning are more appropriately used as approximations of student attitude toward the course rather than as measures of student learning achievement.

*Keywords:* community of inquiry, social presence, teaching presence, cognitive presence, perceived learning, learning outcome, achievement, satisfaction, CoI Survey

COMMUNITY OF INQUIRY FRAMEWORK AND LEARNING OUTCOMES

by Jennifer Ann Maddrell

This dissertation is dedicated to my mom and dad and their constant love and encouragement to be good girl, have a good time, and learn a lot.

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# TABLE OF CONTENTS

Page

## LIST OF TABLES

# CHAPTER I

# INTRODUCTION AND LITERATURE REVIEW

## Introduction

The Community of Inquiry (CoI) is a conceptual framework for the optimal use of computer-mediated communication to support critical thinking, critical inquiry, and discourse among higher education students and teachers (Garrison, Anderson, & Archer, 2000). Garrison et al. (2000) first presented the CoI as a framework for interaction and communication that suggested deep and meaningful learning in computer-mediated distance learning environments occurs through the interaction of three essential elements, including (a) social presence, (b) teaching presence, and (c) cognitive presence. As proposed by Garrison et al., "The elements of a community of inquiry can enhance or inhibit the quality of the educational experience and learning outcomes" (p. 92). Over the past decade, the CoI framework has been a popular foundation for both practitioners and researchers studying computer-mediated communication and interaction in distance education. A recent review of Google Scholar lists over 1,050 citations to Garrison et al.'s 2000 *Internet and Higher Education* article. In addition, the ProQuest Dissertation and Theses database lists over 60 studies with "community of inquiry" in the title or abstract since January of 2000.

However, the CoI framework and the body of surrounding research were criticized for a lack of empirical evidence that the framework leads to deep and meaningful learning outcomes (Rourke & Kanuka, 2009). While some view CoI research as supportive of the underlying theoretical assumptions (Akyol et al., 2009; Garrison & Arbaugh, 2007; Garrison, Anderson, & Archer, 2010), others argue CoI research has been preoccupied with validation of methods to measure communication, interaction, and student perceptions while failing to investigate the framework's central claim that a CoI, with the prerequisite elements of social presence, teaching presence, and cognitive presence, leads to meaningful learning outcomes (Rourke & Kanuka, 2009). In addition, the reliance in prior CoI studies on students' self-reports of learning may suggest a potential and important research limitation (Gonyea, 2005). The purpose of this research was to examine the extent to which students' perceptions of a community of inquiry as defined within the social presence, teaching presence, and cognitive presence constructs are related to actual course learning achievement outcomes as assessed by the course instructor.

## Literature Review

### CoI Framework

Garrison et al. (2000) offered the CoI as a guide to student and teacher computer-mediated interaction and communication and a template for distance learning research. The CoI was presented as a theoretical communication and interaction framework to optimally support the learning process and builds on social-constructivist approaches to learning and instruction. The focus of the CoI is on facilitating critical reflection on the part of the student and critical discourse among the teacher and peer students. Garrison et al. (2000) argue that distance-learning environments, supported by computer-mediated communication, must include the three essential elements of social presence, teaching presence, and cognitive presence in order to foster the development and practice of higher-order thinking skills.

**Social presence.** Social presence within the context of a computer-mediated classroom is the degree to which students feel connected while engaging in mediated communication (Swan & Shih, 2005). Social presence theory builds upon the concept of social presence from the work of Short, Williams, and Christie (1976) in technology-mediated communication and is often used as a theoretical framework in the study of asynchronous computer-mediated communication (DeWever, Schellens, Valcke, & Keer, 2006). Theory and research on social presence in asynchronous computer-mediated learning environments have moved beyond an evaluation of the medium's effect on social presence to an evaluation of how social presence can be cultivated through instructional methods to support critical thinking and critical discourse within the computer-mediated environment (Garrison et al., 2000). Some argue that while social presence alone will not ensure the development of critical discourse, it is difficult for such discourse to develop without it (Arbaugh, 2008; Garrison & Cleveland-Innes, 2005). Similarly, others view social presence as a mediating variable between teaching presence and cognitive presence (Garrison, Anderson, et al., 2010; Garrison, Cleveland-Innes, & Fung, 2010).

While some studies have suggested a relationship between social presence and perceived learning (Arbaugh, 2008; Richardson & Swan, 2003; Swan & Shih, 2005), findings in other research have not found a correlation between social presence and perceived learning measures (Akyol & Garrison, 2008; Shin, 2003). Similarly, findings are mixed regarding the relationship between social presence and satisfaction with some studies reporting a positive correlation between social presence and measures of satisfaction (Akyol & Garrison, 2008; Arbaugh, 2008; Richardson & Swan, 2003; Swan

& Shih, 2005), while others found either no relationship (So & Brush, 2008) or that social presence was not a predictor of satisfaction (Joo, Lim, & Kim, 2011). Findings are also mixed regarding the relationship between social presence and a student's intent to persist with some indicating a correlation (Shin, 2003) and others reporting social presence was not a predictor of persistence (Joo et al., 2011).

**Teaching presence.** Teaching presence is described as a binding element in a CoI that influences the development of both cognitive presence and social presence through the direction and leadership of the educational experience (Garrison et al., 2000). Many argue that research has demonstrated the importance of teaching presence in establishing and sustaining a CoI (Akyol et al., 2009; Garrison, Anderson, et al., 2010; Garrison, Cleveland-Innes, et al., 2010).

Teaching presence is comprised of three primary social, organizational, and managerial components, including (a) instructional design and organization, (b) facilitating discourse, and (c) direct instruction (Anderson, Rourke, Garrison, & Archer, 2001). Research has suggested the need for facilitation to support the construction of knowledge in an online environment (Kanuka & Anderson, 1998). Other research (Baker, 2010) has also indicated a statistically significant correlation ($r^2 = .56$) between the teaching presence construct, as defined within the CoI, and instructor immediacy, a construct that has been widely studied in instructional communication research (Witt, Wheeless, & Allen, 2004). Immediacy refers to both verbal and nonverbal communication behaviors that influence perceptions of closeness to another (Mehrabian, 1968). A meta-analysis of teacher immediacy research suggests statistically significant positive correlations between teachers' nonverbal and verbal immediacy with both student-perceived learning and affective outcome measures ($r^2$ = .24 to .25), but smaller positive correlations with cognitive learning outcomes ($r^2$ = .01 to .03) (Witt et al., 2004). While CoI research has suggested significant differences in the extent and type of teaching presence within a given online course (Anderson et al., 2001), studies have indicated a statistically significant positive relationship between teaching presence and student satisfaction (Abdous & Yen, 2010; Shin, 2003), as well as between teaching presence and student-perceived learning (Arbaugh, 2008; Shea, Li, & Pickett, 2006; Shea, Li, Swan, & Pickett, 2005; Shin, 2003; Swan & Shih, 2005).

**Cognitive presence.** Cognitive presence is defined within the CoI framework as the extent to which distance students construct meaning through both critical reflection and discourse and is suggested to be a vital element in critical thinking (Garrison et al., 2000). Framed within a social-constructivist perspective, cognitive presence focuses on higher-order thinking associated with community members' critical inquiry processes versus specific individual learning outcomes (Garrison, Anderson, & Archer, 2001). Computer-mediated communication technologies are seen as potential vehicles to support student-student discourse to facilitate co-creation of meaning and understanding (Paulus, 2007).

Cognitive presence is operationalized in the CoI framework through a group-based practical inquiry process focusing on four phases of critical inquiry, including (a) the triggering event, (b) exploration, (c) integration, and (d) resolution (Garrison et al., 2001). The CoI framework assumes a progression through the phases of the inquiry process that requires direction through teaching presence design, facilitation, and direct instruction, and is influenced by the social presence within the group (Garrison, 2007).

## Perspectives on Learning and Instruction

**Perspectives on learning.** The CoI builds on social-constructivist approaches to learning and stands in contrast to both behavioral and cognitive perspectives. Behavioral theories suggest that learning is a change in a learner's behavior caused by experiences and associations formed when a stimulus event occurs, the learner's behavior occurs in response to the stimulus, and a consequence of that response arises (Burton, Moore, & Magliaro, 2004). Cognitive theories of learning are concerned with how information is perceived, represented, organized, encoded, and retrieved within memory (Winn, 2004).While constructivist viewpoints vary, most share a common perspective that learning is an active process of constructing versus acquiring knowledge (Duffy & Cunningham, 1996).

**Perspectives on instruction.** Behavioral theories suggest that the role of instruction is to shape the environment in order to ensure that the stimulus-response-consequence relationships are in line with the goals for instruction and to strengthen the stimulus-response associations through repeated and continuous paring of the stimulus with the response, along with the consequences (Burton et al., 2004). As such, instruction is designed to control the stimuli presented to the learner, allow opportunities for active and observable learner response, and confirm the knowledge of results to the learner (Fleming & Levie, 1978). To assist learners in making correct stimulus-response associations, the instruction is designed to precisely describe to learners the goals of learning, including what learners are expected to accomplish (Rothkopf, 1996).

From a cognitivist perspective, the theory of generative learning often guides the instructional presentation, practice, and feedback strategies designed from a cognitive perspective and suggests that learners generate meaning based on prior experiences, attitudes, and abilities and that students learn best when they generate their own connections between what they already know and the to-be-learned material (Wittrock, 1974). Theory and research suggests that when learners are prompted using elaboration strategies that encourage learners to form and support arguments to defend their elaborations, better recognition of the underlying concepts and principles may result than presentation alone (Woloshyn, Willoughby, Wood, & Pressley, 1990). The cognitivist perspective is also influenced by cognitive load theory (CLT) that suggests working memory's processing limitations impact a learner's ability to process, encode, and retrieve information and, therefore, the design of instruction should eliminate irrelevant cognitive activities that do not lead to schema acquisition and automation (Sweller & Chandler, 1994).

For constructivists, instruction is a process designed to support and challenge an individual learner's knowledge construction versus knowledge transmission from experts to novices (Duffy & Cunningham, 1996). Based on constructivists beliefs that knowledge is individually constructed and based on experiences and perceptions of the environment (thereby context dependent), instruction is founded on the support of multiple perspectives, learning within relevant contexts, and critical discourse among participants (Duffy & Cunningham; Garrison, Anderson, & Archer, 2000).

Critics of cognitive perspectives on instruction argue that instruction is too often focused on the information or content presented (or made available to learners) and the learner's processing of that information without sufficient attention to knowledge creation activity and the context (Wilson, 1997). While behaviorist and cognitivist views of instruction emanate from an objectivist perspective in which goals and objectives are set by the designer, a constructivist perspective often advocates negotiating instructional goals and objectives with the leaner as part of the learning process (Jonassen, 1991). Yet, some argue that while constructivism offers a philosophical framework, it has yet to evolve into a refined theory that describes effective instruction or design strategies (Tobias & Duffy, 2009).

## CoI Research

**Content analysis.** With the growth of computer-mediated distance learning environments has come research to study the quantitative aspects of participation and the qualitative nature of the interaction and discourse through a range of content analysis techniques based on the asynchronous discussion transcripts (DeWever et al., 2006). The frequently cited transcript analysis framework forwarded by Henri (1992) focuses on a quantitative analysis of the participative, social, interactive, cognitive, and metacognitive dimensions of participant interaction occurring within the asynchronous computer-mediated communication. In contrast, other researchers have focused on the qualitative aspects of the computer-mediated discourse, such as the social negotiation and social construction of knowledge in computer conferencing (Gunawardena, Lowe, & Anderson, 1997) or the interactional features such as the exchange patterns among participants (Fahy, Crawford, & Ally, 2001; Fahy et al., 2000).

In early research based on the CoI framework, Rourke, Anderson, Garrison, and Archer (1999) presented a content analysis categorization scheme for examining both the quantitative and qualitative aspects of social presence within a CoI from asynchronous discussion transcripts based on defined categories and indicators of social presence, including (a) emotional expression seen in affective responses, (b) open communication seen in interactive responses, and (c) group cohesion seen in cohesive responses. By analyzing the text in thematic units, the researchers measured the social presence density by dividing the number of social presence indicators coded in the transcript by the number of words in the transcript. A similar calculation was done at the level of the indicator. While this early exploratory study did not attempt to assess sufficient or optimal levels of social presence, the researchers argued that the social presence density calculation offered an important quantitative measure of the degree of social presence within the computer-mediated learning environment.

Similarly, Garrison, Anderson, and Archer (2001) offered a transcript analysis method to assess cognitive presence in an asynchronous computer-mediated environment using a set of descriptors and indicators for each of the four phases of the practical inquiry model embedded in the CoI framework, including (a) the triggering event in which an issue or problem is identified through evocative discourse, (b) exploration in which students explore the issue through critical reflection and inquisitive discourse, (c) integration in which students construct meaning from ideas formed during exploration within tentative discourse, and (d) resolution in which students apply the knowledge in committed discourse. A systematic procedure was established for assigning message level segments of the asynchronous text-based transcript to each of the four phases. The relative frequency of each of the four cognitive presence categories were compared by Garrison et al. (2001) and Kanuka, Rourke, and Laflamme (2007) and results indicated 8% to 11% of message level segments (as a percentage of total segments) were coded as trigger messages, 42% - 53% as exploration messages, 13% - 26% as integration messages, and only 4% - 10% as resolution messages. These finding of low levels of discourse and knowledge construction support earlier research that suggested asynchronous computer-mediated communication among students rarely moves beyond sharing and comparing of information (Gunawardena et al., 1997). While Garrison et al. report significant challenges in establishing a replicable coding scheme, they found the process of analyzing transcripts a promising approach for assessing the degree of cognitive presence within an online course discussion.

Anderson et al. (2001) developed a methodology to assess the existence of online teaching presence through content analysis of asynchronous computer conferencing transcripts. Similar to the procedures described above, content analysis included collecting samples from transcripts in different online courses and devising rules for categorizing segments of the texts. Segments of the transcript were selected at the message unit and categorized into one of the three teaching presence categories noted above. In this study, over 75% of all teacher messages included some form of direct instruction while instructional design was observed the least frequently within between 22% and 33% of the messages. Messages related to the facilitation of discourse varied widely across the observed courses with between 43% and 75% of the teacher messages. While the results indicated varying patterns of teaching presence between the analyzed courses, the researchers suggested the content analysis tool offers an effective means to compare the degree of teaching presence across courses.

**Student perception surveys.** These initial CoI studies using text-based transcript analysis as a means of exploring and describing student interactions and discourse have been described as interpretivist in nature (Garrison & Arbaugh, 2007). In an effort to move beyond descriptive qualitative studies of computer-mediated discourse, a team of researchers recently developed and tested a 34-item, five-point Likert-type scale survey instrument to quantitatively measure students' perceptions of social presence, teaching presence, and cognitive presence within a computer-mediated learning environment (Arbaugh et al., 2008, 2007). Building from other research that also attempted to capture students' perceptions of the CoI presences using a variety of survey instruments (Arbaugh & Hwang, 2006; Garrison, Cleveland-Innes, & Fung, 2004; Gunawardena, 1995; Gunawardena & Zittle, 1997; Shea et al., 2005; Swan & Shih, 2005; Tu, 2002), a primary objective of creating a new survey instrument was to examine the relationships among perceived social presence, teaching presence, and cognitive presence, as well as their relationships to perceived learning outcomes (Garrison & Arbaugh, 2007). Following a multi-institution study utilizing the survey, Arbaugh et al. (2008) suggested that the CoI survey offers a valid measure of perceived social presence, teaching presence, and cognitive presence to augment the qualitative transcript analysis.

Within a study of over 5,000 college students, Shea and Bidjerano (2009a) modified the CoI survey items related to teaching presence in an effort to better assess the instructor's influence. From the responses to the modified 37-item survey instrument, the researchers conducted a factor analysis that suggested that teaching presence, social presence, and cognitive presence accounted for 69.19 % of the variance in the correlation matrix, or 58.17%, 7.91%, and 3.11% respectively for each factor. Through cluster analysis of respondents, the researchers suggested that membership within a particular teaching presence and social presence cluster is strongly associated with the students' perceptions of cognitive presence. Students with low perceptions of both social presence and teaching presence were more likely to report low cognitive presence, but for those with low perceptions of social presence and high perceptions of teaching presence (or low perceptions of teaching presence and high perceptions of social presence), the cognitive presence scores were higher which suggested a moderating influence of *both* teaching presence and social presence on cognitive presence.

In other research utilizing the 37-item CoI survey instrument with over 2,000 college participants, Shea and Bidjerano (2009b) added their support for the validity of the survey through factor analysis. Their research findings also suggested that both social presence and teaching presence are correlated with cognitive presence. Further, 70% of the variance in students' perception of cognitive presence was linked to students' perceptions of the teacher's ability to foster teaching presence and social presence. In addition, social presence associated with online discussion was strongly correlated with variance in cognitive presence. While lower levels of comfort with online discussion were seen to be strongly correlated with lower levels of cognitive presence, teaching presence did appear to have a moderating role. When the students perceived the teacher taking an active role in managing the online discussion, the students reported higher levels of cognitive presence.

Yet, contrary to prior research conducted using transcript analysis noted above, the majority of the students responding to the Shea and Bidjerano (2009a) survey reported achieving the highest levels of cognitive presence which the researchers speculate points to a limitation in relying solely on the content analysis of discussion transcripts to evaluate levels of cognitive presence and learning. This conclusion was supported by other researchers who suggested that looking for evidence of high levels of cognitive presence solely within discussion transcripts was misguided as critical inquiry and critical discourse is often fostered in other course activities and students tend to focus their best efforts on assignments for which they receive the highest portion of their course grade which is typically *not* in online discussion, but rather term papers or other assignments (Archer, 2010).

**CoI critique.** While some recent reviews of CoI research suggested the framework offers an important conceptual perspective and useful approach to studying online communication and interaction (Garrison, 2007; Garrison & Arbaugh, 2007), others argued that existing CoI research offers little support for deep and meaningful learning in a course using a CoI framework (Rourke & Kanuka, 2009). Rourke and Kanuka (2009) reviewed 252 journal articles from 2000 to 2008 referencing the CoI and found only 48 that analyzed course data related to CoI framework. Only five reported an assessment of student learning and the measure was limited to student perceived learning as the measure assessed, typically as a single item on a student perception survey. Rourke and Kanuka concluded that most CoI research has focused on learning processes versus specific learning outcomes and has been sidetracked with investigations of student satisfaction, research measurement, and students' perceptions of their learning, social presence, teaching presence, and cognitive presence while failing to investigate the framework's central claim that a CoI, comprised of the three presences (as independent variables), influences deep and meaning learning outcomes (as the dependent variable).

In a response to the Rourke and Kanuka (2009) critique of CoI research, Akyol et al. (2009) asserted that the CoI was forwarded as a learning process model based on a constructivist orientation emphasizing knowledge construction, which Akyol et al.

contrast to an objectivist focus on learning outcomes as the end products of inquiry. Akyol et al. assert cognitive presence, operationalized through the embedded four phase practical inquiry model, reflects the transactional nature of the learning process. In addition, the use of perceived learning in research assumes that a subjective measure of cognitive learning is as valid as an objective measure (Baker, 2010). Others have used self-reports of learning to overcome potential limitations from inconsistencies across courses and instructors and the restricted grade range in graduate-level courses (Arbaugh, 2008).

While CoI research suggested that perceptions of social presence, teaching presence, and cognitive presence are related to students' perceptions of learning (Arbaugh, 2008), it remains unclear whether the students' perceptions of learning and community are associated with meaningful learning (Rourke & Kanuka, 2009). Studies of student perceptions have suggested that most students report achieving the highest levels of cognitive presence (Shea & Bidjerano, 2009a), yet these findings are in sharp contrast to studies relying on the content analysis of discussion transcripts to evaluate levels of cognitive presence and learning, as previously described.

The difference in findings may suggest a potential limitation of relying on students' self-reports of learning (Gonyea, 2005). Upon observing positive (but low) correlations between the students' self-reports and the pre-post measures of performance gain, Pohlmann and Beggs (1974) concluded that student's self-reported growth and objective pre-post objective assessment of growth are relatively independent. Further, Pohlmann and Beggs suggested that self-report measures of academic growth appeared to be influenced by the growth in orientation and attitudes toward the course subject matter.

Similarly, while Pike (1996) found a positive relationship between self-reports of learning and objective measures of academic development, he suggested using self-reports as a general indicator of achievement, but not as a substitute for objective measures of academic gain. While a meta-analysis of research examining the validity of self-evaluation of ability suggested a small positive correlation ($r^2 = .08$) between self-perception and objective measures of performance (Mabe & West, 1982), a later meta-analysis of research on student self-assessment in higher education examined studies that compared student self-assessment and instructor assessment and found most studies reported overrating on the part of the student (Falchikov & Boud, 1989). Falchikov and Boud (1989) also reported a difference in self-assessment accuracy based on two factors, including (a) course level (with students in advanced courses having closer agreement with the instructor as compared to students in introductory courses), and (b) subject area (with more accurate self-assessments in science than in social science). In later research, Pike (1999) stressed the need to exercise caution when using students' self-reports of gains to differentiate among outcomes due to research evidence suggesting the influence of *halo error*, or the tendency of survey respondents to give consistent evaluations across a set of items based on general perceptions of the subject (Gonyea, 2005).

Others argue that the criticism of the CoI framework and existing research was misguided and a misrepresentation of both the nature of the framework, as well as the purpose and conclusions of previous studies (Akyol et al., 2009). Akyol et al.(2009) argue that it was unreasonable to criticize the underlying value of the CoI as educational inquiry process framework (emphasizing the process of knowledge construction, critical inquiry, and discourse) based on an absence of existing studies examining the influence of the CoI on objective measures of learning outcomes. Others argue that the difference in reported cognitive presence in research suggested a need to extend research on learning process outcomes to more course activities than just course asynchronous discussions (Archer, 2010; Shea et al., 2011).

## Beyond CoI Research

**Learning outcomes within whole class, group, and individual instruction.** The central goal of the CoI framework is the creation and sustainability of a community of inquiry that goes beyond student-content interaction to incorporate collaborative educational experiences among students and the teacher within the distance learning environment (Garrison et al., 2000). Yet, beyond specific CoI research, findings are mixed with regard to the effects of whole class, small group, and individual instruction on learning outcomes. A meta-analysis of 54 studies comparing examination performance of college students in computer-based instruction (CBI) and conventional classes found superior CBI performance in 37 of the studies (Kulik, Kulik, & Cohen, 1980). A more recent meta-analyses of small group, whole class, and individual learning strategies suggested that under certain conditions, instructional strategies involving small groups (two to four students) resulted in a small, but significantly positive effect on individual achievement over either whole class (Lou, Abrami, & Spence, 2000) or individual learning approaches (Lou, Abrami, & d' Apollonia, 2001). Findings from a meta-analysis of 51 studies comparing achievement outcomes between small group to whole class instruction suggested that the effects of small group instruction were significantly larger for students of all ability levels when (a) teachers were trained in small group instruction (b) grouping was based on ability and group cohesiveness, and (c) cooperative learning (which promotes both interdependence and individual accountability within carefully designed activities) was used as the method of instruction (Lou et al., 2000).

Similarly, findings from a meta-analysis of 122 studies comparing small group learning with computer technology versus individual learning with computer technology suggested that the effects of small group learning over individual learning with regard to individual achievement are significantly enhanced when (a) students had group work experience, (b) cooperative learning strategies were employed, (c) group size was small (pairs of students), (d) the subject was in the social sciences (versus math, science, or language arts), and (e) students were either low or high ability who appeared to benefit from receiving and giving support (Lou et al., 2001). However, even when superior group products or task outcomes were produced, no significant positive effects on individual achievement resulted when the group work (a) used no cooperative learning strategies, (b) groups were large, (c) group work used unstructured exploratory environments, or (d) the computer-based programs provided students with elaborate feedback (Lou et al., 2001). Overall, these finding suggested that when working in groups, not all students may learn equally well and group task performance was not positively related to individual learning achievement in large groups with no designed cooperative strategies (Lou et al., 2001) .

**Interaction theory and research.** Three interaction types are frequently considered within distance education, including (a) student-content, (b) student-teacher, and (c) student-student interactions (Moore, 1989). An underlying assumption in the CoI framework is that all three interaction types are necessary in order to support deep and meaningful learning. In a recent meta-analysis of 74 distance education studies, the influence of the three interaction types on student achievement was examined (Bernard et al., 2009). Interaction was categorized based on the conditions and capacity to elicit or activate interactive behavior in students. While the review offered support for the individual influence of all three interaction types on student learning, a difference in effectiveness was suggested favoring student-content and student-student interactions over student-teacher interaction. Further, through the coding of interaction strength within the meta-analysis, a significant linear relationship was found between effect size and (a) student-content interaction strength and (b) student-content interaction in combination with either student-teacher or student-student interaction suggesting that high quality student-content strategies which help students engage in the content and with the teachers or other students makes a significant difference in student achievement. However, the researchers note that the results are heterogeneous based on a range of instructional strategies and student interactions and that future distance education research is needed to evaluate which designs to support interaction improve learning outcomes.

## Purpose of Research

### Statement of Problem

From the literature review, gaps exist in our understanding of the relationships among the CoI presences and student learning outcomes. Studies of group work and interaction do not support a claim that any opportunity for student-student, student-content, and student-teacher interaction will automatically lead to deep and meaningful learning. In addition, research offers mixed findings with regard to the relative effectiveness of group instruction versus individual instruction, suggesting a preference for group instruction only under certain small group conditions and when specific collaborative learning strategies are utilized. Further, while online student-student interactions combined with rich student-content and student-teacher interaction may lead to increased student *perceptions* of learning, social presence, teaching presence, and cognitive presence, these perceptions may not be related to *actual* student achievement outcomes.

**Research Questions**

The purpose of this research was to examine the relationships between students' perceptions of social presence, teaching presence, and cognitive presence, and actual course learning achievement outcomes as assessed by the instructor. Five research questions guided this study:

1. To what extent are student perceptions of CoI related to objective measures of student achievement?
2. To what extent are student perceptions of learning achievement related to objective measures of student achievement?
3. To what extent are student perceptions of learning achievement and course satisfaction related to student perceptions of CoI?
4. To what extent are student characteristics, course engagement features, and student course perceptions related to objective measures of student achievement, student perceptions of learning, and student perceptions of CoI?
5. To what extent do designed course interactions contribute to student perceptions of achievement?

# CHAPTER II

# METHODS

## Participants

Participants included both master's and doctoral graduate students enrolled in five courses within a college of education at a large size public university in the southeastern region of the US. While one course focused on qualitative research methods, four courses examined the theory and practice of instructional design and technology, including an overview of field of instructional technology, theory and concepts regarding adult learning and training, the design of instructional simulations, and the application of advanced instructional design techniques. All five courses were conducted during the same 15-week Fall 2010 semester starting August 28, 2010 and ending December 10, 2010. Fifty-one students (68% of those enrolled as of the semester's end) consented to participate with the distribution per course shown in Table 1.As all courses were graduate-level, 96% of the students were 26 years of age or older as of the semester's start with 67% being between 26 and 45 years of age. Fifty-seven percent of the participants were male.

Table 1

*Participant Distribution per Course*

| Course | Enrolled (*n*) | Consenting (*n*) | Consenting (%)[a] | Participation (%)[b] |
|---|---|---|---|---|
| 1 | 15 | 11 | 73.3 | 21.6 |
| 2 | 15 | 12 | 80.0 | 23.5 |
| 3 | 19 | 10 | 52.5 | 19.6 |
| 4 | 16 | 12 | 75.0 | 23.5 |
| 5 | 10 | 6 | 60.0 | 11.8 |
| Total | 75 | 51 | 68.0 | 100.0 |

[a]Percentage of enrolled in the class. [b]Percentage of total in study.

All courses used a hybrid delivery format with a combination of face-to-face and computer-mediated communication (CMC) to facilitate both synchronous and asynchronous course lecture and discussion. Participants were geographically dispersed and attended the live sessions either (a) on the main campus (27%), (b) at remote learning centers supported by the university, but away from the main campus (24%), or (c) at other distant locations, such as the student's home or work via personal computer (49%). The participants' prior distance learning experience ranged from none to over 30 prior courses ($M = 10$, $SD = 9$).

At the start of the semester, 98% of students assessed their level of computer expertise to be average or better, and 90% assessed their level of proficiency with the conferencing interface used for live sessions to be average or better. By the end of the semester, 94% of students assessed their level of proficiency with the live conferencing interface to be average or better, suggesting a comfort level with computers and the technology used in the computer-mediated learning environment.

All courses used the Blackboard learning management system (LMS) to facilitate asynchronous course communication. All instructors used the LMS to post the course syllabus, assignments, and asynchronous discussion boards. Table 2 shows the mean LMS access for both participating students and instructors for each course in the study based on the number of screens accessed in the LMS during the 15 weeks of the semester. All courses incorporated live lecture and discussion facilitated by the instructor located in a classroom in a broadcasting center on the main campus. As shown in Table 2, during the 15 week semester, the number of live sessions and total minutes of synchronous class time differed among the five classes ranging from as few as five live sessions (730 total minutes) to 13 live sessions (1,693 total minutes). Two different types of synchronous CMC technologies facilitated a connection to the live sessions for participants located either in remote learning centers or at other distance locations. Two courses utilized a one-way audio and video streaming technology to broadcast the live session from the main campus. This form of broadcasting technology allowed only the participants at the main campus and remote learning centers to speak and be seen, while those in other distance locations (typically on a personal computer at home or work) relied on text-chat to communicate with the instructor. The other three courses used a two-way audio and video conferencing technology in which all participants could speak and be seen by other participants.

Table 2

*Synchronous and Asynchronous Activity*

| | Live Sessions | | | LMS Access | |
|---|---|---|---|---|---|
| Course | *n* | Total Minutes | Audio-Video Type | Student (*M*) | Teacher (*M*) |
| 1 | 7 | 927 | Two-way | 597 | 1,241 |
| 2 | 10 | 1,368 | Two-way | 594 | 931 |
| 3 | 13 | 1,693 | One-way | 617 | 1,882 |
| 4 | 11 | 1,172 | Two-way | 875 | 919 |
| 5 | 5 | 730 | One-way | 576 | 685 |
| Total | 10 | 1,215 | | 663 | 1,152 |

## Design

This non-experimental study used correlation methods to examine the relationships proposed within the research questions in a real-world instructional setting. The primary sources of data collected in this study included: (a) the five course instructors' assessments of the consenting students' learning achievement; (b) a survey of student perceptions (performed twice during the semester); and (c) course data collected through the LMS and observation of the live session recordings. The following describes the materials and procedures used to collect this data.

## Instruments

**Instructor-assessed learning achievement data.** Data examining individual learning achievement were collected based on the course instructor's assessment of (a) a significant project or paper in the course, and (b) the final course assessment. Using the syllabus as a guide, the researcher discussed with each instructor the assignments due in the course. Based on the instructor's feedback and an evaluation of the significance of the paper in terms of both course objectives and the student's final grade, a paper or project was selected in each course that aligned with a significant objective in the course and represented between 13% and 33% of the total possible points in the course.

As summarized in Table 3, for the final course assessment, the cumulative points assigned to each consenting student by the instructor for all work in the course were collected and converted to a percentage based on the total possible points for the course. Similarly, for the significant project or paper, the total points assigned by the instructor for the significance work were collected and converted to a percentage based on the total possible points. As an additional measure of achievement for the significant work, the course instructor provided an overall learning assessment (on a 1 to 5 point scale) for the significant work for each participant based on levels of learning achievement prescribed by the Structure of the Observed Learning Outcomes (SOLO) taxonomy (Biggs & Collis, 1982; Biggs & Tang, 2007).

Table 3

*Instructor-Assessed Learning Achievement Variables*

| Variable | Description | Value |
|---|---|---|
| SOLO score | Course instructor learning assessment of the student's significant work based on the SOLO taxonomy | SOLO Taxonomy 1 - 5 |
| Project score | Points assigned by the instructor for the student's significant work based on the instructor's rubric | % of total possible points for significant work |
| Course score | Cumulative points assigned to the student by the instructor for all work in the course | % of total possible points for all work in course |

The SOLO taxonomy is a *hierarchy of learning* evaluation based on both the learning quantity (amount learned) and quality (deep versus surface processing) and has been shown to effectively measure different kinds of cognitive learning outcomes within a range of subject areas in higher education settings and across various academic tasks (Biggs, 1979; Chan, Tsui, Chan, & Hong, 2002; Kanuka, 2005). The five levels include the following (Biggs & Collis, 1982):

1. Prestructural. The student does not address the problem.
2. Unistructural. The student jumps to conclusion focusing on only one aspect of the task or problem with little consistency.
3. Multistructural. The student can generalize only a few limited and independent aspects closing too soon based on isolated data or reaching different conclusions with same data.
4. Relational. The student can generalize within the given context and relate aspects from relevant data.
5. Extended Abstract. The student can generalize to situations not experienced and allows logically possible alternatives.

Appendix A shows the learning outcome data collection form each instructor completed for the consenting students in the course. Given the need to collect grades only for consenting students, the instructors were shown the names of the consenting students and asked to provide five items for each student, including (a) the significant work SOLO score, (b) the total points earned by the student for the significant work, (c) the total possible points for the significant work, (d) the cumulative earned points by the student for the course, and (e) the cumulative possible points in the course.

**Student perception survey.** The online survey instrument (see Appendix B) collected basic demographic data from each student, as well as student perceptions of both CoI and other course features. The following describes the data collected within the student perception survey.

***Student perceptions of CoI.*** Using 37-items from a CoI survey provided by Shea & Bidjerano (2009a), which was based on a 34-item CoI survey developed and validated by Arbaugh et al. (2008), the CoI portion of the survey measured perceived cognitive presence, social presence, and teaching presence using a 5-point Likert-type scale (see the 37 questions in Section II: Community of Inquiry in Appendix B). While Shea and Bidjerano administered the survey after the completion of the course and questions were written in the past tense, the questions used in this survey were written in the present tense as the students were responding to questions about an in-progress course. A composite CoI score was calculated for each student based on the mean responses to all 37 items comprising the CoI section of the survey. Subscales were also calculated based on the mean responses to the applicable question groupings for social presence, teaching presence, and cognitive presence, as shown in Table 4.

Table 4

*Community of Inquiry Composite and Subscale Variables*

| Variable | Description | Value |
|---|---|---|
| CoI composite | Mean of responses to all 37 items comprising the CoI section of the survey | Mean of questions 1 - 37 |
| Social presence subscale | Mean of responses to all 15 items comprising only the social presence section | Mean of questions 1 - 15 |
| Teaching presence subscale | Mean of responses to all 10 items comprising only the teaching presence section | Mean of questions 16 - 25 |
| Cognitive presence subscale | Mean of responses to all 12 items comprising only the cognitive presence section | Mean of questions 26 - 37 |

***Other student data and perceptions.*** The student perception survey captured additional student demographic and student perception data. Table 5 describes the student demographic variables and the values associated with each variable.

Table 5

*Student Demographic Variables*

| Variable | Description | Value |
|---|---|---|
| Age | Student age range at start of course | 1 = 25 or under<br>2 = 26 – 35<br>3 = 36 = 45<br>4 = 46 – 55<br>5 = 56 or above |
| Gender | Student gender | 1 = Male<br>2 = Female |
| Prior distance-learning | Student's self-reported number of distance-learning courses taken prior to this course | Number reported by student |
| Computer expertise | Student's perceived level of overall computer expertise | 1 = Novice<br>2 = Below Average<br>3 = Average<br>4 = Above Average<br>5 = Expert |
| Live conferencing proficiency | Student's perceived level of proficiency with live session conferencing interface used in the course | 1 = Novice<br>2 = Below Average<br>3 = Average<br>4 = Above Average<br>5 = Expert |
| Enrolled course | Which course each student was enrolled | Course identifier 1 – 5 |
| Live session location | Student's self-report of where s/he participated in live class sessions for this course | 1 = main campus<br>2 = remote onsite<br>3 = webconference |

In addition to the CoI survey, Table 6 describes additional items assessing course perception collected with both surveys. These variables include the student's perceived learning and satisfaction with the course, as well as the extent to which the student felt the course was (a) difficult, (b) had a large required workload, and (c) required the student to work very hard (effort), as compared to other courses the student had taken prior to this course.

Table 6

*Student Perception of Course Variables*

| Variable | Description | Value |
|---|---|---|
| Perceived learning | Student agreement s/he learned a great deal in this course | Likert-type scale 1 – 5[a] |
| Satisfaction | Student agreement s/he was satisfied with this course | Likert-type scale 1 – 5[a] |
| Difficulty | Student agreement that the course was difficult compared to other courses | Likert-type scale 1 – 5[a] |
| Workload | Student agreement that the course had a large required workload compared to other courses | Likert-type scale 1 – 5[a] |
| Effort | Student worked hard in this course compared to other courses | Likert-type scale 1 – 5[a] |

[a]1 = Strongly disagree. 2 = Disagree. 3 = Neutral. 4 = Agree. 5 = Strongly Agree

Students were also asked to indicate the extent to which specific student-content, student-student, and student-teacher interactions contributed to their learning in the course, including (a) live class sessions, (b) one-on-one communication with the instructor, (c) readings, (d) projects and papers, and (e) course related discussions with other students. Table 7 describes these course interaction variables.

Table 7

*Student Perception of Course Interaction Variables*

| Variable | Description | Value |
|---|---|---|
| Live session contribution | Student agreement live class sessions contributed to course learning | Likert-type scale 1 – 5[a] |
| One-on-One instructor contribution | Student agreement one-on-one communication with instructor contributed to course learning | Likert-type scale 1 – 5[a] |
| Readings contribution | Student agreement readings contributed to course learning | Likert-type scale 1 – 5[a] |
| Projects and papers contribution | Student agreement projects and papers contributed to course learning | Likert-type scale 1 – 5[a] |
| Discussions contribution | Student agreement discussions sessions contributed to course learning | Likert-type scale 1 – 5[a] |

[a]1 = Strongly disagree. 2 = Disagree. 3 = Neutral. 4 = Agree. 5 = Strongly Agree

**Other course data.** The syllabus, all video recordings of the live sessions, and online learning management system (LMS) data, including student and instructor access data and discussion board posts, were collected for each course. Collected course data were used to describe the courses included in this study and to provide measures for actual course interaction, as described in Table 8.

Table 8

*Actual Course Interaction Variables*

| Variable | Description | Value |
|---|---|---|
| Live session minutes | Total minutes of live class sessions held in the course during the semester | Total minutes of live session recordings |
| Student LMS access | Total number of screens in the LMS accessed by each student during the semester | Total number of screens accessed |
| Instructor LMS access | Total number of screens in the LMS accessed by the instructor during the semester | Total number of screens accessed |

**Procedure**

The study was conducted with students registered in regularly scheduled courses at the university and the university's Institutional Review Board gave approval for the study. Five course instructors were contacted to discuss the potential for including their courses in the study approximately five weeks prior to the start of the semester. Courses were selected to attain a similar student demographic (graduate students) in classes with similar subject matter (college of education courses) using the same type of hybrid delivery format (both synchronous and asynchronous CMC with students attending both at the main campus and at other distance locations). The nature and scope of the study were explained along with what would be asked of the instructors and their students. Before the start of the semester, all five instructors agreed to include their courses in the study and granted the researcher access to the LMS in order to collect data and to contact students directly through the LMS system.

The survey of student perceptions was performed twice during the semester. A link to the online survey was emailed to each registered student in the five courses during the fifth week of classes that also included the informed consent form. Students who provided their voluntary consent and completed the first survey were considered participants in the study and were later sent the link to the second (identical) survey approximately two weeks before the end of the semester to capture changes in perceptions during the course. Each student was required to provide his or her name on the survey in order to match the instructor's learning assessment to the student's responses to the first and second surveys. While three consenting students dropped the course during the semester and were removed from the study, all others who completed the first survey also completed the second (n = 51). The mean completion dates were October 1, 2010 for the first survey and December 6, 2010 for the second survey. Students were not offered compensation to participate, but were informed that those who completed both surveys would be entered into a random drawing for four $25 Amazon.com gift certificates.

Course data were collected throughout the semester. For each course, the syllabus was collected at the start of the semester and all video recordings of the live sessions were saved and reviewed as the course progressed. The online learning management system data, including the student and instructor access data and discussion board posts, were collected at the end of the semester. The five course instructors' assessments of the consenting students' learning achievement were also collected at the end of the semester after the students' grades had been submitted to the university.

**Analysis**

A descriptive analysis of the study's variables was conducted, including a frequency distribution by course of the (a) mean CoI composite and subscale data, (b) mean instructor-assessed learning achievement data, and (c) mean student perceived learning data. One-way within-subjects analysis of variance (ANOVA) was computed to compare the CoI and perceived learning data between the two surveys , while one-way between-subjects ANOVA with post hoc was conducted to compare the mean CoI composite and subscale data, instructor-assessed learning achievement data, and perceived learning data between the courses. The research questions were investigated using Pearson correlation and stepwise multiple regression methods using the variables, instruments, and statistical procedures described in Table 9.

Five students received extensions beyond December 2010 to complete required coursework, including three students who did not complete the significant project or paper. Thus, the data analysis included the survey responses from the 51 consenting students, but calculations including actual learning achievement data excluded participants with incomplete coursework (i.e. pairwise exclusion was used, where applicable).

Table 9

*Research Questions, Variables, Instruments, and Statistical Procedures*

| Research Question | Variable | Instrument | Statistical Procedure |
|---|---|---|---|
| To what extent are student perceptions of CoI related to object measures of student achievement? | CoI composite<br>Teaching presence subscale<br>Social presence subscale<br>Cognitive presence subscale<br>SOLO score<br>Project score<br>Course Score | Student perception survey<br><br>Instructor-assessed learning achievement | Pearson product-moment correlation<br><br>Stepwise multiple regression |
| To what extent are student perceptions of learning achievement related to objective measures of student achievement? | Perceived learning<br>SOLO score<br>Project score<br>Course Score | Student perception survey<br><br>Instructor-assessed learning achievement | Pearson product-moment correlation |
| To what extent are student perceptions of learning achievement and course satisfaction related to student perceptions of CoI? | Satisfaction<br>Perceived learning<br>CoI composite<br>Teaching presence subscale<br>Social presence subscale<br>Cognitive presence subscale | Student perception survey | Pearson product-moment correlation<br><br>Stepwise multiple regression |

Table 9 continued

| Research Question | Variable | Instrument | Statistical Procedure |
|---|---|---|---|
| To what extent are student characteristics, course engagement features, and student course perceptions related to objective measures of student achievement, student perceptions of learning, and student perceptions of CoI? | Age<br>Gender<br>Prior distance-learning<br>Computer expertise<br>Live conferencing proficiency<br>Live session location<br>Live session minutes<br>Student LMS access<br>Instructor LMS access<br>Difficulty<br>Workload<br>Effort<br>Satisfaction<br>SOLO score<br>Project score<br>Course Score<br>Perceived learning<br>CoI composite<br>Teaching presence subscale<br>Social presence subscale<br>Cognitive presence subscale<br>Enrolled Course | Student perception survey<br><br>Instructor-assessed learning achievement<br><br>Observation | Pearson product-moment correlation<br><br>Stepwise multiple regression |
| To what extent do designed course interactions contribute to student perceptions of achievement? | Perceived learning<br>Live session contribution<br>Readings contribution<br>Projects and papers contribution<br>Discussions contribution<br>One-on-One instructor contribution | Student perception survey | Pearson product-moment correlation<br><br>Stepwise multiple regression |

# CHAPTER III

# RESULTS

Results are presented in two sections. The first section presents descriptive statistics summarizing the results of a within-subject analysis of the CoI, learning achievement, and learning perception data collected from both the surveys and the instructors, as well as a between-subjects analysis of the data based on enrollment in each course. The second section presents the results of the analyses of the study's five research questions.

## Descriptive Statistics

**Community of inquiry measures.** Appendix C compares the means for each of the 37 CoI questions in both the first and second surveys. Skewness and kurtosis values were calculated for the mean teaching presence, social presence, and cognitive presence subscales and the CoI composite measure and were within a range of -1.0 to +1.0 for each subscale and composite measure.

A one-way within-subjects ANOVA was computed to compare the mean social presence, teaching presence, and cognitive presence subscales between the first and second surveys. While each mean subscale score increased between surveys, the ANOVA was statistically significant only for the change in the cognitive presence subscale $F(1, 50) = 5.97$, $p = .018$, partial $\eta^2 = .11$, indicating a statistically significant increase in students perception of cognitive presence during the semester. In addition, a one-way within-subjects ANOVA was conducted to compare the mean cognitive presence, teaching presence, and social presence subscales within the second survey. The results suggested a statistically significant difference, $F(1, 50) = 20.70$, $p < .001$, partial

$\eta^2 = .29$. Bonferroni pairwise comparison tests ($p < .001$) indicated that the social presence subscale was significantly smaller than both the cognitive presence and teaching subscales suggesting lower perceptions of social presence than perceptions of teaching and cognitive presences within the group of study participants.

Table 10 shows the CoI composite and subscale measures between courses in the study. Cronbach's alpha reliability coefficients of .95 to .97 for the CoI subscales have been reported in other research using this survey (Shea & Bidjerano, 2009a). Cronbach's alpha reliability coefficients of 0.94 and 0.95 were found for the CoI survey administered to the 51 respondents in this study in the middle and at the end of the semester, respectively. A one-way between-subjects ANOVA (based on data from the second survey) was computed to compare the mean teaching presence, social presence, and cognitive presence subscales and the CoI composite score between the courses. No significant difference ($p > .05$) was found between courses for any of the teaching presence, social presence, and cognitive presence subscales or the overall CoI composite measure.

Table 10

*Mean Community of Inquiry Composite and Subscale Measures by Course*

| | | Teaching Presence | | Social Presence | | Cognitive Presence | | CoI | |
|---|---|---|---|---|---|---|---|---|---|
| Course | $n^{a,b}$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ |
| 1 | 11 | 4.21 | 4.15 | 3.76 | 3.91 | 3.94 | 3.98 | 4.00 | 4.03 |
| 2 | 12 | 4.30 | 4.41 | 4.06 | 4.01 | 4.29 | 4.43 | 4.23 | 4.31 |
| 3 | 10 | 4.13 | 4.43 | 3.87 | 3.91 | 3.98 | 4.13 | 4.01 | 4.19 |
| 4 | 12 | 4.23 | 4.29 | 3.67 | 3.78 | 4.16 | 4.17 | 4.05 | 4.11 |
| 5 | 6 | 3.91 | 4.27 | 3.78 | 3.78 | 3.68 | 4.29 | 3.80 | 4.14 |
| Total | 51 | 4.18 | 4.31 | 3.83 | 3.89 | 4.05 | 4.20 | 4.05 | 4.16 |
| Skewness | | -.41 | -.74 | .12 | -.24 | .02 | -.45 | -.11 | -.64 |
| Kurtosis | | .02 | .13 | .53 | -.63 | .05 | -.30 | .10 | .05 |
| Cronbach's α | | .84 | .84 | .93 | .94 | .97 | .90 | .94 | .95 |

[a]Data collected middle of semester. [b]Data collected end of semester.

**Learning outcome measures.** The percentage of earned to possible points on the paper or project and the total course grades were multiplied by five to place the three instructor-assessed learning achievement measures on the same five point scale as the student perceived learning measure, the CoI subscale and composite measures, as well as the SOLO score. Table 11 summarizes the mean student perceived learning score from both surveys, the significant project SOLO score (SOLO), the scaled significant project or paper (Project) score, and the scaled total earned points in the course (Course) score for each course in the study, as well as in total for all participants (Total). Skewness and kurtosis values were calculated for the learning outcome measures and were within a range of -2.0 to +3.0.

Table 11

*Mean Instructor-assessed and Student Perceived Learning Measures by Course*

| | Instructor-assessed Learning Achievement | | | | | | Student Perceived Learning | | |
|---|---|---|---|---|---|---|---|---|---|
| | SOLO | | Project | | Course | | | | |
| Course | $M^b$ | $n^b$ | $M^b$ | $n^b$ | $M^b$ | $n^b$ | $M^a$ | $M^b$ | $n^{a,b}$ |
| 1 | 3.45 | 11 | 3.78 | 11 | 4.73 | 11 | 4.00 | 4.18 | 11 |
| 2 | 4.08 | 12 | 4.54 | 12 | 4.62 | 12 | 4.25 | 4.83 | 12 |
| 3 | 4.75 | 10 | 4.72 | 8 | 4.71 | 8 | 3.80 | 4.10 | 10 |
| 4 | 3.67 | 12 | 4.67 | 12 | 4.64 | 10 | 4.58 | 4.25 | 12 |
| 5 | 4.80 | 6 | 4.82 | 5 | 4.78 | 5 | 4.00 | 4.68 | 6 |
| Total | 4.02 | 51 | 4.46 | 48 | 4.68 | 46 | 4.16 | 4.39 | 51 |
| Skewness | -.90 | | -1.24 | | -1.15 | | -.01 | -1.42 | |
| Kurtosis | -.20 | | .65 | | .963 | | -.06 | 2.84 | |

[a]Data collected middle of semester. [b]Data collected end of semester.

A one-way between-subjects ANOVA with post hoc was conducted to compare the three mean instructor-assessed achievement measures and the student perceived learning scores between the courses. Results of the ANOVA indicated a significant mean difference between courses for only the SOLO score, $F(4, 43) = 2.85, p < .05$, partial $\eta^2 = .21$, and the project score, $F(4, 43) = 8.83, p < .01$, partial $\eta^2 = .45$. As equal variances cannot be assumed for both SOLO and project scores, a Games-Howell post hoc test indicated that the Course 1 mean SOLO score was significantly lower than the Course 3 and 5 mean SOLO scores, and the Course 1 mean project score was significantly lower than the mean project scores for each of the other four courses.

A one-way within-subjects ANOVA was also conducted to compare the mean student perceived learning scores between the first and second surveys. A statistically significant difference was found, $F(1, 50) = 5.61, p = .022$, partial $\eta^2 = .10$, suggesting an increase in student perceived learning as the semester progressed. In addition, a one-way within-subjects ANOVA was conducted including only students who complete all required coursework ($n = 46$) to compare the mean student perceived learning scores from the second survey ($M = 4.41$, $SD = .75$, $n = 46$) to the instructor-assessed course score ($M = 4.68$, $SD = .56$, $n = 46$), that indicated a statistically significant difference, $F(1, 45) = 5.47, p = .024$, partial $\eta^2 = .11$. These results suggested that students' assessments of what they learned in the class were lower than the course scores assessed by the instructors.

**Research Question One**

Pearson bivariate correlation coefficients were calculated to assess the extent student perceptions of social presence, teaching presence, and cognitive presence were related to the instructor-assessed measures of learning achievement, including the SOLO score, the project score, and the course score. As shown in Table 12, no significant correlations ($p > .05$) were indicated between the CoI composite measure and any of the three instructor-assessed measures of learning achievement. The social, teaching, and cognitive presence subscales were each significantly positively correlated with the other presences, suggesting variance in one presence is accounted for by the other presences, which complicates an examination of this research question based upon the CoI subscales. However, only a significant correlation was found between the cognitive presence subscale and the project score ($r^2 = .08$), suggesting that approximately 8% of the variance in the student's project score was explained by the cognitive presence in the course. Otherwise, no significant correlation ($p > .05$) was suggested between the cognitive presence subscale and either the SOLO score or course score or between either the social presence or teaching presence subscales and any of the three instructor-assessed learning achievement measures.

Table 12

*Community of Inquiry Measures and Instructor-assessed Learning Achievement Correlations*

| Measure | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Teaching presence | - | | | | | |
| 2. Social presence | .52*** | - | | | | |
| 3. Cognitive presence | .74*** | .55*** | - | | | |
| 4. CoI | .92*** | .76*** | .88*** | - | | |
| 5. SOLO | .10 | -.09 | .09 | .05 | - | |
| 6. Project | .26 | -.00 | .29* | .23 | .76** | - |
| 7. Course | .20 | .05 | .16 | .17 | .57** | .43** |

* $p < .05$ level, two-tailed. ** $p < .01$ level, two-tailed. *** $p < .001$ level, two-tailed.

Stepwise multiple regression analyses were conducted to consider the extent to which either (a) the CoI composite score or (b) each of the CoI subscales predicted actual learning achievement in the class. As expected from the outcome of the correlation analysis, results of the regression analyses indicated that neither the CoI composite score, the social presence subscale, nor the teaching presence subscale (alone or combined with the other subscales in a stepwise multiple regression analysis) were predictors of any of the three instructor-assessed learning achievement measures ($p > .05$). Cognitive presence was not found to be a predictor of the SOLO score or the course score, but cognitive presence was a predictor of the project score, $b = .33$, $\beta = .29$, $t(46) = 2.03$, $p = .048$, and explained approximately 6% of the variance in the project score, $F(1, 46) = 4.14$, $p = .048$, $R^2_{adj} = .06$.

To further examine the cognitive presence and project score relationship, a stepwise multiple regression analysis was conducted using the CoI survey question groupings for the practical inquiry framework that comprised the cognitive presence subscale, including (a) *triggering event* (mean of questions 26 – 28) (b) *exploration* (mean of questions 29 – 31), (c) *integration* (mean of questions 32 – 34), and (d) *resolution* (mean of questions 35 – 37). The triggering event, exploration, and integration groupings were not found to be predictors of the project score ($p > .05$). Only the resolution grouping was a significant predictor of the project score, $b = .36$, $\beta = .32$, $t(46) = 2.31$, $p = .025$, and explained approximately 8% of the variance in the project score, $F(1, 46) = 5.34$, $p = .025$, $R^2_{adj} = .08$.

**Research Question Two**

Pearson bivariate correlation coefficients were computed to assess the extent to which student perceived learning from the second survey was related to objective measures of student achievement, including the instructor-assessed SOLO, Project, and course scores, as shown in Table 13. While each of the three instructor-assessed learning achievement measures were significantly positively correlated, no significant correlation ($p > .05$) was found between any of the instructor-assessed learning achievement measures and student perceived learning.

Table 13

*Correlations between Achievement Measures and Student Perceived Learning*

| Measure | 1 | 2 | 3 |
|---|---|---|---|
| 1. SOLO | - | | |
| 2. Project | .76* | - | |
| 3. Course | .57* | .43* | - |
| 4. Student perceived learning | -.04 | -.07 | -.04 |

* $p < .01$ level, two-tailed.

**Research Question Three**

Table 14 lists the mean perceived satisfaction scores for each course and in total for all courses. A one-way within-subjects ANOVA indicated a statistically significant increase in satisfaction scores between the first and second surveys, $F(1, 50) = 7.72$, $p = .008$, partial $\eta^2 = .13$. A one-way between-subjects ANOVA comparing the mean satisfaction scores from the second survey between the courses indicated no significant difference ($p > .05$).

Table 14

*Mean Perceived Satisfaction by Course*

| | | Satisfaction | |
|---|---|---|---|
| Course | $n^{a, b}$ | $M^a$ | $M^b$ |
| 1 | 11 | 3.91 | 4.18 |
| 2 | 12 | 4.17 | 4.67 |
| 3 | 10 | 3.70 | 4.10 |
| 4 | 12 | 4.50 | 4.17 |
| 5 | 6 | 3.50 | 4.50 |
| Total | 51 | 4.02 | 4.31 |
| Skewness | | -.94 | -.48 |
| Kurtosis | | 2.69 | -.74 |

[a]First survey conducted middle of semester. [b]Second survey conducted end of semester.

Pearson bivariate correlation coefficients were computed to assess the extent to which the satisfaction and perceived learning scores from the second survey were related to the CoI composite scores and CoI presence subscales, as shown in Table 15. Notably, student perceived learning and satisfaction were significantly positively correlated ($r^2$ = .58, $p$ < .001), suggesting that nearly 60% of the variance in one was accounted from the other. Satisfaction was significantly positively correlated with the CoI composite measure ($r^2$ = .35, $p$ < .001) indicating that approximately 35% of the variance in satisfaction was accounted from the CoI composite measure. In addition, satisfaction was also significantly positively correlated with teaching presence ($r^2$ = .33, $p$ < .001), social presence ($r^2$ = .14, $p$ < .001), and cognitive presence ($r^2$ = .29, $p$ < .001). Perceived learning was also significantly positively correlated with the CoI composite measure ($r^2$ = .40, $p$ < .001) indicating that approximately 40% of the variance in perceived learning was accounted from the CoI composite measure. In addition, perceived learning was also significantly positively correlated with teaching presence ($r^2$ = .33, $p$ < .001), social presence ($r^2$ = .09, $p$ < .05), and cognitive presence ($r^2$ = .50, $p$ < .001).

Table 15

*Correlations of Community of Inquiry Measures, Satisfaction, and Perceived Learning*

| Measure | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Teaching presence | - | | | | |
| 2. Social presence | .52** | - | | | |
| 3. Cognitive presence | .74** | .55** | - | | |
| 4. CoI | .92** | .76** | .88** | - | |
| 5. Satisfaction | .57** | .38** | .54** | .59** | - |
| 6. Perceived learning | .58** | .30* | .71** | .63** | .76** |

* $p$ < .05 level, two-tailed. ** $p$ < .001 level, two-tailed.

Stepwise multiple regression was conducted to consider the extent to which the teaching presence, social presence, and cognitive presence subscales predicted satisfaction. The regression analysis indicated that only teaching presence was a significant predictor of satisfaction, $b = .65$, $\beta = .57$, $t(49) = 4.90$, $p < .001$, and explained over 30% of the variance in the satisfaction score, $F(1, 49) = 23.98$, $p < .001$, with an $R^2_{adj} = .32$. Stepwise multiple regression was also conducted to consider the extent to which the teaching presence, social presence, and cognitive presence subscales predicted perceived learning. The regression analysis indicated that only cognitive presence was a significant predictor of perceived learning, $b = 1.04$, $\beta = .71$, $t(49) = 7.01$, $p < .001$, and explained nearly 50% of the variance in perceived learning, $F(1, 49) = 49.18$, $p < .001$, with an $R^2_{adj} = .49$.

**Research Question Four**

Pearson bivariate correlation coefficients were computed to consider the extent to which student characteristic, course engagement, and student course perception variables summarized in Table 16 were related to the three instructor-assessed measures of achievement, student perceived learning from the second survey, and the CoI presences from the second survey. The correlation matrix using data from the second survey is shown in Appendix D. In addition, stepwise multiple regression analyses were conducted to consider the extent to which these student characteristic, course engagement, and student course perception variables predicted the three instructor-assessed measures of achievement, student perceived learning, and the CoI composite score and subscales.

Table 16

*Student Characteristics, Course Engagement, and Course Perception Variables*

| Student Characteristics | Course Engagement | Course Perceptions |
|---|---|---|
| Age | Enrolled course | Difficulty |
| Gender | Live session location | Workload |
| Prior distance-learning | Live session minutes | Effort |
| Computer expertise | Student LMS access | Satisfaction |
| Live conferencing proficiency | Instructor LMS access | |

**Correlation with student characteristic measures.** Age, gender, and computer expertise at start of semester were not significantly correlated ($p > .05$) with any of the three instructor-assessed achievement measures, student perceived learning, or the CoI presences from the second survey. Live conferencing proficiency was significantly correlated with the project score ($r^2 = .09, p = .042$), while prior distance-learning experience was significantly correlated with social presence ($r^2 = .08, p = .040$) and course scores ($r^2 = .12, p =.018$).

**Correlation with course engagement measures.** The CoI composite score, social presence, teaching presence, and cognitive presence subscores at the end of the semester were not significantly correlated ($p > .05$) with individual courses. While individual courses were also not related to the SOLO score or the course score, individual courses were significantly positively correlated with the project score ($r^2 = .31, p < .001$), suggesting that over 30% of the variance in the project score was based on the student's enrolled course. Live session minutes was significantly positively correlated only with the project score ($r^2 = .08, p = .046$), but was not related to either SOLO or course scores, student perceived learning, or the CoI presences. Live session location was significantly correlated with social presence ($r^2 = .12$, $p = .012$), but was not related to student perceived learning, teaching presence, cognitive presence, or any of the three instructor-assessed learning achievement measures. Student LMS access and instructor LMS access were not significantly correlated ($p > .05$) with any of the three instructor-assessed learning achievement measures, student perceived learning, or the CoI presences.

To further analyze the relationship between live session location and social presence, a one-way between-subjects ANOVA analysis was computed to compare the mean social presence subscale from the second survey based on how the student attended the live sessions (face-to-face on the main campus, onsite at a remote location away from the main campus, or via webconference or video stream at another distance location). A significant mean difference was found for the social presence subscale based on where the student attended the course, $F(2, 48) = 3.36$, $p = .043$, partial $\eta^2 = .12$. A Tukey HSD post hoc test indicated a significant difference in the mean social presence subscales between those students who attended face-to-face on the main campus ($M = 4.15$, $SD = .52$, $n = 14$) and those who attended at a distance location (other than a remote onsite learning center) using conferencing technologies ($M = 3.72$, $SD = .53$, $n = 25$).

**Correlation with student course perception measures.** Mean responses to the course difficulty, workload, and effort questions for the first and second surveys are shown in Table 17. A one-way within-subjects ANOVA compared the mean difficulty, workload, and effort measures between the first and second survey and was statistically significant for only the increase in perceived workload $F(1, 50) = 6.38$, $p = .015$, partial $\eta^2 = .11$. Table 17 also compares each of the mean student perceived difficulty, workload, and effort measures between courses in the study. A one-way between-subjects ANOVA was computed to compare the difficulty, workload, and effort measures between the courses. A significant mean difference was indicated between courses for only perceived difficulty, $F(4, 46) = 3.20$, $p = .021$, partial $\eta^2 = .22$ and perceived workload, $F(4, 46) = 4.92$, $p = .002$, partial $\eta^2 = .30$. As equal variances can be assumed for both perceived difficulty and workload measures, a Tukey HSD post hoc test was conducted that suggested a significant mean difference only in perceived workload between Course 1 and Courses 3, 4, and 5, $p < .05$.

Table 17

*Mean Perceived Course Difficulty, Workload, and Effort Measures by Course*

| | | Difficulty | | Workload | | Effort | |
|---|---|---|---|---|---|---|---|
| Course | $n^{a, b}$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ |
| 1 | 11 | 2.64 | 3.00 | 3.18 | 3.00 | 3.73 | 3.55 |
| 2 | 12 | 3.17 | 3.17 | 2.92 | 3.58 | 3.58 | 3.83 |
| 3 | 10 | 3.40 | 3.70 | 3.50 | 4.40 | 3.50 | 4.30 |
| 4 | 12 | 4.25 | 4.08 | 4.33 | 4.33 | 4.50 | 4.25 |
| 5 | 6 | 4.50 | 4.17 | 4.33 | 4.33 | 4.33 | 4.17 |
| Total | 51 | 3.51 | 3.57 | 3.59 | 3.88 | 3.90 | 4.00 |
| Skewness | | -.08 | -.26 | -.067 | -.55 | -.29 | -.22 |
| Kurtosis | | -1.15 | -.96 | -1.03 | -.81 | -.40 | -.95 |

[a]First survey conducted middle of semester. [b]Second survey conducted end of semester.

Student perceived course difficulty and perceived effort at the second survey were not significantly correlated ($p > .05$) with any of the three instructor-assessed learning achievement measures, student perceived learning, or the CoI presences. While perceived workload during the first survey was not significantly correlated ($p > .05$) with any of the three instructor-assessed learning achievement measures, student perceived workload at the second survey was significantly positively correlated with both the SOLO ($r^2 = .12$, $p = .015$) and project scores ($r^2 = .23$, $p = .001$).

While satisfaction from the second survey was not significantly correlated ($p >$ .05) with any of the instructor-assessed achievement measures, satisfaction was significantly positively correlated with student perceived learning ($r^2 = .58$, $p = .046$), suggesting nearly 60% of the variance in student perceived learning was explained by student satisfaction with the course. As described previously, satisfaction was a significantly positively correlated with the CoI composite measure ($r^2 = .35$, $p < .001$), teaching presence ($r^2 = .33$, $p < .001$), social presence ($r^2 = .14$, $p < .001$), and cognitive presence ($r^2 = .29$, $p < .001$) using data from the second survey.

**Predictors of instructor-assessed learning achievement.** Using data from the second survey, stepwise multiple regression analyses were conducted to examine the extent to which the social, teaching, and cognitive presence subscales, along with the student characteristic, course engagement, and student course perception measures, predicted each of three instructor-assessed learning achievement measures. The following summarizes the regression results:

***Predictors of SOLO score.*** Using data from the second survey, stepwise multiple regression suggested only student perceived workload in the course was a significant predictor of the SOLO score, $b = .38$, $\beta = .35$, $t(46) = 2.54$, $p = .015$. Perceived workload explained approximately 10% of the variance in the SOLO score, $F(1,46) = 6.45$, $p =$ .015, $R^2_{adj} = .10$.

***Predictors of project score.*** While live conferencing proficiency, perceived workload, and cognitive presence were each significantly positively correlated with project score, none of these variables was a predictor of project score when controlled for the other variables in the regression analysis. As shown in Table 18, results from Step 1 of the stepwise multiple regression analysis indicated enrolled course accounted for over 30% of the variance in the project score. Step 2 indicated live session minutes was also a significant predictor of the project score ($\Delta R^2_{adj} = .10$), which combined with enrolled course accounted for 40% of the variance in the project score, $F(2,45) = 16.62$, $p < .001$, $R^2_{adj} = .40$.

Table 18

*Stepwise Multiple Regression Predictors of Project Score*

| Predictor | $b$ | $\beta$ | $t$ | $R^2_{adj}$ |
|---|---|---|---|---|
| Step 1 | | | | .30 |
| Constant | 3.80 | | 23.69* | |
| Enrolled course | .24 | .56 | 4.55* | |
| Step 2 | | | | .40 |
| Constant | 3.02 | | 10.05* | |
| Enrolled course | .25 | .59 | 5.12* | |
| Live session minutes | .00 | .34 | 3.00* | |

* $p < .01$

Given that the student's enrolled course accounted for 30% of the variance in the project score, additional analysis was conducted to examine further the relationship between the individual courses and project score. As described previously, the Course 1 mean project score was significantly lower than the mean project scores for each of the other four courses. When all data for Course 1 was removed from the stepwise multiple regression analysis, only student perceived workload was a significant predictor of the project score, $b = .16$, $\beta = .41$, $t(36) = 2.67$, $p = .012$. For the remaining four courses, perceived workload explained 15% of the variance in the project score, $F(1,35) = 7.10$, $p = .012$, $R^2_{adj} = .15$.

***Predictors of course score.*** As shown in Table 19, results from Step 1 of the stepwise multiple regression analysis indicated prior distance-learning experience accounted for 10% of the variance in the course score. However, prior distance-learning was *negatively* correlated with course score. While this finding may suggest a difference in performance between distance and on-campus students, a one-way between-subjects ANOVA analysis was computed to compare the mean course score based on live session location and no significant difference between groups of students was indicated ($p > .05$). Step 2 of the regression model indicated student LMS access was also a significant predictor of course score ($\Delta R^2_{adj} = .10$) and when combined with prior distance-learning accounted for 20% of the variance in the project score, $F(2,43) = 6.61$, $p = .003$, $R^2_{adj} = .20$.

Table 19

*Stepwise Multiple Regression Predictors of Course Score*

| Predictor | *b* | β | *t* | $R^2_{adj}$ |
|---|---|---|---|---|
| Step 1 | | | | .10 |
| Constant | 4.76 | | 108.42** | |
| Prior distance-learning | -.01 | -.35 | -2.45* | |
| Step 2 | | | | .20 |
| Constant | 4.64 | | 72.26** | |
| Prior distance-learning | -.01 | -.40 | -2.97** | |
| Student LMS activity | .00 | .34 | 2.55** | |

* $p < .05$. ** $p < .01$

**Predictors of student perceived learning.** A stepwise multiple regression analysis was conducted to examine the extent to which the social, teaching, and cognitive presence subscales, along with the student characteristic, course engagement, and student course perception measures, predicted student perceived learning. As shown in Table 20, results from Step 1 suggested satisfaction alone accounted for nearly 60% of the variance in student perceived learning. Step 2 indicated cognitive presence (shown previously as significantly positively correlated with student perceived learning, $r^2 = .50$) was also a significant predictor of student perceived learning ($\Delta R^2_{adj} = .12$). In Step3, social presence (shown previously as significantly *positively* correlated with student perceived learning, $r^2 = .09$) was found to be *negatively* correlated with student perceived learning when controlled for the other predictor variables. However, social presence was a small predictor within the regression model ($\Delta R^2_{adj} = .02$). Teaching presence (shown previously as significantly positively correlated with student perceived learning, $r^2 = .34$) was not a significant predictor when controlled for the other variables in the regression analysis. Overall, the regression analysis indicated that over 70% of the variance in student perceived learning was accounted from the combination of satisfaction, cognitive presence, and social presence, $F(3,47) = 42.74, p < .001, R^2_{adj} = .72$.

Table 20

*Stepwise Multiple Regression Predictors of Student Perceived Learning*

| Predictor | | *b* | *β* | *t* | $R^2_{adj}$ |
|---|---|---|---|---|---|
| Step 1 | | | | | .58 |
| | Constant | .88 | | 2.04* | |
| | Satisfaction | .82 | .76 | 8.28** | |
| Step 2 | | | | | .70 |
| | Constant | -.68 | | -1.36 | |
| | Satisfaction | .58 | .54 | 5.83** | |
| | Cognitive Presence | .62 | .42 | 4.52** | |
| Step 3 | | | | | .72 |
| | Constant | -.35 | | | |
| | Satisfaction | .60 | .56 | 6.22** | |
| | Cognitive presence | .75 | .51 | 5.09** | |
| | Social presence | -.25 | -.19 | -2.05* | |

* $p < .05$. ** $p < .01$.

**Predictors of CoI composite score.** A stepwise multiple regression analysis was conducted to examine the extent to which the social, teaching, and cognitive presence subscales, along with the student characteristic, course engagement, and student course perception measures, predicted the CoI composite score. Given that the CoI composite score is comprised of the social, teaching, and cognitive presence subscales, the three subscales account for 100% of the variance in the CoI composite score. As shown in Table 21Table 21, 84% of the variance in the CoI composite score was accounted from the teaching presence subscale, 9% from the social presence subscale, and 5% from cognitive presence subscale. With the social, teaching, and cognitive presence subscales removed from the analysis, only satisfaction significantly predicted the CoI composite score, $b = 2.39$, $\beta = .59$, $t(49) = 5.11$, $p < .001$, and explained over 30% of variance, $F(1, 49) = 26.14$, $p < .001$, $R^2_{adj} = .34$.

Table 21

*Stepwise Multiple Regression Predictors of the CoI Composite Score*

| Predictor | | $b$ | $\beta$ | $t$ | $R^2_{adj}$ |
|---|---|---|---|---|---|
| Step 1 | | | | | .84 |
| | Constant | 1.02 | | 5.29** | |
| | Teaching Presence | .73 | .92 | 16.44** | |
| Step 2 | | | | | .95 |
| | Constant | .38 | | 3.07* | |
| | Teaching presence | .03 | .72 | 5.83** | |
| | Social presence | .03 | .38 | 4.52** | |
| Step 3 | | | | | 1.00 |
| | Constant | - | | | |
| | Teaching presence | .41 | .51 | 6.22** | |
| | Social presence | .27 | .31 | 5.09** | |
| | Cognitive presence | .32 | .34 | -2.05** | |

* $p < .05$. ** $p < .001$.

**Predictors of social presence.** While teaching presence and satisfaction were shown previously to be significantly positively correlated with social presence, neither variable was a significant predictor of social presence within the stepwise multiple regression analysis. As shown in Table 22 , Step 1 of the regression analysis indicated cognitive presence accounted for approximately 30% of the variance in social presence. Steps 2 and 3 indicated a small, but significant, prediction of social presence based on prior distance learning experience ($\Delta R^2_{adj}$ = .04) and live session location ($\Delta R^2_{adj}$ = .06). Overall, the regression analysis suggested that approximately 40% of the variance in social presence was accounted from the combination of cognitive presence, prior distance-learning experience, and live session location, $F(3,47) = 11.43, p < .001, R^2_{adj} = .39$.

Table 22

*Stepwise Multiple Regression Predictors of Social Presence*

| Predictor | *b* | β | *t* | $R^2_{adj}$ |
|---|---|---|---|---|
| Step 1 | | | | .29 |
| Constant | 1.40 | | 2.55* | |
| Cognitive presence | .59 | .55 | 4.58*** | |
| Step 2 | | | | .33 |
| Constant | 1.36 | | 2.56* | |
| Cognitive presence | .57 | .46 | 4.51*** | |
| Prior distance-learning | .01 | .26 | 2.05* | |
| Step 3 | | | | .39 |
| Constant | 1.99 | | 3.45** | |
| Cognitive presence | .50 | .46 | 4.05*** | |
| Prior distance-learning | .02 | .26 | 2.34* | |
| Live session location | -.16 | -.26 | -2.31* | |

*Note.* Live session location: 1 = face-to-face at main campus; 2 = onsite remote location; 3 = other distance.
* $p < .05$. ** $p < .01$. *** $p < .001$.

**Predictors of cognitive presence.** While satisfaction was shown previously to be significantly positively correlated with cognitive presence, satisfaction was not a significant predictor of cognitive presence within the regression analysis when controlled for the other predictors. As shown in Step 1 in Table 23, results indicated teaching presence alone accounted for 54% of the variance in cognitive presence. Social presence was also a significant, but small ($\Delta R^2_{adj}$ = .03) predictor. Notably, instructor LMS access was *negatively* correlated with cognitive presence suggesting that higher instructor LMS access was associated with *decreased* cognitive presence. However, the contribution of this variable within the regression model was also small ($\Delta R^2_{adj}$ = .03). Overall, the regression analysis indicated that approximately 60% of the variance in cognitive presence was accounted from the combination of teaching presence, social presence, and instructor LMS access, $F(3,47) = 25.60$, $p < .001$, $R^2_{adj}$ = . 60.

Table 23

*Stepwise Multiple Regression Predictors of Cognitive Presence*

| Predictor | $b$ | β | $t$ | $R^2_{adj}$ |
|---|---|---|---|---|
| Step 1 | | | | .54 |
| Constant | 1.57 | | 4.56*** | |
| Teaching presence | .61 | .74 | 7.67*** | |
| Step 2 | | | | .57 |
| Constant | 1.18 | | 3.07** | |
| Teaching presence | .51 | .62 | 5.70*** | |
| Social presence | .21 | .22 | 2.05* | |
| Step 3 | | | | .60 |
| Constant | 1.42 | | 3.67*** | |
| Teaching presence | .52 | .63 | 5.99*** | |
| Social presence | .21 | .23 | 2.17* | |
| Instructor LMS access | .00 | -.20 | -2.17* | |

* $p < .05$. ** $p < .01$. *** $p < .001$.

**Predictors of teaching presence.** As shown in Table 24, results of the stepwise multiple regression analysis suggested cognitive presence alone accounted for nearly 55% of the variance in teaching presence, but that social presence (previously shown to be significantly correlated with teaching presence) was not a significant predictor when controlled for the other predictors. Perceived computer expertise ($\Delta R^2_{adj}$ = .04) was also a predictor of teaching presence, but it was *negatively* correlated, indicating that those with more (or less) perceived computer expertise had lower (or higher) levels of teaching presence. In addition, the contribution of satisfaction was a small, but positive, predictor of teaching presence ($\Delta R^2_{adj}$ = .03). Overall, approximately 60% of the variance in teaching presence was accounted from the combination of cognitive presence, perceived computer expertise, and satisfaction, $F(3,47) = 26.70, p < .001$, with an $R^2_{adj} = .61$.

Table 24

*Stepwise Multiple Regression Predictors of Teaching Presence*

| Predictor | $b$ | β | $t$ | $R^2_{adj}$ |
|---|---|---|---|---|
| Step 1 | | | | .54 |
| Constant | .55 | | 1.11 | |
| Cognitive Presence | .90 | .74 | 7.67** | |
| Step 2 | | | | |
| Constant | 1.25 | | 2.24* | .58 |
| Cognitive Presence | .91 | .75 | 8.12** | |
| Computer Expertise | -.19 | -.22 | -2.36* | |
| Step 3 | | | | |
| Constant | .96 | | 1.73 | .61 |
| Cognitive Presence | .76 | .63 | 5.92** | |
| Computer Expertise | -.17 | -.20 | -2.27* | |
| Satisfaction | .20 | .23 | 2.17* | |

* $p < .05$. ** $p < .001$.

**Research Question Five**

For each course in the study and in total for all courses, the mean perceived contributions of class interactions to student perceived learning from the first and second surveys are summarized in Table 25. A one-way within-subjects ANOVA indicated no significant difference ($p > .05$) in the mean responses to each interaction type between the surveys, which suggested that the students' perceptions of the relative contribution of the class interactions to learning did not change during the semester. A one-way between-subjects ANOVA based on second survey responses indicated no significant difference ($p > .05$) between courses in any of the responses to these measures.

Table 25

Mean *Perceived Contribution of Class Interactions to Student Perceived Learning*

| | | Live Sessions | | One-on-One Instructor | | Readings | | Projects and Papers | | Course Discussions | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Course | $n^{a,b}$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ | $M^a$ | $M^b$ |
| 1 | 11 | 4.09 | 4.09 | 3.91 | 4.00 | 4.36 | 4.09 | 4.18 | 4.09 | 3.45 | 3.73 |
| 2 | 12 | 4.33 | 4.50 | 4.00 | 4.25 | 4.50 | 4.67 | 4.50 | 4.67 | 4.25 | 4.42 |
| 3 | 10 | 3.80 | 4.60 | 4.00 | 4.00 | 3.80 | 4.30 | 3.80 | 4.10 | 4.20 | 3.90 |
| 4 | 12 | 4.25 | 3.92 | 4.17 | 3.75 | 4.42 | 4.25 | 4.50 | 4.33 | 3.75 | 3.42 |
| 5 | 6 | 3.17 | 4.17 | 4.17 | 4.50 | 3.50 | 3.83 | 4.17 | 4.50 | 3.17 | 4.00 |
| Total | 51 | 4.02 | 4.25 | 4.04 | 4.06 | 4.20 | 4.27 | 4.27 | 4.33 | 3.82 | 3.88 |
| Skewness | | -1.22 | -.99 | -.36 | -.71 | -.86 | -.80 | -.37 | -.23 | -.49 | -.66 |
| Kurtosis | | 1.92 | .80 | -.23 | .03 | .50 | .28 | -.72 | -.63 | -.11 | -.04 |

[a]First survey conducted middle of semester. [b]Second survey conducted end of semester.

Pearson bivariate correlation coefficients were computed to assess the extent to which the students' perceptions of learning are related to their perceptions of the learning contribution of course interaction attributes. As shown in Table 26, student perceived learning was significantly positively correlated with each course interaction attribute.

Table 26

*Correlations between Course Attributes and Student Perceived Learning*

| Measure | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Live Session | - | | | | |
| 2. Readings | .55** | - | | | |
| 3. Teacher One-on-One | .65** | .47** | - | | |
| 4. Projects or Papers | .37** | .65** | .44** | - | |
| 5. Discussions | .36* | .35* | .48** | .35* | - |
| 6. Student perceived learning | .59** | .54** | .48** | .49** | .29* |

* $p < .05$ level, two-tailed. ** $p < .01$, two tailed.

A stepwise multiple regression analysis was conducted to consider the extent to which each course interaction attribute predicted student perceived learning. As shown in Table 27, results from Step 1 suggested the perceived contribution of live sessions accounted for over 30% of the variance in student perceived learning, while Step 2 indicated projects and papers were also a significant predictor ($\Delta R^2_{adj}$ = .07). When controlled for the other predictors, the perceived contribution of readings, teacher one-on-one, and class discussions were not predictors of student perceived learning. Overall, the regression analysis suggested that 40% of the variance in student perceived learning was explained by students' perceptions of the learning contribution of live sessions, papers, and projects, $F(1, 48) = 17.96, p < .001, R^2_{adj} = .40$.

Table 27

*Stepwise Multiple Regression Predictors of Student Perceived Learning*

| Predictor | | *b* | β | *t* | $R^2_{adj}$ |
|---|---|---|---|---|---|
| Step 1 | | | | | .33 |
| | Constant | 2.12 | | 4.67** | |
| | Live Session | .53 | .59 | 5.01** | |
| Step 2 | | | | | .40 |
| | Constant | .91 | | 1.46 | |
| | Live Session | .43 | .47 | 4.02** | |
| | Projects and Papers | .38 | .31 | 2.64* | |

* $p < .05$. ** $p < .001$.

# CHAPTER IV

# DISCUSSION AND CONCLUSIONS

## Significant Findings

### Are Student Perceptions of CoI Related to Objective Measures of Student Achievement?

Responding to the call for additional research to examine learning in a CoI (Rourke & Kanuka, 2009), the purpose of this research was to examine the relationships between students' perceptions of a CoI (including perceptions of social presence, teaching presence, and cognitive presence) and actual course learning achievement outcomes as assessed by the instructor. Expanding upon recent research that suggested a relationship between elements of a CoI and grades as a measure of learning achievement (Abdous & Yen, 2010; Akyol & Garrison, 2010; Shea et al., 2011), results of this study suggested no relationship between the CoI composite score and any of the three instructor-assessed learning achievement measures. Further, no relationship was indicated between either the SOLO score or course score and any of the cognitive, teaching, or social presence subscales, nor was a relationship suggested between the project score and either the social presence or the teaching presence subscales. While a significant positive correlation was indicated between the cognitive presence subscale and the project score (specifically, the cognitive presence resolution grouping), when controlled for other course features, cognitive presence was not a significant predictor of the project score.

In addition, a strong correlation was indicated among the social, teaching, and cognitive presence subscales within the survey, particularly between teaching and cognitive presence ($r^2 = .55$), which suggested the subscales are not independent. While studies examining the survey used in this research suggested it is a valid measure of student perceptions of social, teaching, and cognitive presence (Arbaugh et al., 2008;

Garrison, Cleveland-Innes, et al., 2010; Swan et al., 2008), others have argued further validation of the CoI survey is needed (Diaz, Swan, Ice, & Kupczynski, 2010; Shea & Bidjerano, 2009b).

**Are Student Perceptions of Learning Achievement Related to Objective Measures of Student Achievement?**

As indicated in the analysis of the second research question, no significant correlation was found between any of the instructor-assessed learning achievement measures and student perceived learning. Further, student perceived learning at the end of the semester was significantly lower than the overall course score as assessed by the instructor. The lack of significant correlation between perceived learning and other instructor-assessed measures of achievement are important to not only this study, but also the interpretation of previous CoI studies that used perceived learning as the only measure of learning outcome. The findings from this study are consistent with prior research that suggested student self-reports of learning are not a substitute for objective measures of achievement (Gonyea, 2005; Pike, 1996), and challenge studies that have relied on student self-reports of learning as a measure of learning outcome in distance-education settings (Akyol, Vaughan, & Garrison, 2011; Arbaugh, 2008; Richardson & Swan, 2003; Rovai, 2002; Shea et al., 2006; Shin, 2003).

**Are Student Perceptions of Learning Achievement and Course Satisfaction Related to Perceptions of CoI?**

From the analysis of the third research question, the CoI composite measure accounted for approximately 35% of the variance in satisfaction. In addition, the cognitive, teaching, and social presence subscales were each found to be significantly correlated with student satisfaction. However, when controlled for the other presences in the regression analysis, only teaching presence was a significant predictor of satisfaction, explaining over 30% of the variance in satisfaction. This finding suggested a student's interaction with the course instructor and the designed content interaction are more predictive of student satisfaction than the student's interaction with peers, and supports research that found teaching presence to be a significant predictor of student attitude toward the educational experience (Shea & Bidjerano, 2009b; Shea et al., 2006).

In addition, nearly 40% of the variance in perceived learning was accounted from the CoI composite measure, with the cognitive, teaching, and social presence subscales each significantly correlated with perceived learning. However, when controlled for the other presences in the regression analysis, only cognitive presence was a significant predictor of perceived learning. This finding suggested that a student's perceptions of cognitive presence in a course was related to his or her perceived learning, supporting other research that found a correlation between cognitive presence and perceived learning (Akyol & Garrison, 2010; Arbaugh, 2008). However, student-perceived learning and satisfaction were also significantly positively correlated, with approximately 60% of the variance in perceived learning was accounted from satisfaction.

Taken together, the findings from research questions one, two, and three suggested that student perceptions of CoI were not related to objective measures of achievement, but rather reflected attitudes toward the educational experience. These results are in line with findings in other studies that suggested self-reports of academic achievement were related to the student's attitude toward the course (Pohlmann & Beggs, 1974). Results of this study suggested student self-reports of learning and the CoI survey-based measures are best used as approximations of student attitude toward the course, but should not be considered as proxies for objective measures of student learning achievement.

**How are Student Characteristics, Course Engagement Features, and Student Course Perceptions Related to Objective Measures of Student Achievement, Student Perceptions of Learning, and Student Perceptions of CoI?**

Research question four focused on the perceived contribution of the CoI presences, along with various student characteristics, course interactions, and student perceptions of the course, on both instructor-assessed measures of learning and student-perceived learning. The contribution of these student and course features on CoI measures were also contemplated. While the social, teaching, and cognitive presence subscales were not predictors of any of the instructor-assessed measures of learning achievement, perceived workload, live session minutes, and student LMS activity were predictors of the SOLO score, project score, and course score, respectively. These finding suggested the importance of designing instructional interactions and strategies that engage and challenge the student with the content, peers, and the instructor in the course (Bernard et al., 2009).

While not a predictor of instructor-assessed learning measures, teaching presence was significantly positively correlated with perceived learning, as found in other research (Arbaugh, 2008; Shea et al., 2006). Yet, when controlled for the other CoI presences and the student and course features, cognitive presence (not teaching presence) was found to be a predictor of perceived learning. However, given that teaching presence accounted for 54% of the variance in cognitive presence, the strong correlation between teaching presence and cognitive presence made it difficult to assess the relative influence of these presences.

While social presence is frequently studied in educational research (Arbaugh, 2008; Gunawardena, 1995; Gunawardena & Zittle, 1997; Richardson & Swan, 2003; Rourke et al., 1999; So & Brush, 2008), findings are mixed with regard to the influence of social presence. In this study, the social presence subscale was significantly smaller than both the cognitive presence and teaching subscales suggesting lower perceptions of social presence than perceptions of teaching and cognitive presences within the group of study participants. In addition, social presence predicted less than 5% of the variance in both perceived learning and cognitive presence and was not a predictor of any of the instructor-assessed learning achievement measures or satisfaction.

Regarding the influence of student characteristics, course interactions, and student perceptions of the course, computer expertise was significantly *negatively* correlated with teaching presence, which may suggest that those with less computer expertise seek more teaching engagement that those who are have more computer experience, an important consideration for distance educators who rely on computer-mediated communication technologies to support instruction. Further, prior distance-learning was found to be a predictor of social presence, which suggested that those with less distance learning experience tend to engage less in peer interaction in the distance learning environment. These findings may indicate that social relationships formed in prior courses influenced communication and interaction, including relationship formation with newer students. Research that examined the effects of group demography on social integration indicated that group tenure was related to social integration, suggesting that those with similar dates of entry into the group experienced greater social integration, including perceptions of cohesiveness and satisfaction with others in the group (O'Reilly, Caldwell, & Barnett, 1989). Considered together, these findings suggested students with less computer and distance-learning experience are less inclined to engage in peer interaction and more inclined to engage in with the instructor.

Where the student attended the live session (live session location) was not a predictor of any of the three instructor-assessed learning achievement measures, but was a predictor of satisfaction and social presence with significantly higher mean social presence subscale scores for those students who attended face-to-face on the main campus than those who attended at a distance. While these findings may suggest that live session location influenced student attitude toward the course, these findings are consistent with research suggesting no significant difference in learning outcomes based on the delivery media used to facilitate instruction (Bernard et al., 2004; Clark, 1983, 1994), particularly when comparing on-campus to distance learning outcomes (Lockee, Burton, & Cross, 1999).

Also important are results related to changes in student perceptions over time. While no significant differences were found in either the CoI composite, teaching presence, or social presence subscale measures between the first and second surveys, the significant increase in cognitive presence, perceived learning, satisfaction, and perceived workload between surveys suggested that perceptions of an increasingly demanding workload were accompanied by higher student perceptions of learning, satisfaction, and cognitive presence. This finding is interesting in light of the result that perceived workload at the end of the semester was positively correlated with both the SOLO score and project scores, suggesting an important relationship between student interactions with the content and learning achievement. Given that perceived workload during the first survey was not significantly correlated ($p > .05$) with any of the three instructor-assessed learning achievement measures, these results suggested that increasing the intensity of student's interaction with content may be associated with higher learning achievement, which is consistent with prior research (Bernard et al., 2009). The findings that minutes of live class session was a significant predictor of the project score and student LMS activity was a significant predictor of the course score may also suggest that the greater the intensity of the content, peer, and instructor interaction, the higher the learning achievement.

**What Designed Course Interactions Contribute to Student Perceptions of Achievement?**

To assess the perceived contribution of interaction to learning in this study, students were asked to indicate the extent to which various student-content, student-student, and student-teacher interactions contributed to their learning in the course, including (a) live class sessions, (b) one-on-one communication with the instructor, (c) readings, (d) projects and papers, (e) course related discussions with other students. While perceived learning was significantly correlated with each course interaction attribute, when controlled for the other interaction variables in the regression model, only live sessions and projects and papers were significant predictors of student perceived learning. These findings suggested that student-content, student-student, and student teacher interactions each contributed to perceived learning, but the students perceived a greater contribution from live sessions than asynchronous sessions, from whole class sessions than one-on-one with the instructor, and from projects and papers over class readings.

## Implications of this Study

This study was conducted as a response to the critique that CoI research has inadequately examined that deep and meaningful learning arises in a community of inquiry and the call for research that considers the relationship between the CoI construct and measures of learning outcome (Rourke & Kanuka, 2009). Even those who refute this critique agree that research linking approaches to learning and learning outcomes is worthwhile (Akyol et al., 2009). Results of this study suggested no relationship between the CoI composite score and any of the three instructor-assessed learning achievement measures. Yet, many have argued the CoI is increasingly influential in explaining the effective conduct of online learning (Akyol et al., 2009; Garrison, Anderson, et al., 2010). What explains these opposing interpretations?

One explanation of the opposing interpretations centers on the choice of outcome measures used in CoI research. As discussed previously, CoI research has focused primarily on either CoI learning process outcomes as operationalized in the cognitive presence construct, student-perceived learning outcomes, or affective outcomes, including satisfaction and persistence. In the present study, the CoI composite score was positively correlated with both perceived learning and satisfaction. In addition, perceived learning was significantly positively correlated with satisfaction. However, the CoI composite score, student-perceived learning, and satisfaction were not related to objective measures of learning in this study. These findings suggested student self-reports of learning and the CoI survey-based measures are best used as approximations of student attitude toward the course, but should not be considered as an approximation of objective measures of student learning achievement.

Another explanation for the opposing interpretations of the influence of the CoI relates to perceptions of the extent to which the CoI framework provides sufficient guidance to instructors. As a social-constructivist framework, the CoI suggests social, teaching, and cognitive presences are essential elements within a distance learning environment, yet the framers now admit "the dynamic relationships among the presences could have been emphasized to a greater" extent (Garrison, Anderson, et al., 2010, p. 6). Advocates of the conceptual framework argue the CoI "describes a generic educational experience" (Akyol et al., 2009, p. 124), but acknowledge research findings of the inability of student groups to reach the integration and resolution phases of the practical inquiry model were likely due to issues with teaching presence, including design, facilitation, and direction issues. As others have suggested, constructivism offers a philosophical framework, but has yet to evolve into a refined theory that describes effective instruction or design strategies (Tobias & Duffy, 2009). Similarly, the CoI framework does not offer sufficient guidance to instructors regarding what design, facilitation, and direction strategies positively influence student learning achievement outcomes, as has been forwarded in other inquiry-based approaches (Morrison & Lowther, 2010).

While the CoI framework implies the importance of providing opportunities to support student-content, student-teacher, and student-student interaction within learning environments that foster social, teaching, and cognitive presences, the framework offers little direction regarding the optimal design of these interaction types within a CoI to support instructional objectives. As described previously, distance educators and researchers frequently consider these three interaction types (M. G. Moore, 1989), and a meta-analysis of prior distance education research indicated a positive effect on learning from all three types of interaction (Bernard et al., 2009).

However, as suggested by some (Anderson, 2003), are student-content, student-teacher, and student-student interactions equivalently effective in supporting meaningful learning if offered at a high level? As seen in this study, the social presence subscale was (a) significantly smaller than both the cognitive presence and teaching presence subscales, (b) predicted less than 5% of the variance in perceived learning, and (c) was not a predictor of any of the instructor-assessed learning achievement measures or satisfaction. Similarly, in a recent study, social presence was not significantly correlated with two objective learning outcome measures (Shea et al., 2011). While the CoI framework suggests social presence is an essential element to the educational transaction and social presence has received the most attention of the three presences in research (Garrison & Arbaugh, 2007), recent studies described social presence as an *indirect* or *mediating* variable between teaching presence and cognitive presence in which teaching presence predicted variance in social presence and together predicted variance in cognitive presence (Garrison, Cleveland-Innes, et al., 2010; Shea & Bidjerano, 2009b). However, in the present study, teaching presence was not a predictor of social presence and social presence explained only 3% of the variance in cognitive presence as compared to nearly 55% from teaching presence. These findings add support to those who argue that research has not offered sufficient evidence of the instructional value of social interaction (Mayer, 2009).

In addition, distance education research has shown that providing opportunities for interaction does not mean interaction occurs or that if interaction does occur that it does so effectively in terms of learning (Abrami, Bernard, Bures, Borokhovski, & Tamim, 2011; Ertmer, Sadaf, & Ertmer, 2011; Gunawardena et al., 1997). The results of this study and other research findings suggest the need to go beyond distance education research that contemplates and measures the existence and student perceptions of interaction opportunities within the learning environment to research that directly compares of the relative effectiveness of specific and purposeful interaction strategies including learner-content, learner-learner, and learner-teacher on learning outcomes (Abrami et al., 2011; Kanuka, 2005; Rourke & Kanuka, 2009).

## Conclusions

The strong positive correlation among CoI, perceived learning, and satisfaction measures and the lack of correlation between instructor-assessed learning achievement measures and both CoI and perceived learning are important to not only this study, but also to the interpretation of previous CoI studies. The findings of this study support the assertion by Rourke and Kanuka (2009) that research to date has yet to offer evidence that a CoI (as the independent variable) leads to meaningful learning outcomes (as the dependent variable). While some argue the CoI framework should be considered as a process model focused on the nature of the educational transaction (Akyol et al., 2009), with no relationship suggested between the framework and objective measures of learning, the value of the CoI framework as an educational process model remains challenged.

Results of this study suggested that the CoI survey-based measures and student self-reports of learning are more appropriately used as approximations of student attitude toward the course than as measures of student learning achievement. The fourth and fifth research questions in this study were included as bridges between this research and studies to follow. The findings from this study support the call for new research to examine which interaction conditions and at what level of interaction intensity contribute to student achievement in distance learning (Abrami et al., 2011; Anderson, 2003; Bernard et al., 2009).

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## Appendix A. SOLO Chart to Instructors

| Last | First | Consent | A<br>Significant Work SOLO Score (1 - 5) | B<br>Significant Work Total Earned Points | C<br>Significant Work Total Possible Points | D<br>Cumulative Course Earned Points | E<br>Cumulative Course Possible Points |
|---|---|---|---|---|---|---|---|
| | | y | [enter 1 -5] | [enter earned points] | [enter possible points] | [enter earned points] | [enter possible points] |
| | | y | [enter 1 -5] | [enter earned points] | [enter possible points] | [enter earned points] | [enter possible points] |
| | | y | [enter 1 -5] | [enter earned points] | [enter possible points] | [enter earned points] | [enter possible points] |
| | | y | [enter 1 -5] | [enter earned points] | [enter possible points] | [enter earned points] | [enter possible points] |
| | | y | [enter 1 -5] | [enter earned points] | [enter possible points] | [enter earned points] | [enter possible points] |

| | |
|---|---|
| **Significant Work Description:** | [Briefly describe significant work assignment] |

Key:

A. Provide SOLO Taxonomy Score (1 - 5) for one significant project, paper, or exam
B. Provide Total Earned Points for one significant project, paper or exam
C. Provide Total Possible Points for one significant project, paper or exam
D. Provide Cumulative Course Earned Points - At end of semester
E. Provide Cumulative Course Possible Points - At end of semester

# Appendix B. Student Perception Survey Instrument[a]

## Section 1: General Information

A. Name
First ____________________________________
Last ____________________________________

B. Gender (Select): ___ Male ___ Female

C. Please select the option which best describes how you participate in the live class sessions for this course:

___ ABC University – On-site - Main Campus
___ ABC University – Remote On-site – Other than Main Campus
___ ABC University – Web Conference or Video-Stream to Personal Computer

D. What was your age at the start of this course?

___ 25 or under
___ 26 - 35
___ 36 – 45
___ 46 – 55
___ 56 or above

E. Estimate your level of overall computer expertise?
___ Expert
___ Above Average
___ Average
___ Below Average
___ Novice

F. How many distance learning courses have you taken prior to this course? Respond to all options by entering a number (0 or higher).
[Open Response] ABC University – On-site - Main Campus
[Open Response] ABC University – Remote On-site – Other than Main Campus
[Open Response] ABC University – Web Conference or Video-Stream to Personal Computer
[Open Response] At an institution other than ABC University

G. How proficient are you in using the conferencing interface used for the live sessions in this class?

___ Expert
___ Above Average
___ Average
___ Below Average
___ Novice

Please read each statement carefully and then indicate the degree to which you agree or disagree with the statement

H. Course Difficulty

| | | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| H.1 | Compared to other courses I have taken, this is a difficult course. | 5 | 4 | 3 | 2 | 1 |
| H.2 | Compared to other courses I have taken, this course has a large required work load. | 5 | 4 | 3 | 2 | 1 |
| H.3 | Compared to other courses I have taken, I work very hard in this class. | 5 | 4 | 3 | 2 | 1 |

I. Perceptions of this course

| | | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| I.1 | I am satisfied with this course. | 5 | 4 | 3 | 2 | 1 |
| I.2 | I learn a great deal in this course. | 5 | 4 | 3 | 2 | 1 |

J. Perceptions of Course Interactions

| | | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| J.1 | Live class sessions greatly contribute to my learning in this course. | 5 | 4 | 3 | 2 | 1 |
| J.2 | One-on-one communication with my instructor greatly contributes to my learning in this course. | 5 | 4 | 3 | 2 | 1 |
| J.3 | Readings greatly contribute to my learning in this course. | 5 | 4 | 3 | 2 | 1 |
| J.4 | Projects and papers greatly contribute to my learning in this course. | 5 | 4 | 3 | 2 | 1 |
| J.5 | Course related discussions with other students greatly contribute to my learning in this course. | 5 | 4 | 3 | 2 | 1 |

**Section II: Community of Inquiry[a]**

**Teaching Presence**

| | Teaching Presence: Design & Organization | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 1 | The instructor clearly communicates important course topics. | 5 | 4 | 3 | 2 | 1 |
| 2 | The instructor clearly communicates important course goals. | 5 | 4 | 3 | 2 | 1 |
| 3 | The instructor provides clear instructions on how to participate in course learning activities. | 5 | 4 | 3 | 2 | 1 |
| 4 | The instructor clearly communicates important due dates/time frames for learning activities. | 5 | 4 | 3 | 2 | 1 |

| | Teaching Presence: Facilitation | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 5 | The instructor is helpful in identifying areas of agreement and disagreement on course topics that helps me to learn. | 5 | 4 | 3 | 2 | 1 |
| 6 | The instructor is helpful in guiding the class towards understanding course topics in a way that helps me clarify my thinking. | 5 | 4 | 3 | 2 | 1 |
| 7 | The instructor helps to keep course participants engaged and participating in productive dialogue. | 5 | 4 | 3 | 2 | 1 |
| 8 | The instructor helps keep the course participants on task in a way that helps me to learn. | 5 | 4 | 3 | 2 | 1 |
| 9 | The instructor encourages course participants to explore new concepts in this course. | 5 | 4 | 3 | 2 | 1 |
| 10 | Instructor actions reinforce the development of a sense of community among course participants. | 5 | 4 | 3 | 2 | 1 |

| | Teaching Presence: Direct Instruction | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 11 | My instructor provides useful illustrations that help make the course content more understandable to me. | 5 | 4 | 3 | 2 | 1 |
| 12 | My instructor presents helpful examples that allow me to better understand the content of the course. | 5 | 4 | 3 | 2 | 1 |
| 13 | My instructor provides explanations or demonstrations to help me better understand the content of the course. | 5 | 4 | 3 | 2 | 1 |
| 14 | My instructor provides feedback to the class during the discussions or other activities to help us learn. | 5 | 4 | 3 | 2 | 1 |
| 15 | My instructor asks for feedback on how this course could be improved. | 5 | 4 | 3 | 2 | 1 |

**Social Presence**

| | Social Presence: Affective Expression | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 16 | Getting to know other course participants gives me a sense of belonging in the course. | 5 | 4 | 3 | 2 | 1 |
| 17 | I am able to form distinct impressions of some course participants. | 5 | 4 | 3 | 2 | 1 |
| 18 | Online or web-based communication is an excellent medium for social interaction. | 5 | 4 | 3 | 2 | 1 |
| 19 | I am able to identify with the thoughts and feelings of other students during the course. | 5 | 4 | 3 | 2 | 1 |

| | Social Presence: Open Communication | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 20 | I feel comfortable conversing through the online medium. | 5 | 4 | 3 | 2 | 1 |
| 21 | I feel comfortable participating in the course discussions. | 5 | 4 | 3 | 2 | 1 |
| 22 | I feel comfortable interacting with other course participants. | 5 | 4 | 3 | 2 | 1 |

| | Social Presence: Group Cohesion | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 23 | I feel comfortable disagreeing with other course participants while still maintaining a sense of trust. | 5 | 4 | 3 | 2 | 1 |
| 24 | I feel that my point of view is acknowledged by other course participants. | 5 | 4 | 3 | 2 | 1 |
| 25 | Online discussions help me to develop a sense of collaboration. | 5 | 4 | 3 | 2 | 1 |

**Cognitive Presence**

| | Cognitive Presence: Triggering Event | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 26 | Problems posed increase my interest in course issues. | 5 | 4 | 3 | 2 | 1 |
| 27 | Course activities pique my curiosity. | 5 | 4 | 3 | 2 | 1 |
| 28 | I feel motivated to explore content related questions. | 5 | 4 | 3 | 2 | 1 |

| | Cognitive Presence: Exploration | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 29 | I utilize a variety of information sources to explore problems posed in this course. | 5 | 4 | 3 | 2 | 1 |
| 30 | Brainstorming and finding relevant information helps me resolve content related questions. | 5 | 4 | 3 | 2 | 1 |
| 31 | Online discussions are valuable in helping me appreciate different perspectives. | 5 | 4 | 3 | 2 | 1 |

| | Cognitive Presence: Integration | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 32 | Combining new information helps me answer questions raised in course activities. | 5 | 4 | 3 | 2 | 1 |
| 33 | Learning activities help me construct explanations/solutions. | 5 | 4 | 3 | 2 | 1 |
| 34 | Reflection on course content and discussions helps me understand fundamental concepts in this class. | 5 | 4 | 3 | 2 | 1 |

| | Cognitive Presence: Resolution | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 35 | I can describe ways to test and apply the knowledge created in this course. | 5 | 4 | 3 | 2 | 1 |
| 36 | I am developing solutions to course problems that can be applied in practice. | 5 | 4 | 3 | 2 | 1 |
| 37 | I can apply the knowledge created in this course to my work or other non-class related activities. | 5 | 4 | 3 | 2 | 1 |

[a]Section II was adapted from the CoI survey instrument provided by P. Shea and used in research by Shea and Bidjerano (2009a), which was based on the survey instrument developed by Arbaugh et al. (2007) and validated in research by Arbaugh et al. (2008)

# Appendix C. Mean Community of Inquiry Measures by Question

| | Survey 1 | | | Survey 2 | | |
|---|---|---|---|---|---|---|
| CoI Survey Questions | *M* | Skewness | Kurtosis | *M* | Skewness | Kurtosis |
| 1 | 4.43 | | | 4.61 | | |
| 2 | 4.47 | | | 4.55 | | |
| 3 | 4.25 | | | 4.25 | | |
| 4 | 4.25 | | | 4.14 | | |
| *TP Design & Organization* | *4.35* | | | *4.39* | | |
| 5 | 4.06 | | | 4.39 | | |
| 6 | 4.31 | | | 4.49 | | |
| 7 | 4.22 | | | 4.37 | | |
| 8 | 4.06 | | | 4.14 | | |
| 9 | 4.45 | | | 4.59 | | |
| 10 | 3.96 | | | 4.14 | | |
| *TP Facilitation* | *4.18* | | | *4.35* | | |
| 11 | 4.06 | | | 4.27 | | |
| 12 | 4.20 | | | 4.31 | | |
| 13 | 4.20 | | | 4.39 | | |
| 14 | 4.12 | | | 3.98 | | |
| 15 | 3.73 | | | 4.04 | | |
| *TP Direct Instruction* | *4.06* | | | *4.20* | | |
| Teaching Presence Subscale | 4.18 | -.406 | .017 | 4.31 | -.737 | .127 |
| 16 | 3.75 | | | 3.76 | | |
| 17 | 3.78 | | | 3.71 | | |
| 18 | 3.37 | | | 3.55 | | |
| 19 | 3.53 | | | 3.73 | | |
| *SP Affective Expression* | *3.61* | | | *3.69* | | |
| 20 | 4.04 | | | 4.12 | | |
| 21 | 4.14 | | | 4.20 | | |
| 22 | 4.16 | | | 4.24 | | |
| *SP Open Communication* | *4.11* | | | *4.18* | | |
| 23 | 3.90 | | | 4.02 | | |
| 24 | 3.98 | | | 4.08 | | |
| 25 | 3.67 | | | 3.49 | | |
| *SP Group Cohesion* | *3.85* | | | *3.86* | | |
| Social Presence Subscale | 3.83 | .119 | .528 | 3.89 | -.244 | .631 |
| 26 | 4.00 | | | 4.12 | | |
| 27 | 3.94 | | | 4.12 | | |
| 28 | 4.02 | | | 4.22 | | |
| *CP Triggering* | *3.99* | | | *4.15* | | |
| 29 | 4.14 | | | 4.39 | | |
| 30 | 3.88 | | | 4.16 | | |
| 31 | 3.73 | | | 3.73 | | |
| *CP Exploration* | *3.92* | | | *4.09* | | |
| 32 | 4.10 | | | 4.24 | | |
| 33 | 4.12 | | | 4.27 | | |
| 34 | 4.24 | | | 4.18 | | |
| CP *Integration* | *4.15* | | | *4.23* | | |
| 35 | 4.00 | | | 4.25 | | |
| 36 | 4.14 | | | 4.29 | | |
| 37 | 4.31 | | | 4.41 | | |
| *CP Resolution* | *4.15* | | | *4.32* | | |
| Cognitive Presence Subscale | 4.05 | .016 | .053 | 4.20 | -.450 | .304 |
| CoI Composite Score | 4.05 | -.109 | .100 | 4.16 | -.635 | .054 |

## Appendix D. Correlation Matrix

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Social presence | - | | | | | | | | | | | | | | | | | | | | |
| 2 | Teaching presence | 52** | - | | | | | | | | | | | | | | | | | | | |
| 3 | Cognitive presence | 55** | 74** | - | | | | | | | | | | | | | | | | | | |
| 4 | CoI composite | 76** | 92** | 88** | - | | | | | | | | | | | | | | | | | |
| 5 | SOLO Score | - 09 | 10 | 09 | 05 | - | | | | | | | | | | | | | | | | |
| 6 | Project Score | 00 | 26 | 29* | 23 | 76** | - | | | | | | | | | | | | | | | |
| 7 | Course Score | 05 | 20 | 16 | 17 | 57** | 43** | - | | | | | | | | | | | | | | |
| 8 | Perceived learning | 30* | 58** | 71** | 63** | - 04 | 07 | - 04 | - | | | | | | | | | | | | | |
| 9 | Satisfaction | 38** | 57** | 54** | 59** | - 04 | 04 | - 03 | 76** | - | | | | | | | | | | | | |
| 10 | Age | - 09 | 06 | - 08 | - 02 | - 26 | - 13 | - 10 | 15 | 09 | - | | | | | | | | | | | |
| 11 | Gender | - 15 | - 05 | - 16 | - 13 | - 21 | - 23 | 05 | - 09 | 01 | - 17 | - | | | | | | | | | | |
| 12 | Prior distance | 29* | 07 | 09 | 16 | - 25 | - 15 | - 35* | 10 | 24 | - 01 | 17 | - | | | | | | | | | |
| 13 | Computer | 05 | - 18 | 04 | - 07 | 00 | 08 | - 03 | 12 | - 04 | 11 | - 12 | 21 | - | | | | | | | | |
| 14 | Conferencing | 03 | - 11 | - 06 | - 07 | 16 | 30* | - 09 | 03 | 06 | 06 | - 29* | 34* | 33* | - | | | | | | | |
| 15 | Live location | - 35* | - 24 | - 22 | - 30* | 00 | 09 | - 08 | - 17 | - 33* | - 07 | 10 | 06 | - 14 | 35* | - | | | | | | |
| 16 | Live minutes | 07 | 15 | 07 | 12 | 19 | 29* | - 14 | - 06 | - 04 | - 06 | - 03 | 01 | - 10 | 10 | - 10 | - | | | | | |
| 17 | Student LMS | 24 | 13 | 17 | 19 | 05 | 27 | 28 | 10 | 19 | 17 | 07 | 16 | 25 | 04 | 02 | 00 | - | | | | |
| 18 | Instructor LMS | 04 | 05 | - 15 | - 01 | 14 | - 08 | 07 | - 27 | - 20 | - 04 | 02 | - 15 | - 23 | - 12 | - 02 | 69** | - 08 | - | | | |
| 19 | Difficulty | - 19 | - 14 | 03 | - 12 | 09 | 24 | 11 | - 09 | - 27 | - 03 | 06 | 04 | 14 | 03 | 34* | - 02 | 11 | - 08 | - | | |
| 20 | Workload | - 15 | - 07 | - 01 | - 09 | 35* | 48** | 12 | - 02 | - 12 | 01 | - 09 | - 19 | 20 | 24 | 21 | 20 | 23 | 06 | 63** | - | |
| 21 | Effort | 02 | 13 | 21 | 15 | 14 | 23 | 04 | 13 | 00 | - 05 | 05 | - 08 | 07 | - 03 | 03 | 15 | 04 | 06 | 56** | 63** | - |
| 22 | Enrolled Course | - 12 | 04 | 09 | 01 | 22 | 56** | 01 | 02 | - 02 | 03 | - 11 | 05 | 09 | 40** | 47** | - 09 | 16 | - 29* | 63** | 52** | 37** |

* $p <$ 05 level, two-tailed ** $p <$ 01 level, two-tailed

# VITA

**Jennifer Ann Maddrell**
Old Dominion University
STEM and Professional Studies, Darden College of Education
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For over 15 years, Jennifer worked within leading global insurance companies and progressed through various underwriting and management positions after completing a Master of Business Administration degree from the University of Illinois at Chicago. In 2005, Jennifer began a career transition to pursue her passion for education and technology. After taking a series of instructional design courses at New York University, she was accepted into the Master of Science in Education program at Indiana University where she completed her degree in 2007.

As a doctoral student in the Old Dominion University Instructional Design and Technology program, Jennifer was a Graduate Research Assistant from 2008 - 2009. Jennifer was awarded the 2010 Mandell Award as outstanding student in Instructional Design and Technology within Old Dominion University's Darden College of Education, as well as a 2010 – 2011 dissertation fellowship to complete her doctoral dissertation. She has explored instructional design methods and current technologies to support learning within various conference papers and presentations, on her website at DesignedToInspire.com, and during EdTechWeekly, a live interactive webcast at EdTechTalk.com. Jennifer has served as the Managing Editor of the *Journal of Computing in Higher Education* since July of 2008.

## Education

**Doctoral of Philosophy - College of Education**
Old Dominion University, Norfolk, VA
Instructional Design & Technology program at Old Dominion University, 2011

**Master of Science – School of Education**
Indiana University, Bloomington, IN
Graduated, Instructional Systems Technology, 2007

**Master of Business Administration**
University of Illinois at Chicago, Chicago, IL
Graduated, Strategic Management & Marketing, 1996

**Bachelor of Business Administration**
University of Wisconsin, Madison, WI
Graduated with Finance, Risk Management, and Insurance, 1989

## Academic Honors

- Dissertation Fellowship – 2010 to 2011, Old Dominion University - Darden College of Education
- Mandell Award - 2010 Outstanding Student in Instructional Design & Technology, Old Dominion University - Darden College of Education
- Beta Gamma Sigma - Academic Honor Society in Business
- Phi Kappa Phi – Academic Honor Society
- Pi Lambda Theta - Academic Honor Society in Education

## Scholarly Papers and Presentations

Maddrell, J. A., Morrison, G. R., & Watson G. S. (2011, November). *Community of inquiry framework and learning outcomes.* Featured research presentation accepted submission. Association for Educational Communication and Technology Convention, Jacksonville, FL.

Anglin, G. J., Morrison, G. R., & Maddrell, J. A. (2011, November) *Distance Education Theory, Research, and Practice: Is there A Relationship?* Presentation accepted submission. Association for Educational Communication and Technology Convention, Jacksonville, FL.

Maddrell, J. A., & Watson G. S. (In press). The influence of backchannel communication on cognitive load. In L. Moller & J. Huett (Eds.), *The evolution from distance education to distributed learning*. New York, NY: Springer.

Anglin, G. J., Morrison, G. R., & Maddrell, J. A. (In press). Distance education: practice before research or research before practice? In Y. Visser, M. Simonson, R. Amirault, & L. Visser (Eds.), *Trends and issues in distance education: International perspectives* (2nd ed.). Greenwich, CT: Information Age Publishing.

Maddrell, J. A. (2010). Participant experiences in an informal twitter.com sub-network. In *World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2010* (pp. 2018-2023). Orlando, FL: AACE.

Maddrell, J. A. & Watson G. S. (2010). *The influence of backchannel communication on cognitive load.* Presentation at Association for Educational Communication and Technology 2010 Research Symposium, Bloomington, IN.

Maddrell, J. A. (2010). Test item file for *Integrating computer technology into the classroom: skills for the 21st century* (4th ed.) by G. R. Morrison & D. L. Lowther. Boston: Pearson.

Maddrell, J. A., & Morrison, G. R. (2009). *Designing instruction for concept learning.* Presentation at Association for Educational Communication and Technology Convention, Lexington, KY.

Maddrell, J. A. (2009). *Examining the role of network ties in supporting knowledge management.* Presentation at Association for Educational Communication and Technology Convention, Lexington, KY.

Anglin, G. J., Morrison, G. R. & Maddrell, J. A. (2008). *Analysis of articles published in Educational Technology Research in ETR&D.* Presentation at Association for Educational Communication and Technology Convention, Orlando, FL.

Maddrell, J. A., & Lebow, J. (2008). *Networking with live interactive media.* Presentation at 2008 State University of New York (SUNY) Online Learning Summit, Syracuse, NY.

Ottenbreit-Leftwich, A., & Maddrell, J. A. (2007). *Educating educators using open educational resources.* Presentation at 2007 Open Education Conference at Utah State University, Logan, UT.

Maddrell, J. A. (2007). *Using the Drupal content management system to support personal and collaborative online environments.* Presentation at 2007 Indiana University Instructional Systems Technology Conference, Bloomington, IN.

**Journal Activity, Professional Affiliations, and Service**

- Managing Editor for the *Journal of Computing in Higher Education*, 2008 - present
- Member of American Educational Research Association (AERA)
- Member of Association for Educational Communications and Technology (AECT)
- Member of Association for the Advancement of Computing in Education (AACE)
- Board of Advisors (2004) Association of Professional Insurance Women (APIW)
- Reviewer International Society for Performance Improvement (ISPI) 2009 conference
- Co-host of *EdTechWeekly* live interactive webcast broadcast, 2006 - present

## Professional Experience

**Professional Projects and Appointments** June 2005 to Present

- Contract with the National Institute of Aerospace Associates to perform the instructional evaluation of the Real-World / In-World NASA Engineering Design Challenge, 2010 - 2012
- Previous appointment with Baruch College to design and facilitate courses within a Corporate Training and Instructional Design program in the Division of Continuing and Professional Studies.
- Completed projects include the design of an online learning environment, development of a community web site, and management of an insurance association's online web portal.

**Old Dominion University** January 2008 to December 2009

**Graduate Research Assistant**

- Provided research assistance to faculty within Old Dominion University's Instructional Design and Technology program.
- Served as Managing Editor for the *Journal of Computing in Higher Education.*

**Swiss Reinsurance America Corporation – New York** March 2002 to June 2005

**Associate Product Line Manager and Senior Underwriter**

- Managed planning and project activities as a home office Associate Product Line Manager in the facultative reinsurance underwriting division with over $220 million in premium.
- Counseled staff in the review and authorization of complex reinsurance programs.
- Coordinated and facilitated division's staff training and development initiatives.
- Developed successful client relationships with senior level business partners.
- Performed internal audits evaluating adherence to corporate underwriting guidelines.

**Chubb & Son – Chicago / New York** June 1998 to March 2002

**Regional Underwriting Manager - Risk Management Group**

- Managed the production of risk management insurance contracts in 14 branch offices by developing and directing the group's marketing strategies, underwriting protocols and client service guidelines.
- Directed a staff of casualty underwriting specialists in the Chicago underwriting center with over 50 risk management accounts.
- Fostered successful partnerships with risk managers and brokers resulting in the underwriting group exceeding 1999, 2000 and 2001 new business goals while achieving 95 percent renewal retention.

**Professional Experience (continued)**

**Kemper Insurance Companies – New York / Chicago** January 1990 - June 1998

**Managing Consultant, Home Office Project Manager, Underwriter**

- Managed underwriting staff in a risk management casualty underwriting unit with over sixty-five Fortune 1,000 accounts generating annual revenue of $300 million.
- Supervised a team of underwriters and assistants dedicated to an association program of over 150 individual commercial clients with $15 million in annual program premium.
- Underwrote, negotiated, and managed the delivery of casualty insurance programs that produced an average total annual premium and service revenue of $30 million.
- Developed and implemented underwriting process initiatives, served on corporate policy committees and coordinated corporate underwriting operations with insurance bureaus.