TESTING THE PSYCHOMETRIC PROPERTIES OF THE ONLINE STUDENT CONNECTEDNESS SURVEY

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The Online Student Connectedness Survey (OSCS) was introduced to the academic community in 2012 as an instrument designed to measure feelings of connectedness between students participating in online degree and certification programs. The purpose of this study was to examine data from the instrument for initial evidence of validity and reliability and to establish a nomological network between the OSCS and similar instruments utilized in the field. The study utilized sequential exploratory factor analysis- confirmatory factor analysis (EFA-CFA) and correlational analysis to assess results of the data.

Students enrolled in online courses at higher education institutions located in the United States served as the sample for this study. Three instruments were used during the study. The OSCS was administered first so that the factor structure could be examined for factor validity. Once confirmed, the Classroom Community Scale (CCS) and the Community of Inquiry Scale (COI) served as the instruments to examine nomological validity through correlational analysis of data.

This study provided evidence of factor validity and reliability for data from the OSCS. After the initial EFA-CFA, the four-factor structure held, and 16 of the 25 original items remained for nomological testing. Statistically significant correlations were demonstrated between factors contained in the OSCS, CCS, and COI, providing further evidence of construct validity. These results indicate that for the sample used in this study, the OSCS provides data that are valid and reliable for assessing feelings of connection between participants in online courses at institutions of higher learning.

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CHAPTER 1

INTRODUCTION

Background

The struggling economy and increased competition in the job market have helped intensify enrollment in online classes at higher education institutions over the past 5 years (Sheehy, 2012). This growth has led to an upsurge in research into factors that result in student success in online classes, most notably online student connectedness (Garrison & Arbaugh, 2007; Dawson, 2006; Exter, Korkmaz, Harlin, & Bichelmeyer, 2009; Ouzts, 2006). Online student connectedness refers to human interactions in computer-mediated learning environments that allow individuals to participate comfortably in group communication while simultaneously forming social relationships within the group (Galambos, Abelson, & Black, 1986; Nye & Simonetta, 1996). The ability to understand how students interact and succeed in online courses is critical because online learning is expected to be a vital part of long-term strategies for many higher education institutions (Sheehy, 2012). The need to study factors related to online connectedness has been addressed by several authors (Rovai, 2002a; Slagter van Tyron & Bishop, 2006, 2009; Shin, 2003; Tu & McIsaac, 2002). However, a review of the contemporary literature revealed limited initiatives to design and develop instruments to measure the concept of online student connectedness (Bolliger & Inan, 2012).

Factors that impact online student connectedness have been debated in the literature for several years (Bolliger, 2004; Ke, 2010; Kreijns, Kirschner, Jochems, & Van Buuren, 2004; So & Brush, 2008). It is argued that feelings of connectedness for students in fully asynchronous online courses affect satisfaction and learning outcomes (Arbaugh & Benbunan-Fich, 2007; Bolliger, 2004; Gunawardena & Zittle, 1997; Kim, Kwon, & Cho, 2011; Zembylas, Theodorou,

& Pavlakis, 2008). While research has established the importance of connectedness among online students (Bolliger, 2004; Drouin, 2008), few instruments have been developed to study factors associated with online student connectedness. A critical review of the contemporary literature yielded four instruments that attempt to measure student connectedness in online settings: the Classroom Community Scale (CCS; Rovai, 2002a), the Community of Inquiry Scale (COI; Arbaugh et al., 2008), the Social Perceptions in Learning Context Instrument (SPLCI; Slagter van Tyron & Bishop, 2012) and the Online Student Connectedness Survey (OSCS; Bolliger & Inan, 2012).

Rovai (2002a) developed the CCS to measure students’ sense of community in a learning environment. Subscales were shown to measure social community and learning community, but a test of the psychometric properties revealed that the CCS might be best suited for graduate students (Barnard-Brak & Shiu, 2010). While the CCS measures the relationship between students as it relates to sense of community and perceived learning, it ignores the importance of relationships that students build with the course facilitator and their need for comfort with technology. Evidence suggests that students' feelings toward the facilitator and their level of comfort with technology are critical factors in developing feelings of social connectedness in online educational settings (Akyol & Garrison, 2008; Bolliger, 2004; Bolliger & Inan, 2012; Garrison & Arbaugh, 2007; Moore, 1989).

Arbaugh et al. (2008) developed the COI to measure the degree to which social presence, cognitive presence, and teacher presence constitute a sense of community. Factor analysis for the COI supported the idea of teaching presence as a construct, but it also suggested inconsistencies about whether teaching presence measured one or two factors (Bangert, 2009). While the feeling of community is one facet measured by the COI through its social presence factor, the instrument's purpose is to examine how features of written language promote critical thinking in computer-mediated learning environments (Arbaugh & Benbunan-Fich, 2007). Therefore, it can be argued that the COI is better suited to measure perceived learning than feelings of online student connectedness.

Slagter van Tyron and Bishop (2012) introduced the SPLCI to measure students' perception of social connectedness and group social structure in online courses. By design, the instrument does not explore learner course satisfaction or evaluation of the instructor, both of which have been identified as strong contributors in building feelings of online student connectedness (Akyol & Garrison, 2008; Bolliger, 2004; Bolliger & Inan, 2012; Garrison & Arbaugh, 2007; Moore, 1989). While the instrument examines aspects of social connectedness among students enrolled in online courses, the wording of the items was applicable to social connectedness among students participating in any learning context (Slagter van Tyron & Bishop, 2012). Additionally, evidence of validity and reliability has not been established for data from this instrument, which is critical for instruments included in nomological network studies (Holton, Bates, Bookter, & Yamkovenko, 2007). For these reasons, the SPLCI will not be utilized as part of this study.

In 2012, Bolliger and Inan introduced the OSCS, which purports to measure feelings of connectedness between students in online degree and certification programs. The OSCS examines multiple factors attributed to the development of online student connectedness. Because the OSCS is a newly developed instrument, evidence of factorial validity is limited, and a nomological network has not been established. Establishing a set of constructs related to online student connectedness that are generalizable to a variety of audiences would facilitate discussion in both the academic and practitioner communities and allow for studies of this phenomenon across disciplines.

Need for the Study

The Babson Survey Research Group reported that, as of 2013, 7.1 million college students in the United States were taking at least one fully online course (Allen & Seaman, 2014). This number represents nearly a third of the total enrollment at degree-granting postsecondary institutions (NCES, 2012), and it is expected to continue to grow through 2021. Online courses offer attractive benefits for students including flexibility and convenience. Despite the benefits and projected growth of online course offerings, this learning format is not without problems. Students enrolled in online courses are 10%–20% more likely to drop out (Carr, 2000). One of the main reasons cited is the feeling of isolation from peers and instructors during the course (Curless, 2004; Randolph & Crawford, 2013; Xu & Jaggers, 2011). Randolph and Crawford (2013) noted that this attrition has a negative financial impact on the institution and a devastating psychological effect on the students who do not complete the course.

A second element supporting the need for the study is the promise that it can hold for online teaching above and beyond the CCS and COI. As discussed earlier, online connectedness between students in online higher education environments includes multiple facets such as peer-to-peer relationships, student-to-instructor relationships, comfort with technology, and perceived learning (Akyol & Garrison, 2008; Arbaugh & Benbunan-Fich, 2007; Bolliger, 2004; Bolliger & Inan, 2012; Gunawardena & Zittle, 1997; Zembylas, Theodorou, & Pavlakis, 2008). The OSCS is the first known instrument designed to measure each of these areas as it relates to feelings of connectedness in online higher education. Therefore, its use in research can provide insight into the theoretical and practical applications of methods for the design and implementation of effective online courses.

A final element supporting the need for this study is the fact that the OSCS is beginning to gain notoriety, and it is being used to support research in the area of online student connectedness. A search of Google Scholar, EBSCO Host, and ABI/Inform revealed that, since its introduction to the academic community in 2012, the OSCS study has been cited in six known research papers. Of these six papers, only one (Ford & Inan, 2013) used the instrument as part of quantitative research. In that study, the author reported, but did not calculate, the OSCS data reliability. Rather, reliability estimates from the original validation study (Bolliger & Inan, 2012) were reported. The remainder of the papers referenced the underlying construct of online student connectedness. For data from any instrument to be used to support research, empirical evidence of its construct validity is highly recommended (Cronbach, 1971). Table 1.1 summarizes the information related to the use of the OSCS study in research papers.

Table 1.1

Research Papers Citing the OSCS Study

Authors	Year	Type	Purpose of OSCS Inclusion
Ford & Inan	2013	Conference Proceeding	Determine online student connectedness for secondary math students; instrument used
Randolph & Crawford	2013	Journal Article	Listed as an instrument that measures sense of community in online courses
Ozturk & Ozcinar	2013	Journal Article	Discuss isolation as a problem in online learning
Grau-Valldosera & Minguillon	2014	Journal Article	Discuss dropout reasons for students in online educational courses
Irani, Wilson, Slough, & Reiger	2014	Journal Article	Discuss lack of connectedness among students as a problem in online learning
Salyers, Carter, Carter, Myers, & Barrett	2014	Journal Article	Discuss lack of student familiarity with online technology

In summary, online course enrollment will continue to grow, and it can be deduced from the literature that these course offerings will become an integral part of the financial strategy for higher learning institutions (Allen & Seaman, 2014; Randolph & Crawford, 2013). Online student connectedness has been linked to learning satisfaction outcomes (Arbaugh & Benbunan-Fich, 2007) and course retention (Zembylas, Theodorou, & Pavlakis, 2008). Therefore, the ability to measure feelings of online connectedness using a research-quality instrument is vital to both researchers and practitioners. Based on a review of instruments designed to measure feelings of connectedness, the OSCS may be the first one designed specifically for participants in online educational settings. This study will examine OSCS data for evidence of validity and reliability in measuring these feelings of connectedness exclusively in the online environment. Specifically, convergent validity and discriminant validity of data from the OSCS have not been tested and will be examined as part of this study. Assuming that the examination of validity and reliability confirms the data from the OSCS, a nomological network will then be tested. This research will add to the body of work related to factors that affect student performance in distance learning courses (Garrison, 2000; Randolph & Crawford, 2013; Rodriguez, Ooms, & Montanez, 2008).

Theoretical Framework

Five theories related to online student connectedness will inform the theoretical model used to test the nomological network for the OSCS. The foundational theory driving this study is e-mmediacy (Slagter van Tyron & Bishop, 2006) because it focuses on a wide scope of factors that facilitate social connectedness in online settings. Walther's social information processing theory (1992) is the second theoretical viewpoint. Social information processing provides a relevant theoretical lens because it offers insight into how people process information in a computer-mediated environment. As with e-mmediacy, social information processing examines multiple factors that impact social connection among learners. Contributing to the foundation of the nomological network are McMillan and Chavis' (1986) sense of community theory; Garrison, Anderson, and Archer's (2000) community of inquiry theory; and Short, Williams, and Christie's (1976) social presence theory. Both sense of community theory and community of inquiry theory are supported by published instruments. These instruments will be used to statistically examine the nomological network for data from the OSCS. Because this research is concerned with establishing convergent and discriminant validity and constructing a nomological network for the OSCS, the exploration of multiple theories is necessary.

Social Presence Theory

Short, Williams, and Christie (1976) defined social presence as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (p. 65). In other words, social presence defines the extent to which a person is perceived as being "real" in computer-mediated communication (CMC) settings (Gunawardena & Zittle, 1997). Social presence theory asserts that the ability to transmit information used in face-to-face communications (i.e., facial expression and tone) impacts the degree to which a person receiving a message in a CMC environment is perceived to be involved in the communication. Social presence theory also focuses on the communication medium and recognizes that communication is only effective if the communication medium has the appropriate social presence required for the level of interpersonal involvement required. As it relates to online student connectedness, social presence has been positively correlated to learner satisfaction in online courses (Gunawardena & Zittle, 1997).

Social Information Processing Theory

Social information processing theory explains how people get to know one another and how they develop and manage relationships in CMC settings without nonverbal cues (Walther, 1992). The theory asserts that the amount of time it takes to observe and decode information from textual cues impacts the feeling of connection among participants in CMC settings (Walther, 1992). Social information processing theory contends that the medium itself is not the reason that connection among participants is limited. Rather, the time it takes to transmit the message and the way the message is interpreted by others determines if a connection will take place. The passage of time and the inclusion of frequent interactions initiated by either participants or a facilitator can overcome the fact that participants do not communicate face to face (Walther, 1992; 1993). Further, forming a social connection can happen, but it will take longer in CMC settings than in traditional face-to-face settings (Olaniran, Rodriguez, & Williams, 2011).

E-mmediacy Theory

E-mmediacy is "the feeling of social connectedness one has with fellow online class participants (classmates, instructor, and teaching assistant) through computer mediated experiences" (Slagter van Tyron & Bishop, 2006, p. 293). Introduced in 2006, e-mmediacy theory has been used to explain feelings of social connectedness that students and faculty acquire through the technologically enhanced online learning environment. E-mmediacy theory draws from Mehrabian's (1969) theory of immediacy, which examined the verbal and nonverbal cues people use to reduce the perception of physical distance between them in face-to-face communication. Building on Mehrabian's (1969) work, e-mmediacy asserts that the same strategies used to reduce the perception of distance in face-to-face communication are even more important in online environments because participants are actually separated by time and space (Freitas, Meyers, & Avtgis, 1998). These strategies include frequent interactions, the encouragement of participation, and the ability of the instructor to provide support for technology. The inclusion of these strategies is linked to learners' positive feelings about the course, fellow students, and the instructor (Slagter van Tyron & Bishop, 2006).

Sense of Community Theory

Sense of community theory is defined as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (McMillan & Chavis, 1986, p. 9). The theory focuses on the experience of community as opposed to its structure, formation, and setting. Sense of community was first applied to online education by Rovai (2002a), who asserted that connectedness between students could occur in a virtual classroom setting. Similar to both social information processing and e-mmediacy, sense of community theory minimizes the limiting factors related to the electronic communication medium, such as isolation and the inability to meet face to face, and focuses more on the factors such as frequent interactions and group assignments, which lead to building a social connection between participants. Rovai (2002a) recognized that the social presence of the instructor, which included frequent interactions and the organization of small group activities, mitigated feelings of isolation among students. Further, Rovai (2002a) claimed that the establishment of this connection would lead to a decrease in attrition rates in online educational settings.

Community of Inquiry Theory

Community of inquiry theory is defined as "a process model of online learning which views the online educational experiences as arising from the interactions of three presences—social presence, cognitive presence, and teaching presence" (Swan, Garrison, & Richardson, 2009, p. 45). Dewey (1959) described the elements of inquiry and community as being at the center of any worthwhile learning experience. He asserted that it was the elements of inquiry and sense of community that led learners to take responsibility for their knowledge and to work independently toward learning achievements. Garrison, Anderson, and Archer (2000) built upon this initial theory by viewing inquiry and community within the framework of online learning. It is this version that will be referenced throughout this study. Community of inquiry theory investigates how written language used in computer conferencing activities promotes critical/higher-order thinking (Garrison, Anderson, & Archer, 2000). The framework and theory provide insight into the complexities of both online and blended learning environments and center on collaboration between teachers and students, who are viewed as the key participants in the educational process.

Pending the outcome of Study 1, data from the OSCS will be examined for validity against existing theories related to online student connectedness. Figure 1.1 depicts the theoretical model informing the proposed nomological network.

Purpose of the Study

The purpose of this study is twofold and will be conducted in two parts. Study 1 will examine factorial validity for OSCS data, confirm the factor structure of the refined set of items, and test and report reliability of the scale scores. Pending the outcome of Study 1, Study 2 will seek to test the nomological network for the instrument using the proposed theoretical model.

Conducting this study in two parts will allow the final items to be to be tested using an independent sample. Replicating the confirmatory factor analysis on an independent sample demonstrates the stability of the model across independent samples and is common in psychometric studies (Gillaspy & Campbell, 2006; MacCallum, Roznowski, & Necowitz, 1992; Petrie, Tripp, & Harvey, 2002).

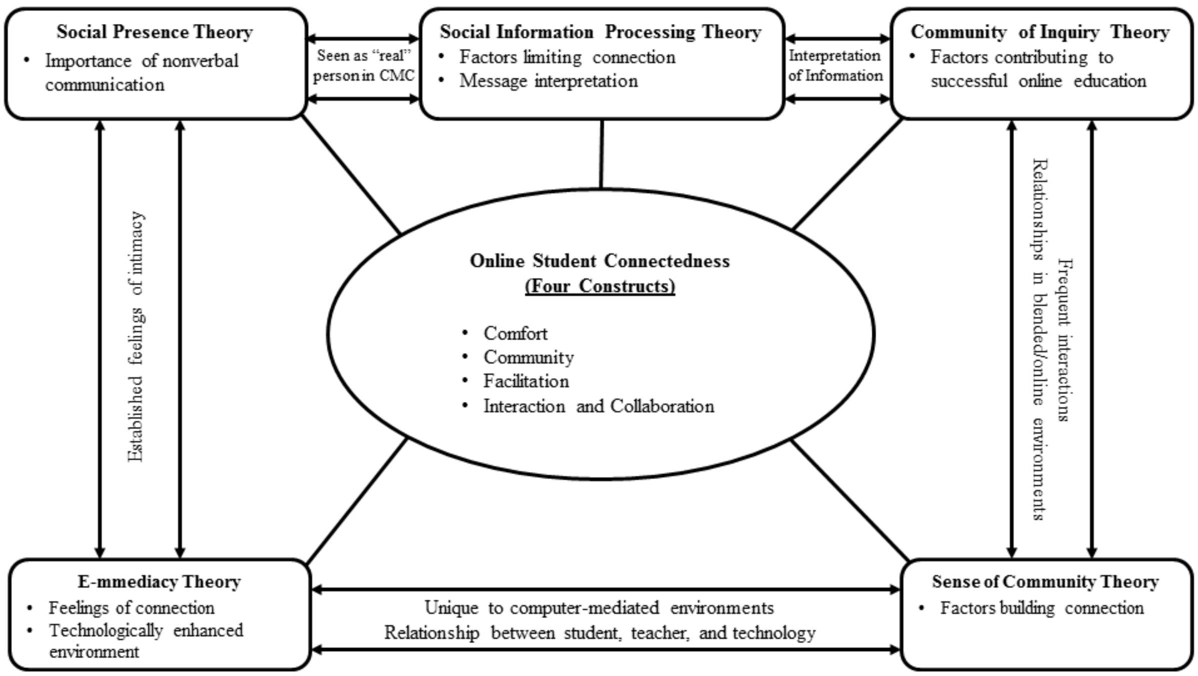

Figure 1.1. Theoretical model to test OSCS nomological network.

Research Hypotheses

Study 1 seeks to examine factorial validity for the OSCS. The following hypotheses will be tested against the factor structure of the OSCS:

$H1_a$: Pattern coefficient values for data from each of the four subscales will be > .70 (Hair et al., 2010).

$H1_b$: Reliability coefficient values for data between the overall instrument and data from each subscale will be .80 or higher (Nunnally, 1978; Henson, 2001).

$H1_c$: Factor structure scores for the OSCS will yield good fit indices: CMIN/*df* > .30, Tucker-Lewis index (TLI) >.95, comparative fit index (CFI) > .95, root mean square error of approximation (RMSEA) < .70, standardized root mean square residual (SRMR) < .08 (Byrne, 2010; Hooper, Coughlan, & Mullen, 2008; Kline, 2005).

Study 2 seeks to replicate the confirmed factor structure from Study 1 and provide evidence of a nomological structure for the OSCS. Fit indices will be evaluated using the same guidelines from Study 1: CMIN/*df* > .30, TLI > .95, CFI > .95, relative fit index (RFI) > .09, RMSEA < .70, SRMR < .08 (Byrne, 2010; Hooper, Coughlan, & Mullen, 2008; Kline, 2005). To establish a nomological network, the strength of relationships for observed scale scores between factors from the OSCS and factors from the identified related constructs (COI & CCS) will be examined. Thresholds established in Ward, Fischer, Lam, and Hall (2009) will be used to assess these relationships. Strong correlation will be indicated by .50 < | *r* |; moderate correlation will be indicated by .30 < | *r* | < .50; and weak correlation will be indicated by .10 < | *r* | < .30. As it relates to the OSCS, theory supports the following hypotheses:

H2: Data from the OSCS will be positively correlated with data from the CCS.

$H2_a$: Data for *comfort* from the OSCS will demonstrate a *strong correlation* with data for *connectedness* and data for *learning* from the CCS.

$H2_b$: Data for *community* from the OSCS will demonstrate a *strong correlation* with data for *connectedness* and data for *learning* from the CCS.

$H2_c$: Data for *facilitation* from the OSCS will demonstrate a *strong correlation* with data for *learning* and a *moderate correlation* with data for *connectedness* from the CCS.

$H2_d$: Data for *interaction and collaboration* from the OSCS will demonstrate a *strong correlation* with data for *connectedness* and data from *learning* from the CCS.

H3: Data from the OSCS will be both positively and negatively correlated with data from the COI.

$H3_a$: Data for *comfort* from the OSCS will demonstrate a *strong positive correlation* with data from *social presence* and data for *teaching presence* from the COI.

$H3_b$: Data for *community* from the OSCS will demonstrate a *strong positive correlation* with data for *social presence* and a *moderate positive correlation* with data from *teaching presence* from the COI.

$H3_c$: Data for *facilitation* from the OSCS will demonstrate a *strong positive correlation* with data from *teaching presence* and a *moderate positive correlation* with data for *social presence* from the COI.

$H3_d$: Data for *interaction and collaboration* from the OSCS will demonstrate a *strong positive correlation* with data for *teaching presence* and a *moderate positive correlation* with data for *social presence* from the COI.

$H3_e$: Data for *comfort* and *facilitation* from the OSCS will demonstrate a *strong positive correlation* with data for *cognitive presence* from the COI.

$H3_f$: Data for *community* and *interaction and collaboration* from the OSCS will demonstrate a *weak positive correlation* with data for *cognitive presence* from the COI.

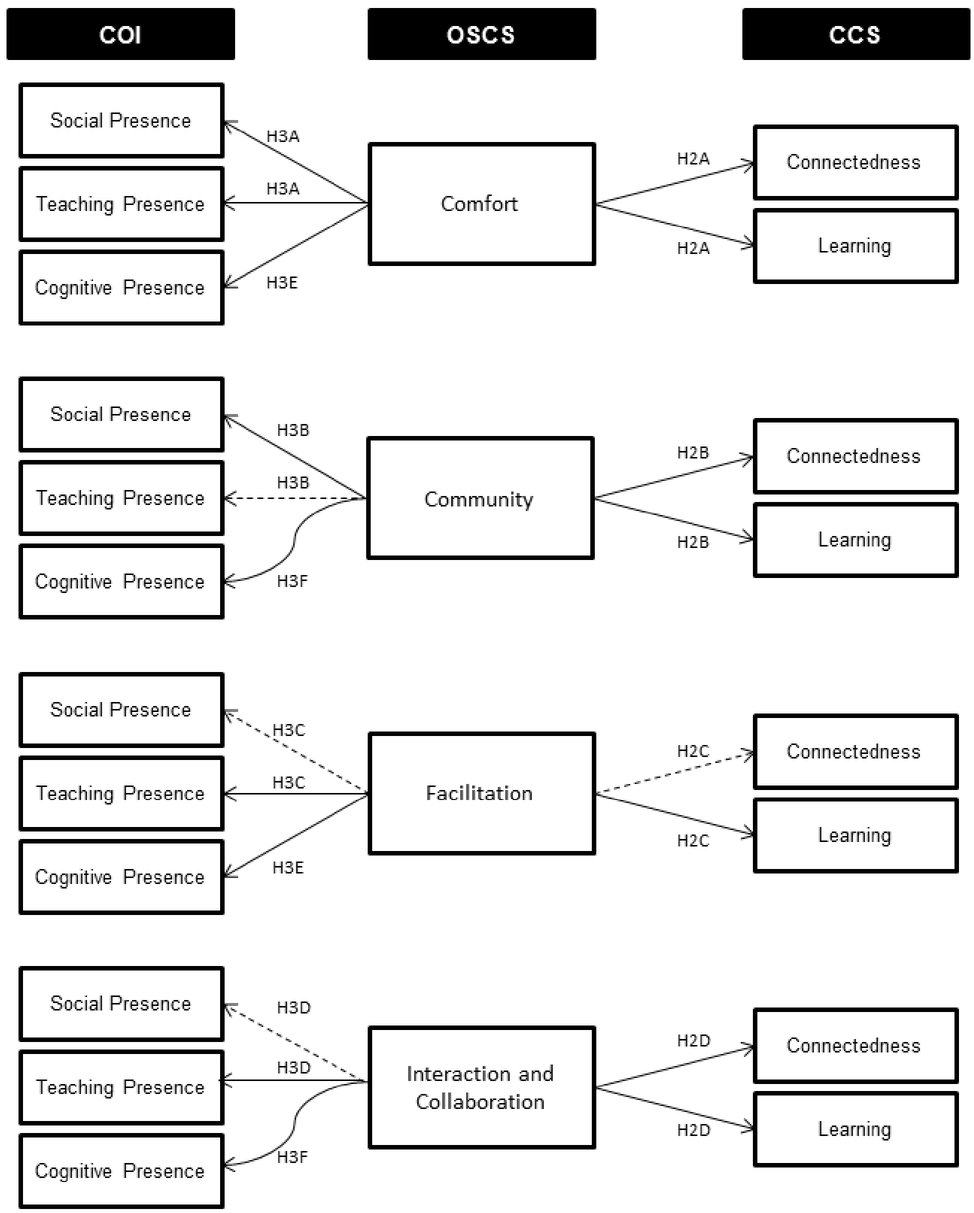

Figure 1.2. Hypothesized model for OSCS nomological network.

<u>Key</u>
OSCS: Online Student Connectedness Survey
COI: Community of Inquiry Scale
CCS: Classroom Community Scale

<u>Directional Paths</u>
Strong Correlation:
Moderate Correlation:
Weak Correlation:

Delimitations

1. This study will use participants currently enrolled in at least one fully online course at a 4-year, public higher learning institution located in the United States. Online courses are defined as courses where all of the content is delivered using technology and there are no required face-to-face meetings (Dickson & Osborn, 2011).
2. Data will be collected at one time for each study and, therefore, may suffer from common method bias. Tests for common method bias will be conducted as described in the methodology section of this manuscript.
3. A research panel company will be used to identify participants. The panel will be given selection criteria as outlined in the sample section in the methodology section of this manuscript (Rao, Kaminska, & McCutcheon, 2010).
4. Participants may be enrolled as undergraduate-level or graduate-level students.
5. Self-report data will be used in the study.
6. Demographic data will be gathered but will not be considered beyond ensuring that participants meet the requirements of this study.
7. This study will be limited to self-report measures by students participating in fully online courses. Although instructors are also participants in these courses, they will not be recruited to complete the survey.
8. To increase generalizability of the results, this study will be open to students enrolled in traditional, trimester, and quadmester semester formats. Traditional semester formats are defined as academic terms lasting between 14–20 weeks (NCES, 2012). Trimester terms last between 8–12 weeks, and quadmester formats are those that last between 4–12 weeks (NCES, 2012). While early research suggested a difference in academic rigor and teaching

standards for courses with shorter semesters (Allen, Miller, Fisher, & Moriarty, 1982), more recent studies have shown that no difference exists in learning outcomes and student satisfaction based on the length of the term (Anastasi, 2007).

9. Theory suggests that the passage of time and the frequency of interactions increase the connection between students in CMC environments (McMillan & Chavis, 1986). Therefore, participants must be enrolled in courses that require student-to-student interaction (i.e., study groups, group projects, and required discussion postings).

Limitations

1. Differences in teaching methods and style could affect how participants respond to the survey (Bolliger, 2004).
2. Other factors, including the level of experience with technology used in online courses, could influence participants' responses to the survey questions and the results obtained (Zimmerman, 2012).
3. Participants may be enrolled in more than one online course; therefore, they might concentrate on more than a single course experience when responding to the surveys.
4. In some cases, students may prefer to enroll in a particular course in a face-to-face format, but the college only offers the course in an online setting, thereby forcing students into the online student population.
5. Self-report data may suffer from inaccuracy because of recall problems and social desirability effects (Crockett, Schulenberg, & Petersen, 1987).
6. Research suggests that favorable responses for the online course format increase each time a student completes an online course (Allen & Seaman, 2014; Xu & Jaggers, 2011). Although

information on the number of online courses completed by each participant will be gathered, the researcher will not moderate for this phenomenon during the study.

7. Responses will only come from students who agree to complete the survey. This limitation could result in non-response bias in the data (Lineback & Thompson, 2010).

Definition of Terms

This section contains a list of terms that will be introduced during this study. Each term includes a citation to a full reference that can be accessed in the event that the reader needs more clarification on the topic.

Common method bias: Variance that is attributable to the measurement method rather than to the constructs the measures are assumed to represent (Podsakoff, MacKenzie, & Lee, 2003).

Community of inquiry theory (COI): Factors related to the sense of community a participant develops in a learning environment (Garrison, Anderson, & Archer, 2000).

Computer-mediated communication (CMC): Synchronous or asynchronous electronic mail and computer conferencing by which senders encode messages that are relayed from senders' computers to receivers' computers (Walther, 1992).

Confirmatory factor analysis (CFA): A statistical technique used to verify the factor structure of a set of observed variables (Suhr, 2006).

Convergent validity: Evidence to show that measures that should be related are in reality related (Trochim, 2000).

Discriminant validity: Evidence to show that measures that should not be related are in reality not related (Trochim, 2000).

E-mmediacy theory: Feelings of social connectedness that one has with fellow online class participants (classmates, instructor, teaching assistant) through computer-mediated experiences (Slagter van Tyron & Bishop, 2006).

Exploratory factor analysis (EFA): A statistical method of analysis used to explore the possible underlying factor structure of a set of observed variables (Child, 1990).

Immediacy theory: Any of several nonverbal communications, such as eye contact, gestures, smiles, and humor, which are associated with subjective evaluations about the presence of the teacher (Melrose, 2009).

Internal consistency: Measures whether items that propose to measure the same general construct produce similar scores (Cronbach, 1951).

Nomological network: A representation of constructs in a study and their linkages (Cronbach & Meehl, 1955).

Online course: A course where all of the content is delivered using technology and there are no required face-to-face meetings (Dickson & Osborn, 2011).

Online student connectedness: Human interactions in computer-mediated learning environments that allow individuals to participate comfortably in group communication while simultaneously forming social relationships within the group (Galambos, Abelson, & Black, 1986).

Social presence theory: The feeling that others are involved in communicative interaction (Short, Williams, & Christie, 1976).

Social information processing theory: Explains how people get to know one another online without verbal cues and how they develop and manage relationships in a computer-mediated environment (Walther, 1992).

Sense of community theory: Factors related to how participants develop a sense of connection in a virtual classroom setting (Rovai, 2002a).

Social desirability theory: Refers to the need of a respondent to obtain approval by responding in a culturally and socially acceptable manner (Edwards, 1957).

Summary

The anticipated growth of online courses and the issue of attrition among students in these courses are elements that could impact the strategy of higher learning institutions. A lack of social connection between students enrolled in this course format is one reason that has been attributed to this attrition (Curless, 2004; Randolph & Crawford, 2013; Xu & Jaggers, 2011). For these reasons, a viable method to measure online student connectedness is necessary. This chapter provided background on the instruments found in the literature that attempt to measure factors that impact student connectedness. The need for the study was established, a theoretical framework was presented, and the purpose of the study was explained. The chapter concluded with research hypotheses, limitations and delimitations of the study, and the definitions of the terms found in the manuscript.

CHAPTER 2

LITERATURE REVIEW

This review of the literature explores the phenomenon of online student connectedness and ties it to relevant constructs. It starts with an examination of the development of the Online Student Connectedness Survey (OSCS) and highlights the need to examine the validity and reliability of data from the instrument. Next, student connectedness theories are discussed. From these theories, two instruments that will be used to assess the nomological network for the OSCS will be examined, and empirical studies that provide support for this study's hypotheses and research model are put forth.

Development of the OSCS

In 2012, Bolliger and Inan introduced the OSCS in *The International Review of Research in Open and Distance Learning*. The OSCS is purported to measure feelings of connectedness between participants in online educational settings (Bolliger & Inan, 2012). The instrument was created using a three-step process. Step 1 included an in-depth review of the literature associated with academic environments and sense of isolation. From this review, the authors identified four elements associated with student connectedness: 1) comfort, 2) community, 3) facilitation, and 4) interaction and collaboration. Once factors related to online student connectedness were identified, the authors developed 78 Likert-scale items that were reviewed for reliability by a panel of four experts in the educational field from the United States as part of step 2. From this reliability review, 48 items were retained. The authors then conducted a validation study to narrow the items from 48 to 25. Principal components analysis (PCA) with oblimin rotation was the selected exploratory factor analysis (EFA) method. Factor retention methods included the eigenvalues greater than one rule, scree test, total variance, and residuals. Internal reliability for the entire survey was reported as $\alpha = .98$, and the reliability measures for the four subscales were as follows: comfort ($\alpha = .97$), community ($\alpha = .96$), facilitation ($\alpha = .94$), and interaction and collaboration ($\alpha = .97$). It is important to note that these reliability estimates are considerably higher than acceptable average scores as alphas during psychometric testing have been reported to generally range between .75 to .90 (Henson & Roberts, 2006; Nunnally, 1978).

In step 3, a pilot study using the 25-item scale was conducted with 146 students enrolled in an online information technologies certificate program at a Turkish university. The pilot confirmed the four-factor structure and supported retaining all 25 items of the scale. However, several limitations influenced generalizability of the results. First, the pilot study utilized a small single institution sample ($n = 146$), which represents a 5:1 response ratio based on the number of survey items. A 10:1 response ratio is the general recommendation for studies including factor analysis (Arrindell & van der Ende, 1985; Everitt, 1975; Garson, 2008). Second, all participants were enrolled as engineering majors, a predominately male subject area. This sample yielded atypical demographic statistics, where 70% of the respondents were male. Because college enrollment for women outranks enrollment for men by a ratio of 1.4:1 (Hausmann, Tyson, & Zahidi, 2011), the sample used in the pilot study is not representative of the overall college population. Next, the original study was conducted at a Turkish university. Although the original survey underwent a test for semantic equivalence across languages (Bolliger & Inan, 2012), the final version was only distributed to one person from the target audience for a pretest prior to distribution. The suggested number of participants needed to pretest a translated instrument prior to distribution is 4–40 people from the target audience (Beaton, Bombardier, Guillemin, & Ferraz, 2002; Forsyth, Kudela, Levin, Lawrence, & Willis, 2006; Harkness, 2003). Finally, the researchers for the pilot study only shared limited results of their factor analysis and excluded the full pattern matrix, thereby affecting the ability of other researchers to make independent interpretations of the data (Henson & Roberts, 2006). Empirical evidence to support validity and reliability is essential for any testing instrument (Cronbach, 1971; Fishman & Galguera, 2003; Urbina, 2004). Therefore, additional testing and full disclosure of the results are necessary to operationalize data generated from the OSCS. These reasons support the first set of hypotheses for this study:

$H1_a$: Pattern coefficient values for data from each of the four subscales will be > .70 (Hair et al., 2010).

$H1_b$: Reliability coefficient values for data between the overall instrument and data from each subscale will be .80 or higher (Nunnally, 1978; Henson, 2001).

$H1_c$: Factor structure scores for the OSCS will yield good fit indices: CMIN/*df* > .30, Tucker-Lewis index (TLI) > .95, comparative fit index (CFI) > .95, root mean square error of approximation (RMSEA) < .70, standardized root mean square residual (SRMR) < .08 (Byrne, 2010; Hooper, Coughlan, & Mullen, 2008; Kline, 2005).

Student Connectedness Theories

Garrison (2000) asserts that theoretical frameworks and models are the cornerstone of credibility and viability for a field of practice. Without them, the field will become stagnant because the opportunity for research to expand the field is limited. Theories related to distance learning have undergone a focal shift as researchers have transitioned from examining the financial implications of distance learning to analyzing its educational benefits (Feenberg, 1999). This transition highlighted the importance of establishing feelings of connectedness between participants enrolled in distance learning courses (Arbaugh & Benbunan-Fich, 2007; Bolliger, 2004; Bolliger & Inan, 2012; Drouin, 2008; Gunawardena & Zittle, 1997; Kim, Kwon, & Cho, 2011; Zembylas, Theodorou, & Pavlakis, 2008). For example, Drouin (2008) investigated the relationship between perceived sense of community, satisfaction, and achievement for 71 students in an online course. Sense of community was defined as "the feeling of belonging or connectedness that is established among learners who have common interests and goals and participate in joint activities" (Drouin, 2008, p. 279). The study found that sense of community was positively correlated with satisfaction and achievement in the course. Students who reported a sense of community were those who communicated with fellow students, frequently participated in asynchronous discussion, and formed a connection with their classmates and instructor during the course. Still, the field of distance education lacks a coherent understanding of interrelated constructs associated with achieving online student connectedness and a validated quality instrument for measuring these constructs (Bolliger & Inan, 2012; Garrison, 2000). To address these gaps, Study 2 will attempt to identify a nomological network of constructs related to achieving online student connectedness.

To begin a discussion on interrelated constructs associated with achieving connectedness in an online learning setting, it is essential to select and review the influential theories and empirical studies related to this concept. To identify these theories, a search using the key terms *student connectedness*, *online course*, and *community* was performed in Google Scholar, EBSCO Host, and ABI/Inform. This search yielded 41 articles. A review of these articles resulted in the discovery of the five theories noted in this study as being related to factors influencing online student connectedness. They are social presence, social information processing, community of inquiry, sense of community, and e-mmediacy. In addition to the OSCS, these theories have influenced two prominent, widely used, empirically tested instruments that purport to measure student connectedness in learning environments: the Classroom Community Scale (CCS) and the Community of Inquiry (COI) Scale.

The Classroom Community Scale (CCS)

Developed by Rovai (2002a), the CCS is a 20-item self-report instrument purported to measure sense of community in online educational settings. Participants respond using a 5-point Likert scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). A search of the academic databases EBSCO Host, Google Scholar, and ProQuest revealed that the CCS has been cited in 308 studies since its development in 2002. The scale is composed of two factors: learning and connectedness. Both factors have been cited as promoting student connectedness (Rovai, 2002a).

Rovai (2002a) defined sense of community in online environments in terms of spirit, trust, interaction, and commonality of an expectation of learning. These dimensions are developed through social presence in the course, social equality, group facilitation, and teaching style. Randolph and Crawford (2013) related these subscales to Bolliger and Inan's (2012) factors of interaction and collaboration, facilitation, and community. This proposed connection suggests that there is a strong relationship between the CCS and the OSCS. Therefore, it is hypothesized that:

H2: Data from the OSCS will demonstrate convergent validity with data from the CCS.

Relationship between the CCS and OSCS

The first scale of the CCS, learning, is defined as "the feeling that knowledge and meaning are actively constructed within the community, that the community enhances the acquisition of knowledge and understanding, and that the learning needs of its members are being satisfied" (Rovai, 2002b, p. 201). Within the framework of the CCS, learning and community are strongly linked. When participants feel a sense of community, trust begins to develop, participants are more open to asking questions of one another to help support their learning, and meaningful relationships begin to form (Dawson, 2006; Ni & Aust, 2008; Sadera, Robertson, Song, & Midon, 2009). Community as it relates to the OSCS describes the feeling of belonging (Bolliger & Inan, 2012) and has been tied to factors such as trust and connection (Bolliger, 2004; Kim, Kwon, & Cho, 2011; Rovai, 2002a, 2002b). Students who feel a sense of community can negate feelings of isolation, thus decreasing dropout rates and improving learning outcomes (Northrup, 2002).

The second scale of the CCS, connectedness, is defined as "the feeling of belonging and acceptance and the creation of bonding relationships" (Rovai, 2002b, p. 201). This feeling manifests in verbal and nonverbal behaviors that help to personalize interactions and is viewed as a positive factor in affecting learning outcomes. The OSCS addresses these feelings within the factor of interaction and collaboration. The element of interaction and collaboration is described as a two-way communication process that requires students to work collaboratively with one another. This type of interaction inspires critical thinking and furthers knowledge (Bolliger & Inan, 2012).

Both learning and connectedness are prominent factors in the theory of e-mmediacy (Slagter van Tyron & Bishop, 2006). E-mmediacy takes it roots from social learning theory, which argues that people learn best in environments where they can construct ideas and form meaningful, collaborative interactions (Bandura, 1971). While learning is viewed as a cognitive function, the formation of communities and a person's perception of his or her role in this community, also known as status, are critical to satisfaction and learning success (Slagter van

Tyron & Bishop, 2006). Once status is established, acceptable behaviors (norms) for interaction are developed. Finally, role differentiation takes place among members within the community, and the group's social structure is adopted. Role differentiation refers to members being assigned in the hierarchy as leaders, followers, or information seekers (Slagter van Tyron & Bishop, 2006).

E-mmediacy also examines how technology can both enhance and impede social connectedness in online learning settings. It asserts that relationship building within online educational settings is a function of the interactions between participants and lack of interaction cannot be solely attributed to the fact that face-to-face communication does not exist. The success of the learning environment is dependent on behaviors that reduce the perception of distance. Mehrabian (1969) first identified these behaviors using the theory of immediacy. Here, verbal and nonverbal gestures, such as smiles, eye contact, and personal recognition, were found to motivate students to learn and develop positive experiences about the course and the instructor (Christophel, 1990; Wilson & Taylor, 2001). E-mmediacy asserts that this same strategy should be employed in online environments to help students develop feelings of connectedness (Slagter van Tyron & Bishop, 2006). The OSCS refers to the enhancement of technology in online educational settings as comfort and the subsequent relationship building as facilitation.

Comfort is defined by the authors as "experiencing contentment and security and comfort with either integrated technologies or the learning environment" (Bolliger & Inan, 2012, p. 45). Students who do not experience a feeling of comfort in an online educational environment tend to become isolated and miss critical learning opportunities, but these feelings can be negated by instructor intervention through facilitation (Bolliger & Inan, 2012; Shin, 2003). Facilitation relates to behaviors demonstrated by instructors in an online educational environment, including frequent messages and feedback on progress throughout the duration of the course. Instructor participation has been linked to success outcomes, and studies have shown that students who are more engaged are more active in the learning process (Moore, 1989; Slagter van Tyron, 2006). Although instructor participation has been positively linked to perceived learning, it has merely been implied as a factor in helping students experience a sense of connection with each other in online educational settings (Young, 2006). Therefore, I deduced that data from facilitation from the OSCS will demonstrate only a moderate relationship with data from connectedness from the CCS.

Slagter van Tyron and Bishop (2006) identified four strategies to enhance e-mmediacy in online educational settings: 1) stimulate frequent interactions during the course, 2) include activities that manage pace and encourage participation, 3) supply support for technologies used in the course, and 4) understand what it means to be a student in an online environment. Research suggests that these four strategies appear to be synonymous with facilitation, comfort, collaboration, and community (the same factors purported to directly affect student connectedness according to the OSCS instrument) (Randolph & Crawford, 2013). To investigate the strength of this connection, the following hypotheses are put forth regarding the relationship between data from factors of the OSCS and the CCS:

$H2_a$: Data for *comfort* from the OSCS will demonstrate a *strong correlation* with data for *connectedness* and data for *learning* from the CCS.

$H2_b$: Data for *community* from the OSCS will demonstrate a *strong correlation* with data for *connectedness* and data for *learning* from the CCS.

$H2_c$: Data for *facilitation* from the OSCS will demonstrate a *strong correlation* with data for *learning* and a *moderate correlation* with data for *connectedness* from the CCS.

H2$_d$: Data for *interaction and collaboration* from the OSCS will demonstrate a *strong correlation* with data for *connectedness* and data from *learning* from the CCS.

The Community of Inquiry Scale (COI)

The COI is a 34-item self-report instrument that measures the dimensions of social presence, cognitive presence, and teaching presence in learning environments (Arbaugh et al., 2008). The scale was created to operationalize Garrison, Anderson, and Archer's COI framework, which was designed to "investigate how features of written language used in computer conferencing activities promote critical/higher-order thinking" (Garrison, Anderson, & Archer, 2000, p. 73). In 2004, Garrison, Cleveland-Innes, and Fung developed the COI scale to "to understand and explain the conditions under which students adopt the role identity of online learners" (p. 61). Responses are reported on a 5-point Likert scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). A search of the academic databases EBSCO Host, Google Scholar, and ProQuest revealed that the COI has been cited in 1,330 studies since its development. Initial results for data from the COI yielded a four-factor structure (Garrison & Arbaugh, 2007), but subsequent studies have confirmed it as having only three factors: social presence, cognitive presence, and teaching presence (Arbaugh et al., 2008; Bangert, 2009).

The COI has been has been used in a wide variety of studies focusing on online higher education (Akyol, Garrison, & Ozden, 2009). Both social presence and teaching presence have been cited as factors promoting social connectedness in distance learning environments (Akyol & Garrison, 2014; Arbaugh & Benbunan-Fich, 2007; Boston et al., 2013). However, cognitive presence has been described as a constructivist viewpoint measuring perceived learning and not a factor that directly influences feelings of connectedness between participants in online educational settings (Pollard, Minor, & Swanson, 2014); therefore, it is hypothesized that:

> H3: Data from the OSCS will be both positively and negatively correlated with data from the COI.

Relationship between the COI and OSCS

The first factor of the COI, social presence, is defined in terms of how "real" a person seems during computer-mediated communication (CMC) (Short, Williams, and Christie, 1976). Garrison, Anderson, and Archer (2000) related this definition to online learning by defining social presence within an online educational environment as "the ability for learners to project themselves socially and emotionally, thereby representing themselves a 'real people' in mediated communication" (p. 94). Social presence facilitates more frequent interactions, thereby forming bonded relationships within the environment. This type of bonded relationship has been correlated with course satisfaction outcomes (Akyol, Garrison, & Ozden, 2009; Northrup, 2002; Ryle & Cumming, 2007).

Since its inception in 1976, social presence theory has appeared in a number of studies examining communication in technology-based environments (Garrison, Anderson, & Archer, 2000; Gunawardena, 1995; Gunawardena & Zittle, 1997; Rovai, 2002a, 2002b; Slagter van Tyron & Bishop, 2006; Walther, 1992). Early on, many social presence studies using CMC asserted that social presence was low because of the lack of ability to establish relationships within computer-mediated environments (Baym, 1995). However, the theory supported the notion that it is interactions within the environment—and not the environment itself—that lead to low perceptions of social presence. As technology began to evolve, social presence was viewed as the foundation of collaborative learning, interaction, and group cohesion (Aragon, 2003; Garrison & Arbaugh, 2007; Boston et al., 2013; Ke, 2010). Bolliger & Inan (2012) assert that comfortable learners are able to participate in the learning environment without fear of persecution. This comfort is facilitated by both a sense of ease with technology and facilitated discourse, course design, and organization from the instructor, the latter of which is directly related to the second factor of the COI, teaching presence (Pollard, Minor, & Swanson, 2014).

Teaching presence is described as instructional management that leads to building understanding and personal meaning among students (Garrison, Anderson, & Archer, 2000). Instructors are viewed as central figures in establishing a sense of community and teaching presence, although they are often not viewed as central figures in the community of learning by their students (Bolliger & Inan, 2012; Young, 2006). Formal titles are attributed to creating a sense of distance between instructors and their students, despite the fact that heavy reliance is placed on the role of the instructor for creating the very collaborative environment that allows for interaction and connectedness between students (Aragon, 2003). For this reason, I deduced that teaching presence will exhibit a strong relationship with factors related to establishing the learning environment and only a moderate relationship with factors related to community and collaboration between students.

$H3_a$: Data for *comfort* from the OSCS will demonstrate a *strong positive correlation* with data from *social presence* and data for *teaching presence* from the COI.

$H3_b$: Data for *community* from the OSCS will demonstrate a *strong positive correlation* with data for *social presence* and a *moderate positive correlation* with data from *teaching presence* from the COI.

$H3_c$: Data for *facilitation* from the OSCS will demonstrate a *strong positive correlation* with data from *teaching presence* and a *moderate positive correlation* with data for *social presence* from the COI.

$H3_d$: Data for *interaction and collaboration* from the OSCS will demonstrate a *strong positive correlation* with data for *teaching presence* and a *moderate positive correlation* with data for *social presence* from the COI.

Cognitive presence is described as triggering events that illicit critical thinking among learners (Garrison, Anderson, & Archer, 2000). Examples of events related to cognitive thinking are the posting of welcome messages, discussion board interactions, and student reflection-type activities (Ryle & Cumming, 2007). Several studies link teaching presence to cognitive presence through learning outcomes, and it has been suggested that it is the instructor's role to enhance cognitive awareness among students (Bolliger, 2004; Bolliger & Inan, 2012, Arbaugh & Benbunan-Fich, 2007; Garrison, Anderson, & Archer, 2000; Garrison & Arbaugh, 2007; Slagter van Tyron & Bishop, 2006; 2009). The instructor's actions are also linked to developing a sense of comfort with technology (Slagter van Tyron & Bishop, 2006). As such, I deduced that facilitation, which is hypothesized to be strongly correlated with teaching presence, and comfort, which is developed through actions of the course facilitator, will exhibit a strong correlation to cognitive presence; therefore:

$H3_e$: Data for *comfort* and *facilitation* from the OSCS will demonstrate a *strong positive correlation* with data for *cognitive presence* from the COI.

Cognitive presence has not been directly correlated with connectedness in the literature; rather it has been tied to the ability to construct and confirm meaning in higher education settings. Of the three elements in the COI framework, cognitive presence is reportedly the most difficult to measure (Garrison & Arbaugh, 2007).). Rovai (2002a) links sense of community to discovering meaning though learning, and Bolliger and Inan (2012) propose strong ties between interaction and collaboration and discovering meaning through learning. When putting forth the assertions of linkages between community, learning, and interaction and collaboration, positive relationships were discovered (Bolliger & Inan, 2012; Rovai, 2002a). For these reasons, I have deduced that there is a relationship between these three factors. However, because the literature has not yet established a direct linkage between cognitive presence, sense of community, and interaction and collaboration in online educational setting, it is hypothesized that:

> $H3_f$: Data for *community* and *interaction and collaboration* from the OSCS will demonstrate a *weak positive correlation* with data for *cognitive presence* from the COI.

Linking data from the OSCS to data from validated constructs in the field serves to establish the nomological network and provides further validation of construct validity (Cronbach and Meehl, 1955). In addition to proposing theoretical linkages, this research will also help to operationalize the theoretical concepts by showing empirical support. Cronbach and Meehl (1955) posited that the establishment of this chain of inference is critical to psychometric measurement.

Summary

This chapter reviewed the literature related to online student connectedness and established relationships between this phenomenon and related constructs in the field of distance learning. The need for additional statistical analysis of the OSCS was put forth. Finally, student connectedness theories were discussed, and support for the study's hypotheses and research model was put forth. The next chapter describes the methodology that was used to conduct research for the proposed model and hypotheses.

CHAPTER 3

METHODOLOGY

This section describes the methodology that was used to conduct this two-part study. Study 1 is described in detail first, followed by information related to Study 2.

Study 1

Research Design

Study 1 utilized a quantitative, cross-sectional, correlational research design to examine factorial validity of Online Student Connectedness Survey (OSCS) data. Survey methodology was used to gather information. Data were analyzed using sequential exploratory-confirmatory procedures to examine, refine, and confirm the factor structure of the instrument's subscales (Durvasula, Netemeyer, Andrews, & Lysonski, 2006; Worthington and Whittaker, 2006). Hypotheses were tested by examining pattern coefficients, structure coefficients, tests of discriminant validity, average variance extracted (AVE), composite reliability (CR), and fit indices.

Population

This study sought to examine the psychometric properties of data from the OSCS, which purports to measure feelings of connection between students participating in online courses in higher education. As such, the target population for this study included students enrolled in online courses at 4-year, public higher education institutions located in the United States. The Babson Institute reports that there are 7.1 million people in this population (Allen & Seaman, 2014). Of this number, about 4% complete their entire program online.

Within the population of students enrolled in online courses, women outrank men by a ratio of 1.4:1 (Hausmann, Tyson, & Zahidi, 2011). According to the NCES (2012), 4.3 million students who are enrolled in online classes in the United States are classified as undergraduates. Of the number, 21.7% are White; 20.2% are Black; 16.4% are Hispanic; 18.2% are Asian; 17.7% are Native American/Hawaiian/Pacific Islander; and 5.8% are categorized as Other. The average age for an online student is 34, and 81% are employed.

Sample Size

Larger sample sizes are preferred in exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) studies because they tend to minimize the probability of errors and increase the generalizability of the results (Osborne & Costello, 2004). Published sample size guidelines for instrument validity studies involving EFA and CFA include subject-to-item ratios ranging from 3:1 (Cattell, 1966) to 20:1 (Hair, Anderson, Tatham, & Black, 1995). Gorsuch (1983) and Hatcher (1994) recommend a minimum subject-to-item ratio of at least 5:1 in EFA. Broad consensus is that there should be at least 10 cases for each item in the instrument being tested for CFA studies (Garson, 2008; Everitt, 1975; Nunnally, 1978). Based on these guidelines, the minimum sample size needed to conduct Study 1 was 375 responses. Although the literature supports a sample size of 375 participants to perform a sequential EFA-CFA study based on the number of OSCS items, a larger sample size was collected (n = 477) to mitigate potential issues with CFA fit indices known to be sensitive to sample size (Kenny & McCoach, 2003).

Participants

Participants for Study 1 were limited to students currently enrolled in at least one online course. To further narrow the sample, participants were enrolled in an institution in the United States to reduce errors related to cultural differences (Poortinga & Van De Vijver, 1987). Participants were recruited from universities that offered the traditional semester format, which is defined as a semester that usually lasts 14–20 weeks; trimester terms, which last 8–12 weeks; and quarter or quadmester courses, which last 4–12 weeks (NCES, 2012). Finally, the final sample included both undergraduate and graduate level students (i.e., they were not limited by classification). Including participants enrolled in multiple semester formats and of different classifications helps increase generalizability of the results.

Data Collection

Two Institutional Review Board (IRB) approvals were required for this study because the faculty researcher changed following the completion of Study 1. The first IRB was approved through the University of North Texas (UNT) in June 2014. The second was approved in February 2015. Copies of both IRB approvals are contained in Appendix A. Data for this study were collected using the Qualtrics research panel firm. A research panel firm pre-recruits and pools together individuals who are representative of a particular population and have agreed to take part in the survey for incentives (Rao, Kaminska, & McCutcheon, 2010). Pollard (2002) noted the following benefits for using research panels: 1) response rates among panel participants are higher than response rates using traditional probability sampling methods; 2) customized samples can be easily constructed from data on hand; and 3) samples can be made demographically representative on multiple variables from data on hand. In order to gather respondents, Qualtrics was given information regarding the target sample criteria, the sample size, the length of the survey, and the survey questions. In addition, Qualtrics was also provided with this information for pre-screening of participants. The research panel firm recruited, pre-screened, and selected survey participants that met the specified criteria.

Baruch and Holtom (2008) concluded that involvement and pre-notification to participants are the most effective ways to increase response rates for online surveys. As such, Qualtrics sent a pre-notification email to each participant 1 week prior to the actual survey being distributed to explain the purpose of the study and logistical details. Even though the research panel sent the email, it is important to note that the researcher created the content. A copy of the pre-notification email is contained in Appendix B. A link to the actual survey was sent on a Monday between 12:00 p.m. and 1:30 p.m. in the respondent's local time zone because research suggests that people are more apt to read email during this timeframe and response rates are 10%–20% higher for surveys administered on this day and time of the week (McCormick & Zheng, 2013). Participants who were currently enrolled in more than one online course were directed to focus on a single course of their choice when responding to the survey. The survey remained open for 2 weeks to achieve the number of respondents needed for Study 1.

Instrumentation

The OSCS is a 25-item scale purported to measure feelings of connectedness for students enrolled in online degree or certification programs (Bolliger & Ian, 2012). The self-report instrument consists of four subscales that measure comfort, community, facilitation, and interaction and collaboration. The OSCS contains statements such as *I feel comfortable in the online learning environment provided by my program*; *I have gotten to know some of the faculty members and classmates well*; *my online instructors are responsive to my questions*; and *I work with others in my online course*. Items are rated using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Data for reliability from the instrument was reported as $\alpha = .98$ during initial validation by its creators (Bolliger & Inan, 2012).

Survey Design

A potential concern of the sample for this study was nonresponse bias. Nonresponse bias occurs when "respondents to a survey are different from those who did not respond in terms of demographic or attitudinal variables" (Sax, Gilmartin, & Bryant, 2003, p. 411). This type of bias can affect the validity and generalization of the results because the sample obtained might not be representative of the population and responses from those who elected to participate may be homogenous. Research suggests that the decision to refrain from survey participation is related to concerns about confidentiality of the responses and the length of the survey (Eveslage, Wilson, & Dye, 2007; Kizilcec, 2014; O'Neill, Wright, & Palmer, 2003; Sax, Gilmartin, & Bryant, 2003). Managing survey design has been cited as an effective method to counter nonresponse bias (Arbaugh & Benbunan-Fich, 2007; Lai, 2008). As such, measures were taken to control for nonresponse bias as part of survey design.

The survey for Study 1 contained 30 items organized into four blocks. Blocks are sets of questions used to organize longer surveys (www.qualtrics.com). Block 1 included three screening questions to ensure that respondents met the target criteria; block 2 was informed consent; block 3 included the 25 OSCS items; and block 4 contained five demographic items.

Block 1 was used to determine if participants fit the criteria for the study, and it was designed to control for nonresponse bias and a homogenous sample. Block 1 included four questions: 1) Are you currently enrolled in at least one online course that is completely asynchronous? 2) Is the course in which you are enrolled located at a four-year college/university in the United States? 3) How strongly do you agree with the following statement: "I enjoy taking courses that are completely asynchronous"? If respondents answered no to questions 1 or 2, they were redirected to the end of the survey and thanked for their participation. Question 3 was formatted using a 5-point Likert scale and was designed to ensure a balanced sample and combat nonresponse bias. Based on best practices suggested by the Qualtrics research panel, a target of no less than 10% but no greater than 30% was suggested for each point on the Likert scale to ensure balance. Of the usable responses, 28% strongly agreed with the statement; 22% agreed; 14% were neutral; 20% disagreed; and 16% strongly disagreed. This breakdown provides evidence that the sample was not homogenous and personal feelings about participating in online courses varied evenly.

Block 2, informed consent, included information about the study, the researcher, and confidentiality of the data. Participants were asked to provide electronic consent by selecting "agree" or "disagree" prior to the survey questions being revealed. If a participant selected "agree," the first question of the survey was revealed. If a participant selected "disagree," the final page of the survey containing the "thank you" message was revealed, the participant was exited from the survey, and the response was not considered usable. Block 3 contained the 25 items from the OSCS. Questions were numbered and sectioned by factor. To decrease the amount of scrolling, page breaks were inserted to separate the questions representing each factor. Further, factors were randomized to decrease common method bias. Podsakoff, MacKenzie, and Lee (2003) attribute common method bias to several reasons, one of which is consistency motif, the desire for respondents to appear consistent to their responses to survey items. When consistency motif occurs, respondents unintentionally produce relationships in data that might not truly exist, thus skewing the results (Johns, 1994; Podsakoff, MacKenzie, & Lee, 2003;

Schmitt, 1994). One method recommended to minimize common method bias is to counter-balance question order (Podsakoff, MacKenzie, & Lee, 2003). To implement this recommendation, the survey design included a random order by section feature, which is a standard feature in the Qualtrics survey software. Block 4 contained five questions developed by the researcher to collect demographic data from participants. Items appeared at the end of the survey and were adapted from U.S. Census Bureau guidelines for collecting data on race, gender, education, and age (Romano &Chen, 2000). Placing demographic data at the end of the survey aligns with APA recommendations on survey design. The *Next* button and the *Percent Complete* bar were presented on the bottom of each survey page (Romano & Chen, 2011). No *Back* button was provided to limit the ability of respondents to return to previously answered items and change responses because of the consistency motif. The Study 1 survey included five pages. A copy of this survey is contained in Appendix C.

Data Analysis

The SPSS random selection feature was used to split the sample. EFA was conducted using 1/3 of the responses (n_1 = 159), with the remaining 2/3 responses (n_2 = 318) saved for CFA analysis. Coefficient alphas were then computed for data from each subscale and the full scale. SPSS statistical software was used to perform the EFA, and SPSS AMOS was used to perform the CFA.

Factor Retention and Interpretation

Henson and Roberts (2006) discussed the importance of the ability of factor analysis studies to be independently evaluated by external researchers. For this reason, this study includes all data related to extraction and retention. The OSCS is purported to contain four factors (Bolliger & Inan, 2012, Ford & Inan, 2013; Ozturk & Ozcinar, 2013). Therefore, based on prior theory, a four-factor solution was forced for EFA. Principal factor analysis (PFA) with oblique rotation was employed because it focuses on the common variance among the items, and it was assumed that the factors would be correlated (Henson & Roberts, 2006). This method of factor analysis is consistent with the literature on EFA, factor extraction, and rotation methods (Brown, 2009; Conway & Huffcutt, 2003; Fabrigar, Wegener, MacCallum, & Strahan, 1999; Gorsuch, 1983).

For item retention, pattern coefficients, structure coefficients, and communalities were examined. EFA was run until all pattern/structure coefficients and item communalities fell within acceptable parameters. Pattern and structure coefficients above .50 were considered acceptable, and those items with values below .50 were deleted (Ford, MacCallum, & Tait, 1986; Henson & Roberts, 2006). Additionally, items that did not load on the correct factor were deleted. Data were examined for factor multicollinearity, and items that cross-loaded at .32 or above on two or more factors were also deleted (Costello & Osborne, 2005; Field, 2005). Factors were retained only if they contained at least three items. Prior research states that factors with less than three items are considered weak and unstable and may be deleted from an instrument during EFA (Tabachnick & Fidell, 1996).

Communalities express the total amount of variance a measured variable has in common with the construct upon which it loads (Paswan, 2009). Item communalities above .50 are most common in social science research (Costello & Osborne, 2005). Therefore, items with communalities above .50 were considered acceptable evidence to support retention of the item for each factor.

Data Screening

Once EFA was complete, data for the remaining items were screened to determine if it was suitable for additional analysis. The Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity were used for data screening. Both the KMO index and Bartlett's test of sphericity indicate suitability of data for structure detection. KMO values between .50 and 1 indicate that factor analysis is appropriate for data interpretation, while values below .50 indicate that data are not suitable for a factor analysis study (Kaiser, 1974). Values between .50 and .70 are mediocre; values between .70 and .80 are good; values higher than .80 and less than .90 are most preferable and considered great; and values above .90 are considered superb (Hutcheson & Sofroniou, 1999; Norušis, 2006). Bartlett's test of sphericity examines correlation between items. Statistical significance ($p < .05$) indicates that the data are suited for factor analysis (Field, 2005).

Earlier in this section, methods to control for common method bias were discussed as it related to the design of the survey. To statistically test for common method bias, the common latent factor method was used. This approach involves adding a first-order latent method factor to the AMOS model and connecting it to all observed items in the model. Comparison between standardized regression weights from the original model and the common latent factor model should yield differences less than .20. Podsakoff, MacKenzie, and Lee (2003) recommend this method in cases where a researcher cannot identify the main source of potential method bias.

Confirmatory Factor Analysis

Once the factor structure was established and data screening complete, CFA was conducted on data from the refined version of the OSCS to confirm the results and analyze goodness of fit. Numerous fit indices are available for data analysis. This study used fit indices and acceptable thresholds established in Byrne (2010); Hooper, Coughlan, and Mullen (2008); and Kline (2005). These indices and thresholds include CMIN/degrees of freedom (CMIN/*df*), comparative fit index (CFI), root means square of approximation (RMSEA), the Tucker-Lewis index (TLI), and the standardized root mean square residual (SRMR). CMIN represents the minimum value of the discrepancy between the model and the data. CMIN/*df* is the chi-square divided by the *df* value and should be less than 3.0 (Kline, 2005). CFI compares the sample covariance matrix with the null model. Values for this statistic should range between 0 and 1 with values greater than or equal to .95 indicating good fit (Hooper, Coughlan, & Mullen, 2008). RMSEA tells how well the model would fit the population's covariance matrix (Byrne, 1998). Acceptable values for this statistic should be greater than .50 but less than .08 (Byrne, 2010). TLI is designed to resolve some of the issues of negative bias. Values greater than or equal to .95 are considered acceptable (Hooper, Coughlan, and Mullen, 2008). SRMR is the square root of the discrepancy between the observed correlation and the predicted correlation (Hu & Bentler, 1999). Values range from 0 to 1, with a value of .08 or less indicating good model fit (Byrne, 2010). In addition to fit indices, factor loadings for each item were examined. Factor loadings above .70 were considered acceptable for establishing model fit (Hair et al., 2010). Table 3.1 details acceptance thresholds for each of the fit indices that were used in this study.

Table 3.1

Fit Indices and Acceptable Thresholds

Goodness of Fit Measure	Recommended Value	References
CMIN/*df*	< 3.0	Kline, 2005
CFI	≥ .95	Hooper, Coughlan, and Mullen, 2008
RMSEA	< .08	Byrne, 2010; Kline, 2005
TLI	≥ .90	Byrne, 2010; Hooper, Coughlan, and Mullen, 2008
SRMR	< .08	Byrne, 2010

Note. CMIN/*df* = chi-squared divided by degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual.

Once model fit was established, convergent validity and discriminant validity for OSCS data were examined. AVE and composite reliability (CR) provided evidence of convergent validity. AVE measures the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error (Fornell & Larcker, 1981). AVE is computed as the sum of the squared factor loadings divided by the number of items as shown in the following formula (Paswan, 2009).

$$AVE = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$$

Composite reliability is based on proportions of variance and takes into account the individual contribution of each latent factor to each item and its item's error (Starkweather, 2012). It is considered to provide a less biased estimate of reliability than alpha (Raykov, 1997). Composite reliability is calculated as the sum of standardized loadings squared divided by the sum of standardized loading squared plus the sum of indicator measurement error as shown in the following formula (Raykov, 1997).

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum VAR(\varepsilon_i)}$$

AVE and CR combined were used to assess convergent validity. AVE of .50 or higher (Paswan, 2009) and CR of .70 or higher are the recommended thresholds to indicate adequate evidence of convergent validity (Hair et al., 2010). Paswan (2009) posits that CR of .60–.70 is acceptable.

Discriminant validity measures the extent to which a factor is distinct from other factors (Paswan, 2009). To calculate discriminant validity, squared interconstruct correlation (SIC) estimates were calculated for each factor and compared to that factor's AVE estimate. SIC was calculated by squaring the standardized covariance estimates calculated by AMOS. Discriminant validity is achieved when AVE estimates for a factor are larger than the SIC associated with a factor. Therefore, AVE > SIC provided evidence of discriminant validity for each OSCS factor.

The final step in Study 1 was to examine reliability for OSCS data. SPSS and AMOS were used to calculate data needed to support the final step. Reliability coefficients were calculated for each factor of the OSCS and the full set of refined items. Reliability coefficients of .80 or higher were considered acceptable evidence of reliability (Henson, 2001; Nunnally, 1978; Paswan, 2009).

Study 2

Research Design

Study 2 utilized a quantitative, cross-sectional, correlational research design to confirm factorial validity of data from the refined OSCS instrument and examine nomological validity between data from the refined OSCS, the CCS, and the COI. Here again, survey methodology was used to gather information. Correlation analysis was used to assess the strength of the relationships for observed scale scores between factors from the OSCS and factors from the identified related constructs (COI & CCS) in determining nomological validity. Demographic data was collected for generalizability purposes.

Population

As in Study 1, the population for this study consisted of students enrolled in at least one course at a higher education institution located in the United States. More than 7.1 million students exist in this population according to data gathered by the NCES in 2012.

Sample Size

The purpose of Study 2 was to confirm reliability of the refined set of items and determine if a nomological network exists between the OSCS, the CCS, and the COI scales. Because Study 2 involved the use of CFA techniques to establish convergent and divergent validity for hypothesized relationships between constructs, a minimum 10:1 ratio of responses was needed (Garson, 2008; Everitt, 1975; Nunnally, 1978). Prior evidence of factorial validity exists for data from the COI and the CCS (Arbaugh et al., 2008; Bangert, 2009; Rovai, 2002b). Therefore, sample size for the 10:1 ratio was based on the OSCS items only. As in Study 1, additional responses were collected to mitigate for CFA fit indices that are sensitive to sample size (Kenny & McCoach, 2003). In total, 263 responses were collected.

Participants

Participants for Study 2 were again limited to students currently enrolled in at least one online course. Here again, participants were recruited from universities that offered the traditional semester formats, trimester terms, and quarter or quadmester courses. Participants were classified as both graduate and undergraduate students.

Data Collection

An independent sample was needed for Study 2. The research panel was advised to recruit different participants than the ones used in Study 1. As in Study 1, a pre-notification email was sent to participants 1 week prior to distributing the survey (see Appendix B, Email 2). Here again, the research panel administered the email, but the content was created by the researcher. A link to the survey itself was emailed on a Monday between 12:00 p.m. and 1:30

p.m. It is important to note that data for Study 2 was collected once Study 1 was complete. This delay was critical because the items used from the OSCS in Study 2 were dependent upon the outcome of the EFA-CFA analysis performed in Study 1. The research panel was responsible for sending the survey link to participants, screening and identifying appropriate respondents, and collecting responses.

Instrumentation

Three instruments were utilized in this study: the revised OSCS from Study 1, the CCS, and the COI. Data collected from the instruments were screened for suitability, and reliability was calculated on all scales. Both convergent validity and discriminant validity were assessed by comparing data from the subscales of the revised OSCS with data from subscales of both the CCS and COI. The OSCS was described in Study 1, thus the information will not be repeated in this section.

The Classroom Community Scale (CCS)

The CCS is a 20-item self-report scale that measures sense of community in a learning environment. The self-report instrument contains two subscales, connectedness and learning, and contains statements such as *I feel that students in this course care about each other* and *I feel that this course results in only modest learning.* Each subscale contains 10 items and is responded to using a 5-point Likert scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). Of the 20 items, 10 are negatively worded and will be reverse-scored during data analysis. Reverse scoring ensures that all of the items are consistent with each other, in terms of what an “agree” or “disagree” implies and is common in data analysis (Pintrich, Smith, Garcia,

& Mckeachie, 1991). A factor analysis study provided evidence of construct validity, where most factor loadings were high (i.e., > .60) (Rovai, 2002b). Cronbach's (1951) coefficient alpha for the CCS was .93. Additionally, the internal consistency estimates for the connectedness and learning subscales were reported as .92 and .87 respectively (Rovai, 2002b).

The Community of Inquiry Scale (COI)

The COI is a 34-item self-report instrument that measures the dimensions of social presence, cognitive presence, and teaching presence in learning environments (Arbaugh et al., 2008). The scale was created to operationalize Garrison, Anderson, and Archer's Community of Inquiry framework (2000) and contains items such as *the instructor clearly communicated course goals; I was able to form distinct impressions of some course participants;* and c*ombining new information helped me answer questions raised in course activities*. Originally, EFA results for the COI yielded a four-factor structure (Arbaugh & Benbunan-Fich, 2007), but subsequent studies have confirmed it as having only three factors (Arbaugh et al., 2008; Bangert, 2009). The three subscales (social presence, cognitive presence, and teaching presence) include 9, 11, and 13 items respectively. Responses are reported on a 5-point Likert scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Literature supports that data from the instrument are valid, reliable, and efficient to measure the dimensions of social presence and cognitive presence, with all factors having reliability alphas of .87 or higher (Arbaugh et al., 2008). Bangert (2009) reported specific reliabilities for each subscale as follows: cognitive presence (α = .95), teaching presence (α = .96), and social presence (α = .91).

Survey Design

Survey nonresponse and nonresponse bias have become an increasing problem for researchers in the United States and internationally, with survey fatigue being cited as one of the main decline reasons (Baruch, 1999; Porter, Whitcomb, & Weitzer, 2004). Survey fatigue is a well-documented phenomenon and has been described as occurring when:

> survey participants become tired of the survey task and the quality of the data they provide begins to deteriorate. It occurs when survey participants' attention and motivation drop toward later sections of a questionnaire. Tired or bored respondents may more often answer "don't know," engage in "straight-line" responding (i.e., choosing answers down the same column on a page), give more perfunctory answers, or give up answering the questionnaire altogether (Ben-Nun, 2008)

Time and length have been cited as the biggest contributors to survey fatigue and nonresponse bias (Dillman, 2000; Porter & Whitcomb, 2003). The likelihood of survey fatigue and non-response increases by almost 50% once the time to complete a survey reaches the 15-minute mark (Cape, 2010). Fatigue has been tied to the inaccuracy of responses, especially in questions located toward the latter portion of longer surveys (Apodaca, Lea, & Edwards, 1998; Cape, 2010). Additionally, survey fatigue can increase measurement error, which can lead to inaccurate answers (Dillman, Tortora, & Bowker, 1998).

Because Study 2 includes items from three instruments, it could take more than 15 minutes to complete, which could lead to survey fatigue. To minimize the effects of survey fatigue and increase response rates, certain measures were implemented in the design of the survey. First, the UNT banner appeared on each page of the survey because the inclusion of a credible source may increase response rates (Cho & LaRose, 1999). Next, the four-block format from Study 1 was reused for this study. Block 1 included the same three screening questions as Study 1 to ensure that respondents met the target criteria and would not include a homogeneous sample; block 2 was informed consent; block 3 contained items from the refined OSCS, the CCS and the COI; and block 4 contained the five demographic items. To control for the consistency motif, factors in block 2 were randomized using the Standard feature in Qualtrics. Minimizing the number of pages has also been purported to reduce survey fatigue and increase response rates (Dillman, 2000). For this reason, the matrix table style was used, and questions for each scale were grouped by factor, which resulted in a total of 5 pages for the survey.

Based on best practices suggested by the research panel firm, one attention filter was added to the survey. Attention filters are straightforward questions that help screen out respondents who are moving through the survey without reading carefully. The following item was inserted into the survey at the halfway mark: *The purpose of this survey is to collect valid information. If you are reading carefully, please select agree.* Responses from participants who failed to follow this command were not considered valid and were not included in the results.

Additional measures taken to reduce the effects of survey fatigue and common method bias in the design of the survey included presenting the *Next* button and the *Percent Complete* bar on the bottom of each screen (Romano & Chen, 2011). No *Back* button was provided to limit the ability of respondents to return to previously answered items and change responses because of the consistency motif.

Data Analysis

To begin, CFA was conducted to confirm the factor structure from Study 1. Study 2 also used fit indices and acceptable thresholds established in Byrne (2010); Hooper, Coughlan, and Mullen (2008); and Kline (2005) to establish model fit. These indices included CMIN/*df*, CFI, RMSEA, TLI, and SRMR. Table 3.1 included earlier in this manuscript details acceptable thresholds for each of the fit indices that were used in this study.

Once model fit was established, convergent validity and discriminant validity for OSCS data were examined. Composite reliability and AVE provided evidence of convergent validity. Shared variances between factors that were lower than the AVE of individual covariance between factors indicated evidence of discriminant validity. Alpha coefficients were calculated for each scale to test for acceptable levels of reliability. Alpha coefficients of .80 or higher were considered acceptable evidence of reliability (Henson, 2001; Nunnally, 1978; Paswan, 2009).

Once the factor structure was confirmed, correlation coefficients between each of the subscales were calculated and compared to examine the hypothesized nomological network. The nomological network examines the extent to which a scale correlates in theoretically predicted ways with other distinct but related constructs (Cronbach & Meehl, 1955). Strong correlation was indicated by $.50 < | r |$; moderate correlation was indicated by $.30 < | r | < .50$; and weak correlation was indicated by $.10 < | r | < .30$ (Ward, Fischer, Lam, & Hall, 2009). These thresholds were used to determine constructs that contributed to the nomological network of the OSCS.

Summary

This chapter discussed the methodology used to collect and analyze data for both studies contained in this research. First, the population, sample, and data collection methods were defined. Second, the instruments used in this research were described. Finally, statistical analysis information for data interpretation was outlined. Chapter 4 provides results from the data collected for both studies.

CHAPTER 4

RESULTS

The purpose of this study was to examine data from the Online Student Connectedness Survey (OSCS) for validity and reliability and to establish a nomological network. The study was broken into two parts. Study 1utilized sequential EFA-CFA analysis. EFA was used to establish the factor structure, and CFA was used to replicate and test the modified structure. Once the structure was confirmed, CFA was run another time, using an independent sample to examine stability of the modified structure and to establish a nomological network between the OSCS and two similar, widely utilized instruments related to the study of online student connectedness. This chapter is organized into two main sections. Section 1 discusses results of the sequential EFA-CFA analysis conducted in Study 1. Section 2 shares results of CFA analysis run on an independent sample and tests of the nomological structure conducted in Study 2.

Study 1

Data Collection and Participants

A total of 1,176 surveys were sent, and 1,137 were attempted. Of the 1,137 attempted, 3% ($n = 35$) were abandoned before completion. Those participants who did not meet the criteria of current enrollment in at least one online course were excluded ($n = 418$) along with those who took less than one minute to complete the survey ($n = 207$). The one-minute exclusion was based on best practices for data collection established by the research panel. After these exclusions, 477 usable responses remained, representing a 40.56% response rate. Of those, 35.2% were male; 88.8% were undergraduates; and 11.2% were at the graduate level. The predominant number of participants were between the ages of 25–34 (40.8%), followed by the 18–24 age group (22.4%), the 35–44 age group (21.6%), the 45–54 age group (8%), and the 55 and older age group (7.2%). 52.8% of the sample were employed for wages while attending college. This sample is representative of the current population of students taking online courses in the United States, where women outrank men by approximately 1.4:1, and the predominant age group is between 25–34 (Hausmann, Tyson, & Zahidi, 2011; NCES, 2012). The sample for Study 1 was split (n_1 = 159, n_2 = 318) to accommodate sequential EFA-CFA analysis.

Exploratory Factor Analysis (EFA)

In the initial EFA ($n_1 = 159$), four factors were extracted based on a priori knowledge of the instrument's structure (Bolliger & Inan, 2012). The four factors accounted for 66.81% of the total variance explained. Items 1, 3, and 5 were deleted because they did not load on the correct factor; Items 2, 6, 17, and 21 were deleted because they had coefficients less than .50 (Ford, MacCallum, & Tait, 1986; Henson & Roberts, 2006), and these items had substantial loadings on more than one factor (Matsunaga, 2010). The analysis was rerun on the remaining 18 items. This time, Item 16 was deleted because it did not meet the .50 cutoff, and the remaining 17 items were re-extracted. In this iteration, Item 15 was deleted because it did not meet the .50 cutoff. Omitting these items resulted in 16 remaining items with pattern coefficients above .50, accounting for 77.17% of the total variance extracted. All structure coefficients had factor loadings ranging from .663 to .892, .694 to .912, .675 to .918, and .670 to .905 (Factors 1, 2, 3, and 4 respectively) and minimal cross-loadings. Table 4.1 shows the pattern and structure matrices for the 16 retained items. Communalities above .50 are considered acceptable for EFA studies of this type in social science research (Costello and Osborne, 2005).

Table 4.1

EFA Pattern/Structure Matrix and Reliabilities for Original and Revised OSCS

			Initial Pattern Matrix				Initial Structure Matrix					Revised Pattern Matrix				Revised Structure Matrix			
Scale	Item	Initial Reliabilities	1	2	3	4	1	2	3	4	Revised Reliabilities	1	2	3	4	1	2	3	4
CFT		.829									.836								
	CFT5		.068	.095	-.063	.628	.377	.497	.426	.789		-	-	-	-	-	-	-	-
	CFT1		.018	.093	-.063	.626	.347	.473	.338	.687		-	-	-	-	-	-	-	-
	CFT3		.438	-.057	-.105	.451	.795	.137	.580	.368		-	-	-	-	-	-	-	-
	CFT4		.822	.121	-.107	.027	.788	.256	.499	.443		.663	.034	.043	.095	.743	.269	.528	.442
	CFT8		.734	-.039	.120	-.022	.758	.131	.540	.377		.767	-.032	.074	-.019	.799	.162	.561	.345
	CFT7		.696	-.060	.084	.037	.705	.143	.591	.528		.892	-.037	-.047	-.013	.846	.247	.522	.359
	CFT2		.437	-.253	.213	.366	.574	.267	.392	.573		-	-	-	-	-	-	-	-
	CFT6		.374	-.014	.137	.134	.526	.195	.447	.375		-	-	-	-	-	-	-	-
COM		.915									.924								
	COM11		-.079	.806	-.035	.123	.115	.854	.290	.568		.003	.912	-.111	-.003	.217	.831	.275	.478
	COM12		-.097	.802	.099	.074	.214	.841	.350	.542		-.034	.859	.048	-.009	.072	.839	.241	.487
	COM14		.061	.832	-.016	.004	.160	.867	.384	.576		-.002	.829	.034	-.002	.174	.925	.356	.629
	COM10		-.113	.766	.065	.074	.115	.815	.326	.528		-.071	.827	.021	.005	.244	.844	.418	.509
	COM9		.054	.698	-.132	.166	.183	.761	.260	.559		.031	.747	-.068	.050	.214	.857	.329	.602
	COM13		.118	.755	.057	-.045	.280	.771	.405	.508		.040	.694	.107	.030	.228	.764	.482	.520
FAC		.816									.862								
	FAC17		-.125	.031	.468	.475	.361	.499	.460	.654		-	-	-	-	-	-	-	-
	FAC20		-.045	-.040	.875	.019	.536	.303	.839	.416		-.080	-.062	.787	.178	.507	.322	.737	.399
	FAC18		.220	.118	.770	-.271	.623	.292	.824	.299		.005	-.008	.918	-.045	.587	.293	.824	.303
	FAC16		-.061	-.084	.632	.271	.634	.305	.742	.302		-	-	-	-	-	-	-	-
	FAC19		.343	.179	.582	-.269	.472	.319	.697	.511		.208	.091	.675	-.116	.620	.305	.792	.300
	FAC15		.049	-.058	.518	.239	.496	.302	.650	.490		-	-	-	-	-	-	-	-
INT		.909									.923								
	INT24		.014	.149	-.052	.851	.417	.659	.446	.923		.004	.100	-.049	.905	.417	.691	.336	.955
	INT23		.052	.068	-.062	.839	.427	.575	.424	.875		.018	.021	-.023	.876	.416	.606	.332	.890
	INT25		-.032	.001	.053	.777	.443	.612	.466	.789		-.054	-.052	.087	.824	.375	.521	.348	.797
	INT22		.109	.217	.006	.600	.420	.484	.639	.672		.097	.155	.007	.670	.450	.631	.383	.823
	INT21		-.012	.130	.167	.494	.296	.461	.303	.661		-	-	-	-	-	-	-	-

Note. CFT = comfort; COM = community; FAC = facilitation; INT = interaction and collaboration.

All communalities for the retained items of the OSCS were acceptable and fell between .566 and .918. The full set of communalities is reported in Table 4.2.

Table 4.2

EFA Communalities

Item	Initial	Extraction
CFT4	.550	.566
CFT7	.613	.720
CFT8	.594	.643
COM9	.635	.586
COM10	.685	.679
COM11	.730	.768
COM12	.718	.745
COM13	.634	.600
COM14	.700	.706
FAC18	.665	.814
FAC19	.611	.663
FAC20	.569	.623
INTC22	.722	.696
INT23	.798	.792
INT24	.859	.918
INT25	.640	.640

Note. CFT = comfort; COM = community; FAC = facilitation; INT = interaction and collaboration.

Data Screening

KMO, Bartlett's test of sphericity, and coefficient alphas were used to screen data for suitability before moving forward with CFA. KMO (.892) and Bartlett's test of sphericity (X^2 = 1906, df = 120, p < .001) indicated that the data were appropriately multivariate normal and suitable for factor analysis.

Alpha reliability was computed at .906 overall for all retained OSCS items. Score reliabilities for items composing each factor were .836, .924, .862, and .923, for factors 1 to 4 respectively. Coefficient alphas of the total scale and subscales demonstrated acceptable reliability (Nunnally, 1978; Tait, Chibnall, & Krause, 1990). Overall, data were considered suitable for further analysis, and CFA was performed.

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis using SPSS AMOS 20 was conducted to analyze model fit on the refined version of the OSCS. Factor loadings and five common model-fit measures were used to assess the model's overall goodness of fit: CMIN to degrees of freedom (CMIN/*df*), comparative fit index (CFI), root mean square error of approximation (RMSEA), the Tucker-Lewis index (TLI), and standardized root mean square residual (SRMR). Additionally, average variance extracted (AVE) and construct reliability (CR) were used to examine convergent validity. Divergent validity was calculated and examined using AVE and SIC values.

Table 4.3

CFA Factor Loadings for Measurement Model

Item	Estimate
CFT4	.710
CFT7	.835
CFT8	.810
COM9	.781
COM10	.853
COM11	.852
COM12	.831
COM13	.717
COM14	.723
FAC18	.732
FAC19	.732
FAC20	.766
INT22	.751
INT23	.911
INT24	.890
INT25	.776

Note. CFT = comfort; COM = community; FAC = facilitation; INT = interaction and collaboration.

Hypothesis $H1_a$ predicted that pattern coefficient values for data from each of the four subscales would be > .70 (Hair et al., 2010). This hypothesis was supported as all factor loadings were above .70. Table 4.3 shows factor loadings for each item in the revised scale.

Hypothesis $H1_b$ predicted that reliability coefficient values for data from the overall instrument and data from each subscale would be .80 or higher (Nunnally, 1978; Henson, 2001). This hypothesis was also supported as alpha coefficients were calculated at .907 for the full scale and .829, .915, .816, and .909 for subscales 1, 2, 3, and 4 respectively.

Finally, hypothesis $H1_c$ predicted that factor structure scores for OSCS data would yield good fit indices (CMIN/*df* > .30, TLI > .95, CFI > .95, RMSEA < .70, SRMR < .08) (Byrne, 2010; Hooper, Coughlan, & Mullen, 2008; Kline, 2005) and all fit indices would meet their recommended acceptance thresholds (Byrne, 2010; Hooper, Coughlan, & Mullen, 2008; Kline, 2005). This hypothesis was supported as all fit indices met acceptable thresholds. Model fit indices are shown in Table 4.4.

Table 4.4

CFA Fit Indices for Measurement Model

Goodness of Fit Measure	Recommended Value	Default Model
CMIN/*df*	> 3.0	2.414
CFI	≥ .95	.955
RMSEA*	≤ .08	.067
TLI	≥ .95	.945
SRMR	≥ .08	.048

Note. CMIN/df = chi-squared divided by degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual. *RMSEA Confidence Interval = 90%.

The range of composite reliability (CR: .62-.86) and average variance extracted (AVE: .55-.70) provided evidence of adequate convergent validity. Shared variances between factors were lower than the associated squared interconstruct correlation (SIC) of individual factors, thus providing evidence of discriminant validity. Table 4.5 shows AVE and discriminant validity values.

Table 4.5

AVE and Discriminant Validity

	1	2	3	4
1. Comfort	.619	—		
2. Community	.006	.631	—	
3. Facilitation	.690	.031	.552	—
4. Interaction and Collaboration	.190	.229	.066	.697

Note. Diagonal elements are the AVE. Off diagonal elements are the SIC values.

Because the data for this study came from self-report instruments, it was tested for common method bias through the common latent variable method (Podsakoff, MacKenzie, & Lee, 2003). If, when adding a common variable to all of the items in the model, the difference between the factor scores with the variable present and factor scores without the variable present does not show a variance greater than 2.0, one can assume that method bias is not a significant problem (Gaskin, 2012). Analysis of this type was run and the varimax rotation failed to converge. These results indicate that common method bias is not a major concern for this study (Siegall & McDonald, 1995).

Overall, the factor structure of the model resulting from EFA was replicated during CFA. This indicated that data from the instrument were stable enough to move forward with Study 2, where CFA on the refined set of OSCS items would be examined using an independent sample and the proposed nomological network would be tested.

Study 2

Data Collection and Participants

A total of 580 surveys were sent and 563 were attempted. Of the 563 attempted, 2.9%

were abandoned before completion. Responses from participants who did not meet the target criteria of online course enrollment in a U.S. college or university and those who did not correctly respond to the attention marker in the survey were excluded from the final tally. After these exclusions, 263 usable responses remained, which represented a 46.71% response rate. Of those, 36.12% were male; 28.1% were undergraduates; and 10.6% were at the graduate level. The majority of participants were between the ages of 25–34 (32.3%), followed by the 35–44 age group (25.09%) and the 18–24 age group (24.71%). The 45–54 age group and the 55 and older age group were tied, representing 8.36% each. 53.6% of the participants in the sample were employed for wages while attending college. Again, demographic data for the sample aligns with data retrieved regarding the current population of students taking online classes at a college or university located in the United States with the number of women outranking men ~1.4:1 and the predominant age group being between 25–34 (NCES, 2012).

Data Screening

Prior to conducting the CFA, data for the revised version of the OSCS were screened for suitability. Because the CCS contains negatively worded items, data for these questions were reverse scored using the Transform→Recode into Same Variable feature in SPSS. Pattern and structure coefficients were examined, and alpha reliabilities for each factor and the total scale were calculated. All pattern/structure coefficients were above .50 and considered acceptable based on prior factor validation studies (Ford, MacCallum, & Tait, 1986; Henson & Roberts, 2006). Based on the screening, data from the revised version of the scale were considered suitable enough to perform the CFA. Table 4.6 shows data screening results.

Table 4.6

Study 2 Data Screening

Scale	Item	Reliability (α)	Pattern Matrix 1	2	3	4	Structure Matrix 1	2	3	4
OSCS		.926								
CFT		.873								
	CFT7		.894	-.022	-.186	.130	.846	.247	.522	.359
	CFT8		.886	.016	-.067	-.037	.840	.162	.561	.345
	CFT4		.783	-.021	.179	-.096	.832	.269	.528	.442
COM		.935								
	COM11		-.046	.959	-.111	-.003	.217	.904	.275	.478
	COM12		-.022	.930	.048	-.009	.072	.899	.241	.487
	COM14		.028	.873	.034	-.002	.174	.893	.356	.629
	COM10		.067	.808	.021	.005	.244	.837	.418	.509
	COM9		.127	.681	-.068	.050	.214	.765	.329	.602
	COM13		-.149	.660	.107	.030	.228	.754	.482	.520
FAC		.746								
	FAC18		-.156	.026	.861	.004	.587	.293	.529	.303
	FAC20		.109	-.164	.530	.323	.507	.322	.593	.399
	FAC19		.186	.203	.509	.043	.620	.305	.500	.300
INT		.915								
	INT24		.094	-.032	-.048	.838	.417	.691	.336	.873
	INT23		.145	-.004	-.040	.801	.416	.606	.332	.862
	INT25		-.019	.044	.093	.795	.375	.521	.348	.839
	INT22		.007	-.015	.057	.790	.450	.631	.383	.838

Note. OSCS = Online Student Connectedness Survey; CFT = comfort; COM = community; FAC = facilitation; INT = interaction and collaboration.

Confirmatory Factor Analysis (CFA)

CFA using SPSS AMOS 20 was conducted to determine if the model from Study 1 could be replicated using an independent sample. Factor loadings and the same five common model-fit measures from Study 1 were used to assess the model's overall goodness of fit: CMIN to degrees of freedom (CMIN/*df*), comparative fit index (CFI), root mean square error of approximation

(RMSEA), the Tucker Lewis index (TLI) and standardized root mean square residual (SRMR). Additionally, average variance extracted (AVE) and construct reliability (CR) were used to examine convergent validity. Divergent validity was calculated and examined using AVE and squared interconstruct correlation (SIC) values.

Two items in factor 3 were below the desired value of .70 (Hair et al., 2010). However, all factor loading values were .60 or greater, indicating that the model had a fair measurement structure (Nimon & Zigarmi, 2014). Table 4.7 details CFA factor loadings for the model.

Table 4.7

Study 2 CFA Factor Loadings for Measurement Model

Item	Estimate
CFT4	.821
CFT7	.854
CFT8	.836
COM9	.840
COM10	.890
COM11	.764
COM12	.887
COM13	.908
COM14	.761
FAC18	.667
FAC19	.699
FAC20	.751
INT22	.839
INT23	.871
INT24	.872
INT25	.833

Note. CFT = comfort; COM = community; FAC = facilitation; INT = interaction and collaboration.

The model demonstrated acceptable fit and all fit indices met their recommended thresholds (CMIN/*df* > .30, TLI > .95, CFI > .95, RMSEA < .70, SRMR < .08) (Byrne, 2010; Hooper, Coughlan, & Mullen, 2008; Kline, 2005). Model fit indices are shown in Table 4.8.

Table 4.8

Study 2 CFA Fit Indices for Measurement Model

Goodness of Fit Measure	Recommended Value	Default Model
CMIN/*df*	> 3.0	2.44
CFI	≥ .95	.954
RMSEA*	≤ .08	.074
TLI	≥ .95	.943
SRMR	≥ .08	.056

Note. CMIN/df = chi-squared divided by degrees of freedom; CFI = comparative fit index; *RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual. *RMSEA = 90% confidence level.

The range of CR (.58–.91) and AVE (.50-.72) provided evidence of adequate convergent validity. Shared variances between factors were lower than the associated SIC of individual factors, again providing evidence of discriminant validity. Table 4.9 shows AVE and discriminant validity values.

Table 4.9

Study 2 AVE and Discriminant Validity

	1	2	3	4
1. Comfort	.700	—		
2. Community	.070	.712	—	
3. Facilitation	.258	.281	.501	—
4. Interaction and Collaboration	.090	.499	.138	.887

Note. Diagonal elements are the AVE. Off diagonal elements are the SIC values.

As in Study 1, data for Study 2 were tested for common method bias through the common latent variable method. Again, the varimax rotation failed to converge, indicating that common method bias is not a major concern for data used in this study (Siegall & McDonald, 1995).

Nomological Network

The final part of this study was concerned with the establishment of a nomological network between factors included in the OSCS, CCS, and COI. The establishment of a nomological network is critical in psychometric studies because it examines linkages between data from new instruments and one established by the literature and empirical studies and provides further evidence of construct validity for newly established instruments (Cronbach & Meehl, 1955). Figure 1.2 located in Chapter 1 represents the research model used to empirically examine these hypotheses.

All analysis related to the examination of the nomological network was conducted using SPSSv.20 and AMOS. To begin, alpha reliabilities and descriptive analyses were conducted to assess the mean and standard deviation for the full scale and subscales in each instrument. Table 4.10 shows these outputs.

Table 4.10

Alpha Coefficients, Means, and Standard Deviations for Subscales of the OSCS, COI, and CCS

Instrument	Scale	No. of Items	Α	*M*	*SD*
OSCS			.926		
	Comfort	3	.873	4.226	.668
	Community	6	.935	3.181	1.036
	Facilitation	3	.746	3.989	.689
	Interaction & Collaboration	4	.915	3.763	.874
COI			.874		
	Social Presence	9	.876	3.878	.635
	Teaching Presence	13	.920	4.020	.588
	Cognitive Presence	12	.922	3.918	.619
CCS			.872		
	Connectedness	10	.832	3.284	.659
	Learning	10	.888	3.055	.735

Note. α = alpha coefficient; M = means; SD = standard deviation; OSCS = Online Student Connectedness Survey; COI = Community of Inquiry Scale; CCS = Classroom Community Scale.

Following the descriptive analysis, correlation coefficients were computed between factors in the hypothesized network to assess the strength of the relationships. Because directional strength was hypothesized, a one-tailed test of significance was calculated. All but two of the correlational coefficient relationships between the OSCS and the CCS (FAC→LRN and INT→LRN) were statistically significant at ($p < .001$). FAC→LRN and INT→LRN were statistically significant at p < .05. Table 4.11 shows correlations between factors in the OSCS (comfort, community, facilitation, interaction and collaboration), the COI (social presence, teaching presence, cognitive presence), and the CCS *(*connectedness, learning).

Twelve hypotheses related to the nomological were put forth as part of this research. To assess the strength of the relationships, strong correlation was indicated by $.50 < | r |$; moderate correlation was indicated by $.30 < | r | < .50$; and weak correlation was indicated by $.10 < | r | < .30$.

Table 4.11

Correlations between Factors in the OSCS, COI, and CCS

	Cognitive Presence	Connectedness	Learning	Teaching Presence	Social Presence
Comfort	.521**	.378**	.426**	.458**	.430**
Community	.502**	.736**	-.124**	.436**	.635**
Facilitation	.611**	.602**	.351	.752**	.653**
Interaction and Collaboration	.544**	.674**	.021	.525**	.727**

Note. **Correlations significant at p < .001; *Correlations significant at p < .005.

Results generally supported the theoretically based predictions and demonstrated that factors established in support of online student connectedness were associated with factors of cognitive presence, connectedness, learning, teaching presence, and social presence. This suggests that online student connectedness as defined by data from the OSCS can be included within the nomological network of the community of inquiry theory and factors related to the classroom community scale. Hypothesis H2 predicted that data from the OSCS would positively correlate to data from the CCS. This hypothesis was partially supported as an examination of data from these two instruments revealed that all correlations between the OSCS and the CCS were positive with the exception of community and learning (*r = -.124*, *p = .001*). Results for the five remaining hypotheses for H2 varied. Hypothesis $H2_a$ predicted a strong positive relationship between comfort from the OSCS and connectedness and learning from the CCS. This prediction was partially supported as comfort demonstrated a moderate positive relationship with both factors (*r = .378, .426* respectively). Hypotheses $H2_b$ predicted that community from the OSCS would demonstrate a strong positive relationship with connectedness and learning from the CCS. Results revealed a strong positive relationship between community and connectedness (*r = .726*), but a weak negative relationship between community and learning (*r = -.124*), meaning that hypothesis $H2_b$ was also partially supported. Hypothesis $H2_c$ predicted a moderate positive relationship between facilitation from the OSCS and connectedness from the CCS and a strong positive relationship between facilitation from the OSC and learning from the CCS. Facilitation demonstrated a strong positive relationship with connectedness (*r = .602*) and a moderate positive relationship with learning (*r = .351*). Overall, this hypothesis was partially supported. The final hypothesis between the OSCS and the CCS predicted that interaction and collaboration would demonstrate a strong positive relationship with both connectedness and learning. This prediction was partially supported. Interaction and collaboration was strongly correlated with connectedness (*r = .674*), but no relationship was shown to learning (*r = .021*). In summary, factors related to connectedness from the CCS generally correlated highly with factors from the OSCS while factors related to learning from the CCS correlated moderately or not at all with factors from the OSCS.

Hypotheses H3 predicted that data from factors of the OSCS would correlate both positively and negatively with data from factors of the COI. This hypothesis was not supported because an examination of the correlation coefficients reveals that all correlations computed for data from these two scales was positive. Hypotheses $H3_a$ predicted a strong positive relationship between comfort from the OSCS and social presence and teaching presence from the COI. This prediction was partially supported as comfort demonstrated a moderate positive relationship with both factors (*r = .458, .430* respectively). Hypothesis $H3_b$ predicted a strong positive relationship between community from the OSCS and social presence from the COI and a moderate positive relationship between community from the OSCS and teaching presence from the COI. This hypothesis was supported (*r = .635, .436* respectively). Hypothesis $H3_c$ predicted a strong positive relationship between facilitation from the OSCS and teaching presence from the COI and a moderate positive relationship between facilitation and social presence. Results partially supported this hypothesis as facilitation and teaching presence demonstrated a strong relationship (*r* = .653), but also a strong positive correlation with social presence (*r* = . 752). Hypothesis $H3_d$ was also partially supported. It was predicted that interaction and collaboration from the OSCS would demonstrate a strong positive relationship with social presence from the COI and only a moderate positive relationship with teaching presence from the COI. Instead, interaction and collaboration demonstrated a strong positive relationship with both social presence (*r = .727*) and teaching presence (*r = .525*).

Of note are the results of hypotheses $H3_e$ and $H3_f$. Cognitive presence was not expected to correlate strongly with factors from the OSCS that are related to student connectedness and interaction based on prior literature (Garrison, Anderson, & Archer, 2000). Overall, it was predicted to exhibit a strong correlation with comfort and facilitation from the OSCS ($H3_e$) and a weak correlation with community and interaction and collaboration ($H3_f$). The predictions for $H3_e$ were supported (*r = .521, .621*) for both factors respectively. However, both community and interaction and collaboration also correlated strongly with cognitive presence (*r = 502, .544)*, meaning that $H3_f$ was partially supported. Details for individual hypotheses related to data from the OSCS, CCS, and the COI; and their correlation outcomes are shown in Table 4.12.

Table 4.12

Results of Hypotheses Predicted for Study 2

Hypothesis	Path Prediction	Strength Prediction	Strength Actual	Direction Prediction	Direction Actual	Hypothesis Supported?
$H2_a$	CFT→CON	Strong	Moderate	Positive	Positive	Partial
	CFT→LRN	Strong	Moderate	Positive	Positive	Partial
$H2_b$	COM→CON	Strong	Strong	Positive	Positive	Yes
	COM→LRN	Strong	Weak	Positive	Negative	No
$H2_c$	FAC→CON	Moderate	Strong	Positive	Positive	Partial
	FAC→ LRN	Strong	Moderate	Positive	Positive	Partial
$H2_d$	INT→CON	Strong	Strong	Positive	Positive	Yes
	INT→LRN	Strong	None	Positive	Positive	No
$H3_a$	CFT→ SP	Strong	Moderate	Positive	Positive	Partial
	CFT→TP	Strong	Moderate	Positive	Positive	Partial
$H3_b$	COM→ SP	Strong	Strong	Positive	Positive	Yes
	COM→TP	Moderate	Moderate	Positive	Positive	Yes
$H3_c$	FAC→SP	Moderate	Strong	Positive	Positive	Partial
	FAC→TP	Strong	Strong	Positive	Positive	Yes
$H3_d$	INT→SP	Moderate	Strong	Positive	Positive	Partial
	INT→TP	Strong	Strong	Positive	Positive	Yes
$H3_e$	CFT→ CP	Strong	Strong	Positive	Positive	Yes
	FAC→ CP	Strong	Strong	Positive	Positive	Yes
$H3_f$	COM→ CP	Weak	Strong	Positive	Positive	Partial
	INT→CP	Weak	Strong	Positive	Positive	Partial

Note. CFT = Comfort from the OSCS; COM = Community from the OSCS; FAC = Facilitation from the OSCS; INT = Interaction and Collaboration from the OSCS; LRN = Learning from the CCS; CON = Connectedness from the CCS; SP = Social Presence from the COI; TP = Teaching Presence from the COI; CP = Cognitive Presence from the COI.

Based on these results, the final nomological network model was altered. Figure 4.1 shows the final directional paths and strengths between factors form the OSCS, COI and CCS.

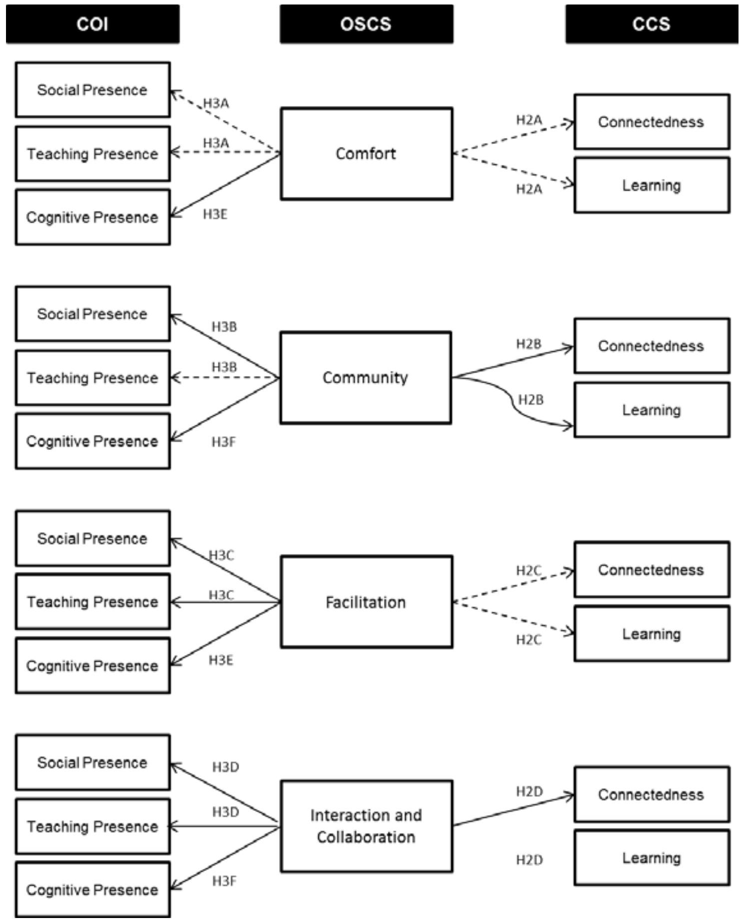

Figure 4.1. Final model for OSCS nomological network.

Key
OSCS: Online Student Connectedness Survey
COI: Community of Inquiry Scale
CCS: Classroom Community Scale

Directional Paths
Strong Correlation: ⟶
Moderate Correlation: - - ->
Weak Correlation: ⤻

Summary

Chapter 4 included the results of this study. Data analysis and evaluation of hypotheses put forth as part of this study were described in detail. Chapter 5 presents a discussion of findings, recommendations for future research, and implications for practice.

CHAPTER 5

FINDINGS, RECOMMENDATIONS, AND IMPLICATIONS

The objective of this chapter is to discuss the findings from the present study and to present recommendations and implications for future research and practice. This chapter is organized into three sections. The first section summarizes and presents a discussion of the findings. The next section discusses limitations and delimitations of this study and provides recommendations for future research. The final section provides implications of this study's findings for theory and practice.

Discussion of Findings

The purpose of this study was to examine validity and reliability of data from the Online Student Connectedness Survey (OSCS) and to establish its nomological network. The study was broken into two parts. Study 1 examined factor validity for data from the OCSC using sequential EFA-CFA. Study 2 sought to replicate the refined version of the OSCS using data from an independent sample and empirically test the proposed nomological network. Three sets of hypotheses guided this study. Findings for each are discussed below.

Factor Validity of the OSCS: Hypotheses $H1_a$, $H1_b$, and $H1_c$

The first set of hypotheses sought to examine the factor structure of the OSCS using sequential EFA-CFA and confirm the findings using an independent sample thorough CFA. Using a split sample ($n_1 = 159; n_2 = 318$), the a priori four-factor structure of the OSCS held during the initial EFA, but nine of the original items were deleted during the analysis because they either loaded on the incorrect factor or they did not meet the required pattern coefficient threshold of .50 or higher (Ford, MacCallum, & Tait, 1986; Henson & Roberts, 2006). This left

16 items in the revised version of the scale for use during the sequential CFA portion of this study. Though lower than the results of the original Turkish study, factor coefficients for each item were above .70 during CFA (Hair et al., 2010), and alpha reliabilities were consistent with common results found in psychometric studies (Bangert, 2009; Henson & Roberts, 2006; Rovai, 2002a, 2002b). Further, the model demonstrated acceptable fit (*CMIN/df = 2.41; CFI = .955; RMSEA = .067; TLI = .945; SRMR = .048*). These findings provided preliminary evidence of the factor structure of the OSCS.

To further examine data from the instrument for validity and reliability, CFA was then conducted on data from the OSCS using an independent sample. The goal of this analysis was to replicate results of the first study and confirm the factor structure of the revised version of the instrument. Again, the factor structure held. Factor coefficients for all items were above .60 and considered acceptable (Nimon & Zigarmi, 2014). Additionally, the model exhibited acceptable fit (*CMIN/df = 2.44; CFI = .954; RMSEA = .074; TLI = .943; SRMR = .056*). These results confirmed factor validity for data from this study's sample and provide further evidence of reliability and validity of the OSCS. Findings of this portion of the study suggest that data from the OSCS is valid and reliable for assessing the feelings of connectedness among students in online courses.

H2: Data from the OSCS will demonstrate convergent validity with data from the CCS.

Hypotheses included in H2 evaluated relationships between the OSCS and the CCS. Predictions made in H2 were partially supported, demonstrating a link between the OSCS and the CCS. Of note were the results of correlations between the factor learning from the CCS and each factor of the OSCS. First, community from the OSCS was predicted to have a strong positive relationship with learning from the OSCS. Results indicated the exact opposite ($r = -.124$). This correlation is considered weak according to established thresholds (Ward, Fischer, & Lam, 2009). Additionally, the correlation was negative, indicating that as one factor increased, the other decreased. At face value, this result seems to conflict with literature related to social learning and the assertion that learning increases as meaningful relationships and the group's trust deepens (Bandura, 1971; Dawson, 2006; Sadera, Robertson, Song, & Midon, 2009). However, it is important to note that correlation does not equal causation, and it should not be interpreted that in all cases as the sense of community increases, learning decreases or vice-versa (Wright, 1921). Instead, a more thorough examination of the items in the learning factor of the CCS is warranted.

Of the ten items listed in the learning factor of the CCS, three are centered on the ability to have questions answered by others in the course, and two speak to the personal motivation to learn. Within these items, the concept of learning is positioned as an external process that relies solely on the course facilitator and the personal motivation of the learner. The remaining five items are positioned to question learning as part of a community, but three are negatively worded. Prior research suggests that negatively worded items may impact correlations in Likert-scale instruments (Roszkowski & Soven, 2010). The structure of the learning factor of the CCS vastly contrasts with the structure of the community factor of the OSCS. Here, all items are positively worded, and each focuses on building relationships with others within the environment. For this reason, the results of this correlation may have been affected by wording and format. Before concluding that a negative relationship exists between the concept of learning and community, further empirical evaluation is recommended between these two factors.

H3: Data from the OSCS will be both positively and negatively correlated with data from the COI.

The final set of hypotheses included in this study examined the relationship between the OSCS and the COI. Here, predictions were generally supported with a few exceptions. First, the interaction and collaboration factor from the OSCS was predicted to have a moderate positive relationship with the factor of social presence from the COI. While the relationship was positive, it was strong, not moderate as predicted. This may suggest the facilitator's formal title is not a hindrance to students viewing this role as a partner in the community of learning as was previously suggested in the literature (Arbaugh & Benbunan-Fich, 2007).

Another significant finding was the strong correlation between factors from the OSCS and the cognitive presence factor from the COI. Prior literature provided no support for a direct correlation between cognitive presence, community, and interaction and collaboration; therefore, a weak correlation was hypothesized. Contrary to this prediction, cognitive presence demonstrated both a statistical significance and a strong correlation with community and interaction and collaboration ($p < .001; r = .502, .544$ respectively). This finding is practically significant because literature on the role that cognitive presence plays in the establishment of student connection in online classes is in its infancy stages, and it has been suggested that cognitive presence is not a factor that directly influences feelings of connectedness between participants in online educational settings (Pollard, Minor, & Swanson, 2014). Additionally, it was previously posited that students participating in this course modality seek higher meaning through critical thinking as part of their learning process (Garrison, Anderson, & Archer, 2000). Based on the findings in this study, it can be deduced that the ability to connect with peers through facilitated interactions contributes to this critical thinking process. All other hypotheses in H3 were supported and behaved as predicted.

OSCS Factor Examination

An additional finding of this study was developed from an analysis of the items associated with each factor of the OSCS. As mentioned earlier, nine items were deleted during the initial EFA, leaving only 16 of the original 25 items in the revised version. The most stable of the OSCS factors during this portion of the study was community. During the initial EFA, this factor was the only one that was able to retain all items because they met acceptable thresholds with factor coefficients, structure coefficients, and communalities. Additionally, the community factor demonstrated the highest alpha reliability ($\alpha = .924$).

Items representing the factor of facilitation were weakest in terms of alpha reliability, AVE, and CR during both parts of this study. A review of the survey reveals that of the six original items in the factor, only three were retained during the initial EFA analysis. Of the deleted items, two contained the word "collaboration" and inquired about facets of interaction between students. In general, these items seemed to be synonymous with items in the interaction and collaboration factor and may be the reason they correlated strongly here during EFA.

The final deleted item in the facilitation factor asked for opinions about the facilitator's role in promoting interaction between learners. Here again, wording of the questions could be perceived as an inquiry about interaction between students as well. Because the wording of these items was so closely linked, it is believed that this led to their failure to load on the predicted factor and their low factor correlations. Of note is the fact that the facilitation factor demonstrated a strong correlation with the interaction and collaboration factor during the initial EFA ($r = .642$) even after item deletion. This again suggests that this factor could have some overlap with the interaction and collaboration factor.

Conclusion of Findings

In summary, results of this study's findings provide sufficient evidence of validity and reliability for the OSCS. Results of the nomological network suggest that, while the OSCS has a relationship with the CCS and COI, enough variance exists to establish the OSCS as a different way to measure facets of feelings of connectedness between students participating in online educational environments. Because data from the COI and CCS has been established empirically, linkages between these scales and the OSCS provides further evidence of construct validity for the OSCS instrument as a valuable tool to measure student connectedness in online settings. Strong evidence of construct validity is important for scales used in social research (Cronbach, 1951).

The findings of this study add to the literature surrounding successful strategies for the design and implementation of distance learning courses. Data suggests that perceived feelings of connection is multi-faceted and involves equal participation from the students and the course facilitator. It was previously assumed that the course facilitator provided the platform for student connection, but that their title alienated them from being viewed as a participant in the course (Garrison, Anderson, & Archer, 2000). However, data from this study demonstrated that facilitation had strong relationships with factors in both the COI and CCS, suggesting that the facilitator plays a major role in the level of connectedness perceived between students in online settings. For this reason, distance courses should be designed with active participation from the facilitator in mind. Teaching strategies in these courses should also be examined, and support for additional professional development of distance learning facilitators may be warranted.

The findings of this study also provide the academic community with empirical evidence for a viable instrument to measure feelings of connection exclusively in online educational settings. As stated earlier, limited instruments exist in this area, and the OSCS is thought to be the first instrument that examines the role that the facilitator, student, and comfort with interaction and technology playing a role in developing feelings of connection between students in distance learning settings. A major conclusion of this study is evidence that the OCSC holds promise for the academic and practitioner community above the CCS and the COI.

Limitations, Delimitations, and Recommendations for Future Research

No matter how thorough, no study is without its limitations and delimitations. It is important to discuss this information because it influences the interpretation and places constraints on the generalizability of the study's results. As such, major limitations and delimitations affecting the generalizability of this study's results will be discussed in this section.

One limitation of this study is the difference in teaching methods and styles of facilitators in online courses. It is suspected that the level of interaction between the facilitator and students might vary greatly depending on one's teaching style and experience with teaching in a virtual environment. Additionally, participants may have been participating in more than one online course simultaneously, which could have magnified this dissimilarity. These differences could have influenced participant responses to the questions, specifically those that were focused on facilitation and learning. To mitigate for the dual enrollment issue, participants were instructed to concentrate on just one course while completing the surveys, but the possibility that this direction was not followed cannot be ignored. Mitigating for teaching style was outside of the scope of this study. A recommendation for future research is to determine if teaching style has an impact on the results of the data. To conduct a study of this type, course facilitator teaching styles could be determined prior to submitting the OSCS to students in their respective courses. It would be useful to examine the degree of teaching presence and immediate behaviors (e.g., timing of feedback and frequency of interaction) as well as how they might influence perceptions of connection and success of students in the course. From here, a test of measurement invariance could be conducted to determine the effect, if any, that teaching styles have on student responses.

A second limitation of this study was the risk of a homogeneous sample. Participation in this study was voluntary. Because of the topic, it was plausible to believe that the sample for this study would consist of those students with a preference for online courses versus the traditional format. Measures to control for this anticipated preference were included in the data screening and collections methods. A question was placed at the beginning of the survey asking participants to share their overall preference for online courses. The research panel was given thresholds to ensure that the sample was diverse. A recommendation for future studies would be to collect data separately for students who prefer online courses versus those who do not to examine whether or not these differences affect the findings put forth in this study. Additionally, students who may have taken online courses at one point but who are no longer enrolled in an online course could be included in the study. Data from this population could provide insight as to whether or not feelings of connectedness, or lack thereof, influenced their decisions about continued attendance in this course modality.

The next limitation of this study was related to student preference for course modality. In some cases, students may be forced into an online class because the institution only offers courses they need in that format. For these students, both preference and the level of experience with technology used in the online course could be factors in their overall satisfaction with the online learning experience (Rodriquez, Ooms, Montanez, & Yan, 2005). If any of the students in the current study were in this situation, their feelings may have influenced the results. This study gathered information about participants' feelings toward online courses through the initial screening process, but these feelings were not factored into the analysis. Additionally, testing for level of comfort with technology was beyond the scope of this study. A future study could include examining the extent to which students utilize technology outside of the classroom, their current level of comfort with technology, and their motivation to learn technology tools utilized in the course. By combining these variables with results of students connectedness gauged from their responses to the OSCS, insight on the impact that course modality preference and comfort with technology have on overall course satisfaction could be explored.

A final limitation of this study is the fact that it relied on self-report data. Self-report data may provide unreliable results because of recall problems and social desirability effects (Crockett, Schulenberg, & Petersen, 1987). Tests of social desirability in scale items attempt to measure the truthfulness of respondents during self-report studies (Crowne & Marlowe, 1960). The effects of social desirability can introduce bias, which can become a source of error in psychological and social science testing. Although safeguards to mitigate for these phenomena were included in this study via the survey configuration, tests for social desirability impacts were outside of the scope of this study. A future recommendation would be to include a test of social desirability as part of the scale to mitigate this risk. Including a test of this kind could provide more confidence in the results obtained in future studies.

A main delimitation of this study was the sample. The sample was purposely limited to students located in and taking courses at four-year universities in the United States. For this reason, results of this study are limited to the cultural aspects of those in the United States. In future studies, the sample could be expanded to include students outside of the United States. In doing so, the researcher would need to determine if cultural differences related to interaction and collaboration in educational settings could be a factor in the results obtained. One way to determine if cultural differences are a factor would be to assess manifest validity. Manifest validity studies how language is selected and combined into questionnaire statements during the creation of surveys (Larsen, Nevo, & Rich, 2008; Nimon, Shuck, & Zigarmi, 2015). Based on the language used in a statement and the interpretation of the respondent, language bias could occur and impact the overall results. Conducting a test of manifest validity for the OSCS could help mitigate against potential cultural differences related to language when administering the survey outside of the United States.

Finally, the sample was limited to those enrolled in online courses that were asynchronous in nature, meaning there were no scheduled meetings in person or through the use of technology. Adding the element of face-to-face classroom instruction makes a course blended (Allen & Seaman, 2014) as opposed to fully online, which conflicts with the target audience that the OSCS purports to measure. However, a recommendation would be to broaden the audience to include participants enrolled in courses that do include the element of synchronous meetings using technology to determine if that element would affect the results. Doing so could increase generalizability if the structure of the instrument holds.

One finding not related to limitations and delimitations in this study that warrants further research is the link between community and learning. In many online courses, the structure includes required discussions between students via chat boards. This type of requirement may have been instituted as a staple in online courses to somehow account for the absence of face-to-face conversations that would take place in a traditional setting. It has been posited that discussion between students can enhance the sense of community (Bolliger, 2004; Rovai, 2002a). However, findings from this study may suggest that community may not be a strong factor influencing learning. An additional recommendation for research is to revisit the concept of community as it relates to connection in online learning. As society's comfort level with technology grows, the way communities and communication take place has evolved. Applications like Facebook, Instagram, and Vine provide a sense of connection and community between people where direct conversation and words are not always necessary to build this sense of community. Future research could explore connection between students in online courses where forced discussion has been replaced with other forms of connection including the use of social media tools. This research could strengthen the understanding of how different forms of community building affect connection in online educational settings.

The addition of an empirically tested instrument designed to measure feelings of online student connectedness holds promise for research related to success and retention of students in this course type. Quantitative studies can be conducted across cultures and provide support for strategic decisions related to the expansion of online courses at institutions of higher education and to the format of these courses.

Implications for Theory and Practice

Findings of this study support the use of the OSCS as a viable instrument to measure feelings of connection between students participating in online educational settings. As such, implications for theory and practice are detailed below.

Implications for Theory

The concept of online learning has evolved in past decades, yet theories devoted to this area are still in the infancy stages (Zimmerman, 2012). One of the strongest theoretical concepts in the literature for online learning is the assertion that community and connection have strong links to the performance and learning of students participating in this course modality (Akyol & Garrison, 2008; Bolliger & Inan, 2012; Rovai, 2002a, 2002b). This study was able to add to the body of research on social learning and provide evidence that community is a factor involved in the study of feelings of connection in online classes through its presence in prior research.

The finding that cognitive presence is highly correlated to feelings of connection may enhance future theories related to online learning. The opportunity to provide a framework that explores the integration between student connectedness in online courses and their level of cognitive presence will strengthen the research on the phenomena of how connectedness is achieved and sustained in the online educational environment. New theories devoted to the development of cognitive presence and the variables that influence this factor would also be useful.

Another interesting theoretical implication related to online courses are preconceived notions that students have toward online learning courses based on prior experience with this course modality. A growing body of research explores why students drop out of online courses (Carr, 2000); however, theories devoted to the decision to remain in this course modality are absent from the literature. It can be assumed that major drivers influencing the choice to attend an online class are the age of the student and current work status (e.g., full-time, part-time, and unemployed); however, theories related to the exploration of these decisions do not appear to exist. Using the OSCS to measure perceived feelings of comfort, community, facilitation, and interaction and collaboration for students currently in these courses could lead to the development of theories and frameworks that would examine variables affecting the cognitive factors involved in the decision to continue along this path of education. Additional implications for theory related to each factor of the OSCS are discussed below.

Implications for Practice

The OSCS is a tool that can be used to assess the current performance of online courses at higher educational institutions and potentially determine the satisfaction level of students in these courses. This type of assessment could lead to the creation of early intervention and retention strategies designed to improve satisfaction for these students. Because online course enrollment is expected to increase over the next decade (Allen & Seaman, 2014), this exploration is critical for institutions with online learning courses already in place as well as those attempting to implement programs of this type.

An additional implication for practice is the impact that student feelings of connectedness in current courses could have on the design and development of future online courses. Technological advances open the door for creativity in the way these courses are structured. In addition, the findings of this study may raise awareness of how students view facilitation strategies of the instructor, and it is quite possible that more time and effort could be placed on professional development for those teaching online courses. The OSCS can be used as a vehicle to recognize the need for change and implement new ideas based on a more thorough understanding of student needs, expectations, and motivations regarding connectedness. Additional implications are discussed for each factor of the OSCS below.

Comfort

Bolliger and Inan (2012) defined comfort as "experiencing contentment and security with either integrated technologies or the learning environment" (p. 45). When designing and implementing online courses, both the institution and the instructor have a duty to ensure that the learning environment is a safe place for students to express thoughts and concerns and ask for help if needed. From an institutional perspective, support for technology should be readily available to students. This support can range from online helpdesk numbers, online chat support, or courses designed to familiarize students with the technology courseware. Because online learning can take place anywhere and includes students across time zones, appropriate staffing to support learner needs must be determined. Additionally, institutions should consider including questions from the comfort factor of the OSCS in their end-of-course survey to help unveil student perceptions about the level of support they received. Satisfaction thresholds should be set that will help the institution ensure that they are meeting goals. One of the most important aspects of gathering this type of feedback would be to have a plan of action to act on the feedback once received.

This study added to the body of knowledge concerning the importance that the instructor plays in helping students develop feelings of connectedness in online courses. Instructors should work to encourage active participation between students in their courses. Their role should not simply be as spectator, but as an active participant in discussions and other activities designed to help students connect. More importantly, responses between students should be monitored so that corrective action can be taken if comments appear to belittle or stifle the appropriate sharing of ideas.

As it relates to comfort with technology, instructors have a responsibility to have functional knowledge of course that is being used to teach. Although instructors may not be able to provide the same level of support as a technical helpdesk, there should be some ability to assist with simple troubleshooting. It is also important that facilitators inform their students about technical support options that are available to them.

Community

Community is described as the feeling of belonging and commitment that members have with others in a group (Bolliger & Inan, 2012). In essence, it is the ability for learners to connect with one another by building a bond of trust and emotional attachment. Forming a sense of community may take time; therefore, the course should be designed in a way that helps this bonding take place as quickly as possible. Immediate bonding can accomplished with course introductions between students and the instructor (Slagter van Tyron & Bishop, 2006). These introductions do not always need to take place on discussion boards. With the incorporation of social media into educational settings, institutions and facilitators alike are encouraged to explore how sites like Instagram and Vine might be used to help in this area.

Monitoring feelings of community is critical in online learning because it has been posited that students who feel a sense of isolation are more likely to drop out of a course (Carr, 2000). Here again, instructors play a major role in mitigating these feelings. It is important that instructors monitor the participation of students and reach out to connect with those who may not be as active as others to determine if an issue exists. Additionally, the institution is encouraged to have a feedback mechanism for these students in the event that the student is not comfortable discussing these issues with the instructor.

Understanding perceived feelings of community begins with evaluation. Questions from the OSCS can be used to examine the feedback and determine if action is necessary to help enhance the feelings of community between students completing the course.

Facilitation

Facilitation, as defined by the OSCS, is the ability of the instructor to create learning communities and establish teaching presence (Bolliger & Inan, 2012). Findings of this study suggest that this role permeates all aspects of online course including learning, social presence, connectedness, and cognitive thinking. Because this role is so critical to the success of the course, it is important that the right instructors are placed in these positions and that continuous professional development opportunities are made to these instructors. At the onset of online teaching assignments, institutions are encouraged to arm their instructors with tools that help them promote collaboration between students. The tools can range from the use of blogs dedicated to the course content to tools designed to allow communication between multiple people across time zones. Making these options available to facilitators provides avenues for creativity.

Class size may be a factor in the ability to facilitate effectively in online courses. Although data on the average class size for online courses is not readily available, personal experience reveals that this number can range from 12 students to 50 students depending on the nature and content of the course. In larger classes, it may be difficult for an instructor to make contact on a regular basis with students. For this reason, institutions are strongly urged to make thoughtful decisions about the number of students placed on a course roster and strike a balance between meeting financial goals and ensuring student satisfaction.

The OSCS can be used to effectively gather feedback about perceptions of the facilitator’s interactions throughout the course. Items within the facilitation factor monitor for the timeliness of feedback, tools used to promote collaboration between others, and the actual level of participation that the instructor demonstrates with others in the course. Collectively, these areas provide the framework for instructor success; therefore, they should be monitored frequently.

Interaction and Collaboration

Bolliger and Inan (2012) posit that students rely on the ability to interact and collaborate as a means of transforming information into knowledge. Similar to community, the interaction and collaboration factor is concerned with promoting teamwork and collaboration between students in online courses. Admittedly, this aim can be a challenge when students are dispersed geographically. One suggestion for promoting collaboration is the incorporation of group projects into these courses (Carr, 2000). Group projects can promote conversation and the sharing of ideas between students as they work towards a common goal. If this path is selected, both the course designer and the instructor must be certain that work effort is evenly distributed so that learner satisfaction is not negatively impacted. The OSCS is designed to monitor feelings of interaction and collaboration as it relates to both the sharing of ideas and the collaboration of work efforts. Therefore, its use may provide valuable insight into the aspect of online learning courses.

In summary, the OSCS can be a viable tool for determining performance of online courses in the areas of comfort, community, facilitation, and interaction and collaboration. Its introduction to the practitioner community holds promise for the ability to effectively evaluate these variables and make thoughtful, data-driven decisions.

Conclusion

This study was undertaken to determine if the OSCS could hold promise for the academic and practitioner community as it relates to research for the design of online courses and the success and retention of students participating in this course modality. Research findings accomplished the task of providing evidence of factor validity, reliability, and construct validity for data gathered using the OCSC. Additionally, it provides evidence that the tool may be useful in further research designed to study this phenomenon. The introduction of a reliable and valid scale to measure feelings of connection between students in online courses holds promise for a fresh perspective on this course format. For these reasons, this study provides a significant contribution to theory, research, and practice related to this phenomenon.

APPENDIX A

IRB DOCUMENTATION

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THE OFFICE OF RESEARCH INTEGRITY AND COMPLIANCE

June 6, 2014

Dr. Kim Nimon
Student Investigator: Tekeisha Zimmerman
Department of Learning Technologies
University of North Texas
RE: Human Subjects Application No. 14-216

Dear Dr. Nimon:

In accordance with 45 CFR Part 46 Section 46.101, your study titled "Testing the Psychometric Properties of the Online Student Connectedness Survey" has been determined to qualify for an exemption from further review by the UNT Institutional Review Board (IRB).

No changes may be made to your study's procedures or forms without prior written approval from the UNT IRB. Please contact Jordan Harmon, Research Compliance Analyst, ext. 4643. if you wish to make any such changes. Any changes to your procedures or forms after 3 years will require completion of a new IRB application.

We wish you success with your study.

Sincerely,

Patricia L. Kaminski, Ph.D.
Associate Professor
Chair, Institutional Review Board

PK:jh

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THE OFFICE OF RESEARCH INTEGRITY AND COMPLIANCE

February 19, 2015

Dr. Jeff Allen
Student Investigator: Tekeisha Zimmerman
Department of Learning Technologies University
of North Texas

Institutional Review Board for the Protection of Human Subjects in Research (IRB) RE:
Human Subject Application #14-216

Dear Dr. Nimon:

The UNT IRB has received your request to modify your study titled *"Testing the Psychometric Properties of the On-line Student Connectedness Survey"* As required by federal law and regulations governing the use of human subjects in research projects, the UNT IRB has examined the request to modify the supervising investigator from Kim Nimon to Jeff Allen. The modification to this study is hereby approved for use with human subjects.

Please contact Jordan Harmon, Research Compliance Analyst II, at (940) 565-4258, if you wish to make changes or need additional information.

Sincerely,

Chad Trulson, Ph.D.
Professor
Chair, Institutional Review Board

PKJ

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APPENDIX B

PRE-SURVEY NOTIFICATION EMAILS

Study 1: Email sent to identified participants 1 week prior to survey distribution

Hello,

Thank you for your agreement to participate in our research study involving the validation of a survey designed to measure student connectedness in online courses. The survey, entitled the Online Student Connectedness Survey, is a 25-item survey purported to measure feelings of connectedness for students enrolled in online courses.

In approximately 7 days, you will receive an email that will contain a link to an electronic survey. The survey will take 15-20 minutes to complete and participation is voluntary. Your decision to participate or not will have no impact on the grade you receive in your current course. Your responses will be confidential and we will not collect identifying information such as your name, email address or IP address.

If you have any questions about the study, please contact Kim Nimon at kim.nimon@unt.edu or Tekeisha Zimmerman at zimmermantk@sbcglobal.net.

Thank You

Study 2: Email sent to identified participants 1 week prior to survey distribution

Hello,

Thank you for your agreement to participate in our research study involving the validation of a survey designed to measure student connectedness in online courses. In approximately 7 days, you will receive an email that will contain a link to an electronic survey. The survey contains *XX* items and will take 25–30 minutes to complete. Your decision to participate or not will have no impact on the grade you receive in your current course. Your responses will be confidential and we will not collect identifying information such as your name, email address or IP address.

If you have any questions about the study, please contact Jeff Allen at jeff.allen@unt.edu or Tekeisha Zimmerman at zimmermantk@sbcglobal.net.

Thank You

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