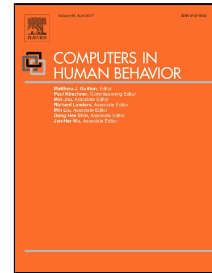


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Social Presence in Relation to Students' Satisfaction and Learning in the Online Environment: A Meta-analysis

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Highlights

- This meta-analysis examined the relationship between Social Presence (SP) and students' satisfaction and perceived learning
- Strong positive relationship between SP and satisfaction
- Strong positive relationship between SP and perceived learning
- Course length, discipline, and SP scale significant moderators for satisfaction
- Course length, discipline, and audience significant moderators for perceived learning

Running Head: **Social Presence and Academic Outcomes**

Social Presence in Relation to Students' Satisfaction and Learning in the Online Environment:

A Meta-analysis

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Social Presence in Relation to Students' Satisfaction and Learning in the Online Environment:

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Abstract

Social presence, the ability to perceive others in an online environment, has been shown to impact student motivation and participation, actual and perceived learning, course and instructor satisfaction, and retention in online courses; yet very few researchers have attempted to look across contexts, disciplinary areas, or measures of social presence. This meta-analysis allowed us to look across these variables of the primary studies and identify the pattern of student outcomes (e.g., perceived learning and satisfaction) in relation to social presence through scrutiny of differences between the studies. The results showed a moderately large positive average correlation between social presence and satisfaction ($r=.56$, $k=26$) and social presence and perceived learning ($r=.51$, $k=26$). Large variation among correlations (86.7% for satisfaction and 92.8% for perceived learning, respectively) also indicated systematic differences among these correlations due to online course settings. We found that (a) the strength of the relationship between social presence and satisfaction was moderated by the course length, discipline area, and scale used to measure social presence; and (b) the relationship between social presence and perceived learning was moderated by the course length, discipline area, and target audience of the course. Implications and future research are discussed.

Keywords: Social Presence, Online Learning, Satisfaction, Perceived Learning, Meta-Analysis

Social Presence in Relation to Student's Satisfaction and Learning in the Online

Environment: A Meta-analysis

1. Introduction

1.1. Current State of Online Education

Online learning continues to be a popular format for educational experiences because of its flexibility and customizability to students' needs (Allen & Seaman, 2016; Cui, Lockee, & Meng, 2013). According to Allen and Seaman (2016), 5.8 million students were enrolled in at least one online course in 2014, with the rate of students enrolling in online courses continuing to match or outpace those of traditional enrollments. Allen and Seaman's report further supports these findings by noting that a large number of higher education academic leaders (63.3%) have indicated that online education is critical to their long-term strategy.

Nevertheless, researchers and practitioners continue to grapple with concerns over online learning, including student feelings of isolation, disconnection from peers and instructors, and a lack of preparation for learning in an online environment, all of which result in higher dropout rates and the perception of an inferior educational experience (Liu, Gomez, & Yen, 2009). The construct of social presence—the ability to perceive others in an online environment—can go a long way to overcoming these issues. In fact, Boston, Diaz, Gibson, Ice, Richardson, and Swan (2009) found that two affective expression indicators of social presence accounted for more than 20% of the variance in student retention.

We have conducted this study to provide a holistic view of social presence in online learning. Through meta-analysis, we examine the nature of the relationship between social presence and student outcomes across contexts, disciplinary areas, and varying measures of social presence.

1.2. The Origins of Social Presence for Online Learning

Anyone who listens carefully to the way people say things quickly learns that the particular words a speaker uses to describe an event or experience can be a rich source of information about his feelings and attitudes (Wiener & Mehrabian, 1968, p.1).

While Wiener and Mehrabian (1968) may have been speaking to an audience that could hardly conceive of today's online learning environments, their opening sentence still holds true. As a construct, social presence today is often considered integral to online education; but in fact, the research base stems from work going much further back. For example, researchers in social psychology, such as Argyle and Dean (1965) and Argyle (1969)'s work with nonverbal communication and interpersonal behaviors and Mehrabian's (1966, 1972) work on immediacy and non-verbal nonverbal communication have all had a significant influence over how we have come to define social presence. Social presence in the online environment is a setting that upon initial glance may appear to be lacking in traditional verbal and nonverbal behaviors.

The most clearly defined line between today's research on social presence and its predecessors is the work of Short, Williams, and Christie (1976) based on their communications research on "the effectiveness and impact of person-to-person telecommunications" (p. vi). They coined the term "social presence," and over time their work has been cited regularly throughout the literature. They posited that social presence is a quality of medium, with some mediums having a lesser ability to convey social presence (e.g., text-based communication). "[Social presence] varies between different media, it affects the nature of the interaction and it interacts

with the purpose of the interaction to influence the medium chosen by the individual who wishes to communicate” (Short et al., 1976, p. 65).

The widespread use of computer-mediated communication (CMC), the term often associated with the early years of online learning, incited several researchers to begin questioning earlier works to see how previous assumptions related to the newer technologies. Walther (1992), for example, provided a critical evaluation on the role of the medium constraining users’ communication, specifically by highlighting weaknesses in CMC research. To illustrate his point, he takes issue with the comparison of task-oriented assignments between simulated computer conferencing groups and face-to-face (F2F) groups with a limited time frame, which by its nature alleviates the advantages of CMC communication channels. Additionally, although he indicated the commonality of comparing verbal communication behaviors between computer conferencing groups and F2F groups, Walther also noted a lack in the examination of nonverbal communication behaviors in F2F in research, which could provide insights into CMC substitutions or equivalences in the research. He also discussed the possibly unfair comparison of F2F and CMC based on contexts and purposes of the communication being studied, including the findings of experimental studies versus authentic CMC groups. At one point Walther explained, “it appears that the conclusion that CMC is less socioemotional or personal than face-to-face communication is based on incomplete measurement of the latter form...” (p. 63). Later, a meta-analysis of the interpersonal effects of CMC (Walther, Anderson & Park, 1994), found that the treatment of time (from 15 minutes to 6 months, in this case) plays a strong role in explaining socially-oriented communication. Walther et al. (1994) go on to say that although room exists to interpret their findings, interpersonal dynamics may not be at the mercy of the medium; up until this point little evidence had supported this case.

Gunawardena (1995) alleviated this tension by situating social presence theory into a particular educational context, and examining the likelihood that users attributed their social presence to either the medium itself or their perception of the medium. The educational context was a multi-university distance education project called The GlobalEd conferences, and was conducted using a listserv. Gunawardena conducted two studies within this context and found that it was students' perceptions of CMC, and not the medium itself, that derived their impression of social presence. Additionally, she found that because instructors can cultivate or create social presence they need to learn to how to adapt to the medium.

1.3. Researching Social Presence in Online Learning

Since the concept of social presence was first linked to online learning, researchers and practitioners have been reconceiving not only what social presence is, but also the particular role/s it plays in online learning (Annand, 2011; Gunawardena, 1995; Kreijns, Van Acker, Vermeulen, & Van Buuren, 2014; Lowenthal, 2010; Oztok & Brett, 2011). This is appropriate because the environments being studied have grown beyond text-based CMC and listservs and are researched in a number of disciplines and contexts. These reconceptions are supported by the varying definitions of social presence presented in Table 1. What all of the definitions have in common, and what we accept as the definition for social presence for this study, is the ability to perceive others in an online environment.

Variations in wording aside, as shown in Table 1, we have learned much about social presence and its influence in online learning over the past 20 years, including the perception that it can be (strongly) felt by participants in computer-mediated communication (Gunawardena, 1995; Richardson & Swan, 2003; Swan & Shih, 2005; Tu & McIsaac, 2002; Walther, 1996). Social presence has been shown to influence a variety of factors in students' learning

experiences. More specifically, social presence can positively influence students' participation and motivation to participate (Jorge, 2010; Mazzolini & Maddison, 2007; Swan & Shih, 2005; Tao, 2009; Tu & McIsaac, 2002; Weaver & Albion, 2005), course and instructor satisfaction (Akyol & Garrison, 2008; Cobb, 2009; Gunawardena, 1995; Gunawardena & Zittle, 1997; Hostetter & Busch, 2006; Richardson & Swan, 2003; Swan & Shih, 2005), and both actual and perceived learning (Hostetter & Busch, 2013; Joksimović, Gašević, Kovanović, Riecke, & Hatala, 2015; Kang & Im, 2013; Picciano, 2002; Richardson & Swan, 2003; Russo & Benson, 2005; Wise, Chang, Duffy, & del Valle, 2004). Further, social presence has implications for course design (Arbaugh, 2005; Mykota & Duncan, 2007; Richardson, Schnieders, vanBarneveld, Pistilli, & Moke, 2013; Swan, Matthews, Bogle, Boles, & Day, 2012; Tu, 2000; Tu & McIssac, 2002; Vrasidas & McIsaac, 2000) and even for retention and intention to enroll in online course (Boston et al., 2009; Liu et al., 2009; Reio & Crim, 2013). Finally, while the concept of social presence has much to do with the interactions between online participants, it has also been found to permeate areas noted for being completed by individual students such as final projects and papers (Hostetter & Busch, 2013; Richardson & Swan, 2003). Ultimately, social presence research underscores the concept that we should encourage social interaction as a means to engage learners in critical thinking and higher-level learning (Garrison & Akyol, 2013).

Research on social presence has increased not only due to the rise in online learning environments and the search for best practices therein, but also in part because of the popularity of the Community of Inquiry (CoI) survey, of which social presence is measured along with teaching presence and cognitive presence. The CoI is a framework widely adopted in the past 15 years and has been used to develop and evaluate meaningful online learning experiences (Akyol

& Garrison, 2008; Arbaugh, 2008; Arbaugh et al., 2008; Boston, et al., 2009; Cobb, 2011; Garrison & Akyol, 2013; Kozan & Richardson, 2014; Swan et al., 2008).

1.4. Measuring Social Presence

The complex measurement of social presence varies sometimes based on specific contexts. The two most common formats for measuring social presence are self-reporting, such as surveys, (Arbaugh et al., 2008; Gunawardena & Zittle, 1997; Richardson & Swan, 2003; Tu, 2002a) and behavioral indicators, used to code communication and behaviors (de Bruyn, 2004; Richardson, Koehler, Besser, Caskurlu, Lim, & Mueller, 2015; Rourke, Anderson, Garrison, & Archer, 1999; Swan, 2003; Swan & Shih, 2005). Table 2 provides a list of some of the commonly used self-report measures of social presence, as well as those included within this study. Survey usage results include the work of Gunawardena and Zittle (1997) ($k=5$), Richardson and Swan (2003) ($k=5$), which is based on Gunawardena and Zittle, and the CoI survey or common instrument (Swan et al., 2008) ($k=6$). Other instruments (e.g., Biocca, Harms, & Gregg, 2001; Garrison, Cleveland-Innes, & Fung, 2004; Kang, Choi, & Park, 2007; Kang, Park, & Choi, 2006; Kang, Park, Jung, & Park, 2009; Kim, 2011; Shih, 2004; Wise, Change, Duffy, & del Valle, 2004) accounted for eight of the studies listed in Table 2 and were used in the subsequent synthesis via meta-analysis.

1.5. Social Presence and Student Outcomes

To date, the majority of research on social presence in online courses has included the student outcomes of perceived learning and satisfaction, yielding much information about associated variables such as potential moderators, potential relationships between variables, predicting social presence, or using social presence to predict outcomes. Outcomes, in the case of this research, refers to learners' perceived measure of performance.

1.5.1. Student Satisfaction. Student satisfaction, for the purpose of this study, is an indicator of whether learners are satisfied with their learning experience (Li, Marsh, Rienties, & Whitelock, 2016). Several studies have found social presence to have an impact on student satisfaction. For example, Gunawardena and Zittle (1997) examined social presence as a strong predictor of student satisfaction in a text-based computer conferencing environment. Through regression analysis, they found that social presence accounted for 58% of variance in student satisfaction. Likewise, Strong, Irby, Wynn, and McClure (2012) assessed students' perceptions of the learning environment, social presence, and satisfaction in online agricultural education courses. They found that social presence and the learning environment accounted for 26% of the variance in student satisfaction. Similarly, Hostetter and Busch (2006) found that similar levels of social presence could be generated between F2F and online course settings. In addition, they found with regression analysis that 40% of the variance in learner satisfaction was explained by social presence. This coincides with findings from others, such as Wise, et al. (2004) and Kang, Liew, Kim, and Park (2014).

1.5.2. Satisfaction and Perceived Learning. Richardson and Swan (2003) demonstrated with their correlational study that students who perceived a high level of social presence in an online course were not only more satisfied with their instructor, but also perceived they learned more than students who reported low social presence. Swan and Shih (2005) conducted a mixed-methods study and found significant correlations between perceptions of social presence (peers and instructors) and perceived learning, as well as between the perceived presence of instructors' and satisfaction with instructors. The qualitative results showed that "students perceiving more social presence also used significantly more social presence indicators to project their own presence to their classmates" (p. 130). Cobb's (2011) work on nursing education found that

social presence was highly correlated to both student satisfaction and perceived learning. Using multivariate regression, Cobb found that social presence accounted for 44% of the variance in overall satisfaction and 36% of the variance in perceived learning. Arbaugh (2008) examined 55 online MBA courses to determine if the CoI framework, of which social presence is a measure, could predict student outcomes. He found that social presence was positively associated with students' perceived learning and their satisfaction with the online delivery medium implemented by courses. Similarly, Kang and Im (2013) conducted multiple regression analyses to determine the factors in learner–instructor interaction that predicted learners' perceived learning and satisfaction in online courses. Using Kang's 2009 questionnaire consisting of five factors (guidance and facilitating learning; social intimacy; instructional communication; presence of instructor and instructional support), they found that factors related to instructional interaction significantly predicted learners' perceived learning achievement. They also found that these five factors significantly predicted learners' satisfaction.

1.5.3. Traditional Academic Performance. Only a few studies have examined social presence in relation to traditional academic performance, or grades. Picciano's (2002) early student of traditional academic performance examined the impact of interaction and social presence on performance outcomes. After breaking students into three social presence groupings (low, moderate, and high), Picciano compared mean scores for both a written assignment and an examination, and found that students' perceptions of social presence were not a statistically significant predictor for performance on the examination. However, it was a significant predictor for performance on the written assignment. Picciano concluded that the type of performance measures, in this case an examination versus written assignment, and its alignment with the tasks taking place on the discussion board may be a factor in his findings. Correspondingly, Hostetter

and Busch (2013) used a content analysis of graded discussion postings ($n=4,000$), a social presence survey, and the Classroom Assessment Technique (CAT) which involved a written assignment as a measure of academic performance. The content analysis used Rourke et al.'s (1999) social presence indicator coding schema and was conducted by two independent raters. In this case the researchers found that students who demonstrated higher levels of social presence in the online discussions also perceived higher levels of social presence. A regression analysis indicated that students with higher levels of social presence also performed better on the CAT. Similarly, using an experimental design groups, Joksimović, et al. (2015) compared graded student online discussion postings ($n=1,747$), which were also coded in accordance to Rourke et al. (1999) social presence indicator coding schema. With the treatment groups reporting higher mean social presence values, the researchers found that certain social presence indicators (i.e., continuing a thread, complimenting, and expressing appreciation) were significant predictors of student academic performance, in this case course grades. This led them to conclude that “the ability of a student to project himself within an online learning community is also a significant predictor of academic performance” (p. 13). They also concluded that instructional design and the inclusion of support for meaningful interactions, which allowed for deeper social presence interactions here, are important for better student academic performance outcomes.

1.6. Satisfaction and Perceived Learning as Student Outcomes

For this study, we examined students' satisfaction and perceived learning as target student outcomes for the subsequent meta-analysis. Studies examining satisfaction have long been established as part of the post-secondary research landscape, in part because as a variable, it has been found to influence student persistence, retention, motivation, and success (Astin, 1977, 1992; Booker & Rebmon, 2005; Keller, 1983; Kuo, Walker, Belland, & Schroder, 2013; Pike,

1993; Roberts & Styron, 2010; Schreiner & Nelson, 2013). However, some researchers have criticized the construct of perceived learning as not being as valid or critical as traditional learning outcomes. Thus, we wish to establish our rationale for selecting this construct as a variable. To begin, our selection of student outcomes to include is due in large part to a number of studies related to online learning that have also included these variables; whereas, as indicated previously, very few studies have examined social presence and traditional learning outcomes, such as grades.

Second, we argue that sometimes perceived learning is the appropriate measure for the research context and may be exactly what a number of the researchers planned to examine, never intending for it to be viewed as a substitute for cognitive or traditional learning outcomes. As Richardson et al. (2010) explained, the outcome measures in a number of studies about online learning are intentionally affective; they are studies concerned with the online learning and the development of social presence and how social presence affected student perceptions of online courses. Affect is still a major source of contention in online learning because a number of researchers and practitioners believe that such education spaces are “not rich enough to communicate affect” (Richardson, Maeda, & Swan, 2010, p. 331). Finally, we would like to point out that perceived learning may be a better measure than traditional learning measures has been argued by several researchers who maintain that traditional measures can be problematic to compare across disciplines and across instructors (Arbaugh, 2005; Pace, 1990; Richardson et al., 2010; Richmond, Gorham, & McCroskey, 1987; Rovai, 2002b).

1.7 Purpose of the Study

Social presence has been shown to impact student motivation and participation (Jorge, 2010; Swan & Shih, 2005), actual and perceived learning (Hostetter & Busch, 2013; Picciano, 2002; Richardson & Swan, 2003), course and instructor satisfaction (Akyol & Garrison, 2008; Gunawardena & Zittle, 1997), and retention in online courses (Boston et al., 2009); yet very few researchers have attempted to look across contexts, disciplinary areas, or measures of social presence. The synthesis of past studies can contribute new knowledge with greater certainty than individual studies, which often vary in their qualities, focus, and findings (Lipsey & Wilson, 2000). Thus, our purpose was to identify the pattern of outcomes in previous research on social presence through scrutiny of differences between the studies statistically linked to their variation in results (Lipsey & Wilson, 2000) and to provide a holistic view of social presence for researchers, course designers, and instructors.

Overall, our meta-analysis sought to better understand the nature of the relationship between social presence and student outcomes (i.e., student satisfaction and perceived learning) by systematically integrating quantitative findings in order to determine the reasons for variation across studies. We also explored how the relationship varies among studies that measure social presence as functions of online course characteristics and other moderators. Specific research questions we addressed with the meta-analysis were:

1. How strong is the relationship between social presence and students' satisfaction in fully online courses? To what extent does the strength of the correlation vary across studies?
2. How strong is the relationship between social presence and students' perceived learning in fully online courses? To what extent does the strength of the correlation vary across studies?
3. What are the conditions (e.g., type of scale used to measure social presence, audience of the course, discipline area, and course length) that moderate the strength of the correlations?

2. Method

2.1. Sampling of Studies

The target population of this synthesis is a set of studies that report on the relationship between social presence and either students' satisfaction or perceived learning between 1992, when the construct of social presence was first applied in online learning literature (i.e., Gunawardena, 1995, Spears & Lea, 1992; Walther, 1992) and May 2015. As a means of searching relevant studies, we used electronic database and search engines including *EBSCO*, *PsycINFO*, *ERIC*, *Education Full Text*, *digital dissertations*, and *Google scholar*. We also reviewed the Community of Inquiry website (<https://coi.athabascau.ca/>) to identify studies. Further we reviewed the unpublished conference papers presented at major education and online learning conferences including *Sloan C*, *Association for Educational Communications and Technology*, *American Educational Research Association*, and *Association for the Advancement of Computing in Education*. These papers were obtained through the conference websites. The key words used for the search were “social presence”, “perceived learning”, “online learning”, “satisfaction”, “online”, “retention” and/or “teacher immediacy”. A manual search was conducted by reviewing the reference list of the identified articles via the preceding electronic search. The entire search process identified 98 studies that might fit the meta-analysis. We carefully read the abstract and evaluated the content of each study to determine the adequacy of these studies for the meta-analysis using the pre-determined criteria.

2.1.1. Inclusion and exclusion criteria. To be included in the meta-analysis, each study must fit three conditions: the study (a) investigated the relationship between social presence and either perceived learning or students' satisfaction in fully online courses in a higher education setting; (b) used social presence as its theoretical framework; and (c) reported quantitative

information, including sample sizes, correlation between social presence and students' satisfaction or perceived learning, or other statistics, such as a t-value, regression coefficient, means, standard deviations or Cohen's *d*, that can be used to calculate the correlation between social presence and either satisfaction or perceived learning.

Based on these criteria, 73 out of 98 originally identified studies were excluded from the sample pool. Of the remaining 25 studies, there were 10 published journal articles, 6 conference proceedings, and 9 dissertations. Fourteen out of 25 studies reported the correlation between social presence and perceived learning, and 19 reported a correlation between social presence and satisfaction; the studies included 3,051 online course participants for perceived learning and 3,862 participants for satisfaction. See Table 3 for detailed information of these studies.

2.2. Coding of Studies

Once we developed an initial coding scheme, we reviewed the scheme and piloted it with the sample of identified studies. The coded variables for study characteristics include:

- course design elements which may have an impact on social presence (e.g., welcome messages, collaborative learning activities, individual assignments),
- publication type (journal, conference paper, dissertation/thesis),
- target audience (undergraduate, graduate, and "other" such as professional development),
- course length (6, 8, or 16 weeks),
- discipline area (Education, Business, and "Other" for areas only having a single study such as nursing), and

- scale used for measuring social presence (Guawardena & Zittle, 1997; Richardson & Swan, 2003; CoI by Swan et al., 2008; and “Other” for scales represented only a single time in the meta-analyses).

We also evaluated the quality of a primary study by evaluating six indices (i.e., statistical conclusion validity-fishing and error rate problems avoided; external validity; internal validity; evidence that statistical assumptions examined; statistical conclusion validity-likely that strong/good statistical power present; statistical conclusion validity-likely that assumptions of statistical tests satisfied). Two members of the research team coded all of the studies individually. The entire team of four members (two faculty members, two graduate students) then reviewed and discussed the results of this coding to determine if any disagreement between two coders existed. The initial inter-coder reliability of agreement expressed in percentages was 95.68% for students’ satisfaction and was 96.43% for students’ perceived learning. Any disagreement on coding was solved and the final rate of agreement is 100% for coding of the correlations.

2.3. Effect Size Extraction

Two types of Pearson’s correlation coefficient (r) that represent the relationship between social presence and student satisfaction or the relationship between social presence and student perceived learning, respectively, served as effect sizes. These retrieved directly from 24 out of the 25 studies. However, because the study by Wise et al. (2004) did not report the correlation, we calculated it from the quantitative information retrieved from the study. A total of 28 effect sizes on the relationship between social presence and student satisfaction from 19 studies, and a total of 30 effect sizes from 14 studies on the relationship between social presence and student perceived learning were extracted.

2.4. Handling Dependent Effect Sizes

Four studies (i.e., Crim, 2006; Kang et al., 2014; Swan & Shih, 2005; Teng, 2005) reported multiple correlations between social presence and perceived learning, as well as between social presence and satisfaction. In addition to these four studies, two other studies (i.e., Jones, 2007; Richardson & Swan, 2003) reported multiple correlations between social presence and perceived learning, and another two studies (i.e., Cobb, 2011; Newberry, 2003) reported multiple correlations between social presence and satisfaction. These multiple effect sizes were obtained from same or nested groups, which were considered dependent on each other. Because handling dependent effect sizes is necessary to avoid mis-estimation of standard errors in a meta-analysis, we computed the weighted average effect size of the dependent effect sizes within group for the same student outcome (e.g., satisfaction). We then used it as a final effect size representing the group. When two types of effect sizes (i.e., the correlation between social presence and satisfaction and between social presence and perceived learning, respectively) were reported for the same group (e.g., Akyol & Garrison, 2008), we treated them as independent for the analysis as we conducted the meta-analysis for each outcome separately (Cooper, 2009). By doing so, a total of 52 effect sizes, 26 independent effect sizes per student outcome (i.e., satisfaction and perceived learning), were used for data analysis.

2.5. Data Analysis

We chose a random-effects model as a theoretical approach for synthesis (Hedges & Vevea, 1998). We acknowledge that the selection of methodological framework (fixed-effect vs. random-effects model) for a meta-analysis has been a great debate (Hedges, 2009), and according to some researchers, the estimated average effect under random-effects model tends to be less conservative than that under fixed-effect model (e.g., Poole & Greenland, 1999).

However, we consider the random-effects approach an appropriate choice because we expected that all the studies focusing on each of the two relationships are neither accessible nor identifiable via the described searching methods; located studies were treated as a sample from all the studies in the target population.

Fisher's *r*-to-*z* transformation (Fisher, 1915) was used to normalize the sampling distribution of Pearson's correlation coefficient. To compute the average effect size, we employed the weight—the inverse of total variance (Hartung, Knapp, & Shinha, 2008)—to reflect the difference in the precisions among effect sizes, which occurred because of the differences in primary study sample size. We then transformed the results back to the original correlation metric for reporting results.

2.5.1. Heterogeneity of effect sizes. We investigated variation of the effect sizes across studies with three statistics. We used a *Q* test (Hedges & Olkin, 1985) to assess the homogeneity of effect sizes. We computed an *I*² statistic that represents the ratio of between-groups variance to the total variation across effect sizes to indicate the amount of effect sizes' variation due to the differences among studies. Finally, we calculated a between-groups variance statistic, τ^2 (Higgins, Thompson, Deeks, & Altman, 2003).

2.5.2. Moderator analysis. Moderator analyses were performed to identify study characteristics (i.e., publication type, target audience of the course, discipline area, course length, and scale used) that may explain the difference in the magnitudes of the relationship between social presence and two student outcomes. Neither course design elements nor instructor behaviors served as a moderator because only seven out of 25 studies reported the course design elements or instructor's behavior/role. As Table 4 shows, our coding revealed inconsistent reporting practice of course design; yet these elements are often identified as being critical for

creating effective online learning environments. We also investigated the moderating effect of the scale used for measuring social presence on the relationship to explore how various operationalization, or possibly measurement error, may explain the effect size variation. Comprehensive Meta Analysis (CMA) V2.0 software were used to conduct all quantitative analyses.

2.5.3. Sensitivity analyses. We conducted a priori power analyses with the expected correlation of .5 with 25 effect sizes (Valentine, Pigott, & Rothstein, 2010), ensuring the current meta-analysis has sufficient statistical power (i.e., power = 1) for testing both the average effect size and heterogeneity of effect sizes for both outcomes (i.e., satisfaction and perceived learning).

Studies that report significant outcomes, relatively high effect sizes, and large sample sizes, are more likely to be published than studies with non-significant outcomes, lower effect sizes and smaller sample sizes (Stern & Simes, 1997). This may result in publication bias because more weight was given to published studies versus unpublished studies when summarizing the obtained effect sizes. We used funnel plots (i.e., plot of effect sizes as a function of standard error) to examine if any publication bias exists in the current meta-analysis. We also conducted Orwin's Failsafe N analysis (Orwin, 1983) and Duval and Tweedie's Trim and Fill test (Duval, 2005) using CMA to explore the existence of publication bias.

3. Results

3.1. Relationship between Social Presence and Satisfaction

3.1.1. The average correlation of social presence and satisfaction. The weighted average effect size of the original Pearson's correlation metric was 0.56 ($SE = 0.02$), which indicated a strong, positive relationship between social presence and satisfaction. The forest plot

of the 26 independent Pearson's r effect sizes with their 95% confidence intervals is shown in Figure 1. The mid-point of each line represents the point estimate of the effect size. The length of each line represents the range of 95% chance that the true effect size lies in. The plot suggests large variation among the effect sizes. In addition, large confidence intervals for some effect sizes also indicate variation in precision among effect sizes. Consistent with the observation from the forest plot (Figure 1), the result of Q test indicates significant heterogeneity among effect sizes, $Q(25)=187.64$, $p<0.001$, $\tau^2=.048$. The I^2 statistic was 86.68%, indicating about 87% of variation in the correlations between social presence and satisfaction is due to systematic differences among studies being included in the meta-analysis. The large variation in effect sizes also suggests the need for moderator analyses.

3.1.2. Moderators for social presence and satisfaction relationship. Course length, discipline area, and the type of scale used for measuring social presence were identified as significant moderators in determining the strength of the correlation between social presence and satisfaction as reported in Table 5. More precisely, the weighted average correlation significantly varied among the courses with different course length, $Q(2)=18.26$, $p<0.001$. The average correlation between social presence and satisfaction is weakest when the course length is shorter (6 weeks; $r=0.48$, $k=3$). Although sample sizes for the 8-week courses are small, the magnitude of the correlation seems to be stronger as the course length is longer (8 weeks; $r=0.72$, $k=2$; 16 weeks; $r=0.53$, $k=9$). Second, the strength of the correlation between social presence and satisfaction varies across academic disciplines ($Q(2)=11.93$, $p=0.004$). The correlation for online courses in education ($k=7$, $r=0.42$) is weaker than in other disciplines (i.e., agriculture and life science, nursing, introductory computer skill, and other mixed, $k=8$, $r=0.62$), but stronger than in business ($k=3$, $r=0.32$). Third, the scale type was a significant moderator, $Q(3)=15.89$, $p=0.001$.

The correlation between social presence and satisfaction is stronger when social presence was measured by the Richardson and Swan (2003) scale ($k=3$, $r=0.73$), rather than when it was measured by the scale of Guanwardena and Zittle (1997) ($k=8$, $r=0.58$), the CoI Survey ($k=4$, $r=0.62$), or other scales that were developed for a particular study ($k=9$, $r=0.39$). Finally, neither publication type ($Q(2)=1.90$, $p=0.39$) nor target audience ($Q(2)=2.361$, $p=0.307$) served as a significant moderator. Interestingly, our result showed that the correlation between social presence and satisfaction are the same regardless of whether courses are offered at the graduate or undergraduate level.

3.2. Relationship between Social Presence and Perceived Learning

3.2.1. The average correlation of social presence and perceived learning. The weighted average Pearson's correlation was 0.51 ($SE=0.05$), which indicated a strong positive relationship between social presence and perceived learning. The forest plot of the 26 independent Pearson's r effect sizes with their 95% confidence intervals is shown in Figure 2. Similar to the effect size for satisfaction, the precision of effect sizes for perceived learning varied across studies.

The result of Q test showed significant heterogeneity among effect sizes, $Q(25)=345.77$, $p<0.001$. The estimated between-groups effect size variance was $\tau^2=0.123$, a relatively large variation among 26 effect sizes. The I^2 statistic was 92.77 %, which indicates about 93% of variation in effect sizes was due to the differences among studies. Similar to the results with satisfaction, this high I^2 statistic suggests the need of moderator analysis to identify the factors that explain variation in effect sizes.

3.2.2. Moderators for social presence and perceived learning relationship. First, course length was identified as a significant moderator, $Q(2)=7.19$, $p=0.027$. The weighted

average correlation between social presence and perceived learning for courses last 16 weeks was 0.58 ($k=11$), for courses last 8 weeks was 0.49 ($k=2$), and for courses 6 weeks in length was 0.45 ($k=3$). This indicates that the longer the course lasted, the stronger the relationship between social presence and perceived learning. Second, the average correlations differed by discipline area, $Q(2)=11.92$, $p=0.003$. Although the sample size is small, the correlation tends to be weaker for online courses in Education ($k=7$, $r=0.42$), compared with courses in other disciplines ($k=8$, $r=0.62$), but higher than that for courses in Business ($k=3$, $r=0.32$). Third, the target audience was a significant moderator, $Q(2)=7.69$, $p=0.021$. The online courses for certification or mixed program showed higher average correlation between social presence and perceived learning ($k=9$, $r=0.59$) than the courses offered in graduate program ($k=5$, $r=0.47$) or in undergraduate program ($k=4$, $r=0.35$). Finally, publication type (i.e., $Q(2)=2.49$, $p=0.29$) and scale type (i.e., $Q(3)=4.51$, $p=0.34$) were identified as non-significant moderators, which indicates that no difference in magnitude of the relationship by the type of reports or the scale used for measuring social presence. These results are also summarized in Table 5.

3.3. Sensitivity Analyses

Figures 3 and 4 are the funnel plots of Pearson's r s to examine publication bias. The funnel plot for student satisfaction was nearly symmetrical with two studies on the very left top of the funnel (Figure 3). This indicated that no serious publication bias existed. The results of Orwin's Failsafe N and Trim and Fill analyses also suggested no indication of publication bias as Failsafe N is 134 assuming that the mean of missing effect sizes is 0 and the minimal effect size to be considered it important is 0.1.

In contrast, the funnel plot for perceived learning (Figure 4) was asymmetrical, with an absence of studies on the left bottom of the funnel, indicating that studies with smaller sample

sizes were absent in the pool of studies included in the meta-analysis so that a publication bias might exist. However, smaller sample studies tend to be less influential in meta-analysis because the weight assigned to the effect size based on a small sample size is small. In addition, Orwin's Failsafe N is 82 when we assume the mean of the missing effect sizes is 0 (i.e., no correlation), and the effect size would not hold practical importance when it is smaller than 0.1. This means that at least an additional 82 studies (with the average effect size of 0) would be needed to reduce the current overall effect to 0.1. Because it is unlikely that the average effect size of all missing effect sizes are close to zero even when we retrieve additional effect sizes from the population, the result supports no publication bias for perceived learning effect size. Further, Duval and Tweedie's (2005) Trim and Fill result suggested that three missing cases would make the funnel plot symmetric. With the imputation of the three missing cases, the average effect size is 0.613, which is even higher than the current result. Thus, we can conclude that the impact of publication bias on our finding is minimal and will not alter our findings.

4. Discussion

4.1 Social Presence and Student Outcomes

Although social presence may not be the only factor to consider when designing or evaluating online courses, this meta-analysis on social presence has revealed its exceedingly important function in predicting essential student outcomes, namely satisfaction and perceived learning. In turn, these student outcomes have consistently been shown to impact student persistence, retention, motivation, and success (Astin, 1977, 1992; Booker & Rebmon, 2005; Kuo et al., 2013; Pike, 1993; Roberts & Styron, 2010; Schreiner & Nelson, 2013). The concept of social presence highlights the ideal that we should encourage social interaction as the underpinnings of critical thinking and higher-level learning for students (Garrison & Akyol,

2013). Additionally, when considering the importance of social presence in online courses, we can return to previous studies that frame social presence as having a relationship to students' participation and motivation to participate, course and instructor satisfaction, perceived learning, traditional academic outcomes such as grades, and as having implications for course design and retention (Boston et al., 2009; Cobb, 2009; Gunawardena & Zittle, 1997; Hostetter & Busch, 2013; Jorge, 2010; Swan & Shih, 2005; Swan et al., 2012; Tu & McIsaac, 2002; Weaver & Albion, 2005).

Our findings revealed the magnitude of the relationship between social presence and student outcomes, as well as the ability to predict student outcomes in fully online courses. For students' satisfaction in fully online courses, the magnitude was 0.56; for students' perceived learning it was 0.51, thus indicating that social presence may very well predict students' satisfaction and perceived learning. There is, however, significant variation in the magnitude of the correlations across online course settings. With this in mind, we then conducted moderator analyses to explain some of the features that may differentiate the relationships.

4.2 Moderators for Social Presence-Student Outcome Relationship

For students' satisfaction, we identified course length, discipline area, and the type of scale used for measuring social presence as significant moderators in determining the magnitude of the correlation between social presence and satisfaction. We found that courses longer in duration (more than 6 weeks) tended to have stronger magnitude of the correlation (8 week courses, $r=0.72$, $k=2$; 16 week courses, $r=0.53$, 9). We also found that the correlation varies across discipline area, with education weaker than other disciplines (i.e., agriculture and life science, nursing, introductory computer skill, and other mixed), but stronger than business. Finally, the correlation between social presence and satisfaction is higher when social presence

was measured by the Richardson and Swan scale (2003) compared to other scales included in the meta-analysis.

For students' perceived learning, course length was a significant moderator, the longer the course length the stronger the magnitude, Academic discipline area was again a significant moderator with the correlation tending to be weaker for online courses in Education compared with courses in other disciplines. We also found that course target audiences served as a significant moderator with courses offered for certification or mixed levels showing higher average correlations than general courses offered in graduate or undergraduate program.

Because course length presented as a significant moderator for predicting both student outcomes, we suggest additional research in this area. We found that longer courses more accurately predicted student outcomes. Does this mean we need to expand the context in which we consider the length of a course? Is it better for students to enroll in two semester-length courses or two shorter courses that run consecutively within a semester? We know from the work of Akyol and Garrison (2008) that social presence “develops” over time, with particular aspects increasing and waning as appropriate. One example is the development of community playing a bigger role early on in the course but once it is established the need to develop wanes. When Akyol and Garrison (2008) examined a semester-length course they found that open communication (*in which learners build and sustain a sense of group commitment*) and affective expression (*in which learners share personal expressions of emotion, feelings, beliefs, and values*) were higher in the beginning of the course and that affective expression waned as group cohesion (*in which learners interact around common intellectual activities and tasks*) increased (Akyol & Garrison, 2008; Swan, Garrison, & Richardson, 2009). Would the same or some parallel process occur in shorter intensive courses? In a later study, Akyol, Vaughan, and

Garrison (2011) examined course duration and social presence with 6- and 13- week formats, all else being the same including instructor and discussion topics with the exception of group dynamics. They found statistically significant differences in both affective communication ($t(34) = 5.074, p < 0.001$) and group cohesion ($t(34) = -4.554, p < 0.001$) between the two course duration formats (p. 235). No difference existed for open communication. The authors suggested a longer duration would have allowed for the development of group cohesion and community, although students in the short-term class perceived themselves to be a community.

Academic discipline area was also a significant moderator for predicting both student outcomes. Specifically, we found significant differences between “education,” “business,” and “other” disciplines, suggesting that the correlations varied across these three categories. The findings complement the study by Arbaugh, Bangert, and Cleveland-Innes (2010), who found differences between academic disciplines and concluded the differences in part could be a result of hard versus soft paradigm development and an emphasis on pure versus applied disciplines. In another study, Gorsky, Caspi, Antonovsky, Blau, and Mansur (2010) examined the relationship between disciplinary difference between natural sciences versus humanities and students' and instructors' active participation (posting message) in course forums. They found much higher interaction in science courses than in humanities. The authors noted that one possible explanation might be related to the nature of assignments in science courses. They indicated that since mandatory problem solving is essential part of assignment in science courses, high level of interaction between student-instructor and student-student is expected. Additionally, Arbaugh and Rau (2007) found that students' perceived learning was lower in more quantitative courses than in qualitative courses. The authors pointed out that the discrepancy between different disciplines might be related to how an individual instructor

establishes and facilitates the course (i.e. schedules of activities, structured activities with specific instructions for learner participation). Given this we have to ask ourselves, is this the nature of the teaching methods employed by the disciplines from a traditional context? Or, is it that the specific studies that were conducted and included represent but a fraction of what is available online across disciplines? This finding leads us to more questions than answers and therefore, future research initiatives focusing on discipline-specific differences in the design, facilitation, and outcomes as they relate to social presence.

Moreover, this study provides insights into the measures of social presence currently in use. As summarized in Table 2, previous researchers used a variety of scales to measure social presence. Most prevalent are the CoI survey (Arbaugh et al., 2008), the Gunawardena and Zittle scale (1997), and Richardson and Swan scale (2003). It shows that no two scales are equal, while also indicating that strengths can be found in each despite this disparity. Although two scales may purport to measure the same construct, the dimensions may vary and capture a different element of the same construct based on the set of items (operationalization) included in scale, resulting in differing outcomes. However, we should note that psychometric properties of a scale used to measure a construct will also affect the correlation among constructs. For example, when higher reliability is consistently reported for one scale compared to other scales that measure the same construct (i.e., social presence in our study), the correlation of the construct measured by the scale with higher reliability with student outcomes will also be higher compared with the correlations from other scales as lower reliability results from larger measurement errors and will attenuate the correlation. In this case, the Richardson and Swan scale (2003) demonstrated higher reliability estimates (less measurement error) than the other scales examined. Our result of the meta-analysis was consistent with this finding.

As with other constructs regularly investigated in educational research (e.g., critical thinking), the elusiveness of social presence continues to confound attempts to capture it with a single measure, whether that be through behavioral indicators (de Bruyn, 2004; Rourke, et al., 1999; Swan & Shih, 2005) or self-report measures (Gunawardena & Zittle, 1997; Swan et al., 2008; Tu, 2002a). Several researchers have concluded that because of social presence's multi-dimensional nature, measuring it is no easy feat: especially since defining it is also challenging (Garrison & Akyol, 2013; Kozan & Richardson, 2014; Lowenthal & Dunlap, 2014; Tu, 2002a). As researchers now engaged with this line of inquiry, we concede the struggle of capturing the complex and multifaceted dimensions of social presence. Since these dimensions and our understandings of them seem to evolve with each new context, we implore future researchers to offer concise and succinct operational definitions of the various terms employed. Doing so will help establish a solid foundation from which researchers and educators may engage in fruitful and productive conversations about the nature of learning and the digital realms in which this learning increasingly takes place.

Through the process of conducting this review, we determined the need for improved reporting practices. For example, in some cases instruments used to measure social presence were not fully described. Of the 98 studies initially identified, 57 did not include the statistical information necessary to obtain effect sizes thereby resulting in their exclusion from the study. Moreover, the vast majority did not report on the design elements of the online courses ($k=18$, see Table 4), which may imply that attention is not being paid to principles used to enhance social presence or design effective online courses (Garrison, 2006; Swan et al., 2012; Swan & Shih, 2005; Yamada & Goda, 2012).

Since researchers for online learning and social presence tend to hail from many diverse

disciplinary backgrounds, improving reporting practices by making the various linguistic and conceptual fixtures more accessible and transparent could not only legitimize the field, but also go a long way to further student learning and bolster student outcomes.

4.3. Strengths and Limitations of the Present Study

Limitations of this study include a small sample size (i.e., 26 effect sizes per outcome) despite our attempt to locate relevant studies, which resulted in limiting the generalizability of our meta-analysis. More importantly, the small sample size restricted our opportunities to investigate the heterogeneity of variances in effect sizes. Although we identified some of the moderators that determine the magnitude of effect sizes, a large amount of variation in effect sizes are still unexplained. In particular, it may be worth investigating how the effect size would change as a function of design features either in a primary study or a future meta-analysis. Further, some of the variables that may potentially affect the relationship between social presence and student outcomes (e.g., the role of the instructor, instructor behaviors) were not included in our moderator analyses because of a lack of relevant information reported in the studies, making it a worthy area for future investigations.

Despite these limitations, our study also has a number of strengths, including providing a comprehensive summary of the current literature related to social presence in online learning environments, understanding the nature of the relationship between social presence and student outcomes, and identifying the source of disparity in the reported correlations based on the meta-analytic method. For example, our review provides researchers and practitioners easy access to the wide-ranging research evidence related to social presence in online learning environments as the foundation for future research and practice. Our review indicates the lack of studies that incorporated theory-based course design elements. Little attention to reporting design elements

may imply the limited application of the relevant theory to practice. Moreover, our meta-analysis is the first attempt to synthesize the relevant studies to quantify the common effect size and the disparity among effect sizes across 26 sampled studies. Although the synthesized number of studies may be considered small for a meta-analysis, our results are based on the cumulative outcomes of 3,862 participants for satisfaction and of 3,051 participants for perceived learning. Finally, careful selection of the included studies using the predetermined criteria enhances the statistical validity of our findings.

4.4 Future Research

Our findings point to several possibilities for extending the line of research on social presence and for maximizing students' online learning experiences. First, our review identified a gap in the current literature base in social presence. For example, a primary study in which researchers elucidate the link between social presence and discipline-specific differences in the design, facilitation, and outcomes will provide insights into creating an effective online learning environment but one that may be tailored to that a specific discipline. Second, as students' enrollment in online learning continues to grow, future quality research should focus on identifying how course design elements interact with learning environments and outcomes unique to a particular academic discipline and target student populations.

5. Conclusion

In conclusion, this study provided a comprehensive summary of the current state of the research on social presence using scale-based measures in online learning environments. We have determined that the scale-based measures currently in use can aid in investigating social presence, can be used to predict student outcomes, but can also be improved. The results of this study have implications for conversations about course duration and optimization for facilitating

learning. Additionally, the findings from the moderator analyses can be used to facilitate current and new discussions on how to design a meaningful learning environment from a social learning perspective, one that successfully promotes students' learning. We hope our findings will stimulate the improvement in the quality of reporting practices of research design and findings, as well as to direct future research toward advancing our understanding of effective online learning environments.

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Table 1

Evolution of the Definition of Social Presence

Study	Defines Social Presence as...
Short, Williams, & Christie (1976)	"...the salience of the other in a mediated communication and the consequent salience of their interpersonal interactions" (p. 65).
Walther (1992)	"the feeling that other actors are jointly involved in communicative interaction" (Walther, 1992, p. 54)
Gunawardena & Zittle (1997)	"the degree to which a person is perceived as 'real' in mediated communication" (p. 8).
McLeod, Baron, Marti, & Yoon (1997)	"The degree of tangibility and proximity of other people that one perceives in a communication situation" (p. 708).
Garrison, Anderson, & Archer (1999)	"the ability of participants in the Community of Inquiry to project their personal characteristics into the community, thereby presenting themselves to the other participants as real people" (p. 89).
Biocca, Harms, & Gregg (2001)	"Mediated social presence is the moment-by-moment awareness of the co-presence of another sentient being accompanied by a sense of engagement with the other (i.e., human, animate, or artificial being)" (p. 2).
Picciano (2002)	"A student's sense of being in and belonging in a course and the ability to interact with other students and an instructor although physical contact is not available" (p. 22).
Biocca & Harms (2002)	"moment-to-moment awareness of co-presence of a mediated body and the sense of accessibility of the other being's psychological, emotional, and intentional states" (p. 10).
Tu & McIsaac (2002)	"the degree of feeling, perception, and reaction to another intellectual entity in the CMC environment" (p. 146)
Shin (2002)	"feeling intimacy or togetherness in terms of sharing time and place" (p. 122).
Shea, Pickett, & Pelz (2003)	"the ability of students to project themselves socially and affectively into a community of inquiry" (p. 65).
Kang, Choi, & Park (2007)	"perceived depth of relationships with other learners and the community during e-learning" (p. 2).
Kehrwald (2008)	"an individual's ability to demonstrate his/her state of being in a virtual environment and so signal his/her availability for interpersonal transactions" (p. 94).
Swan, Richardson, & Garrison (2009)	"the degree to which participants in computer-mediated communication feel affectively connected one to another" (p. 9).
Garrison (2011)	"ability of participants to identify with the group or course of study, communicate purposefully in a trusting environment, and develop personal and affective relationships progressively by way of projecting their individual personalities" (p. 34).

(Adapted from Swan, Richardson, & Cleveland-Innes, 2012).

Table 2

Overview of Social Presence Self-report Measures for Online Learning Environments

Study*	Measures	Description	Reliability**
Gunawardena (1995)	GlobalEd Survey Questionnaire, v. 1 (Gunawardena, 1995)	<ul style="list-style-type: none"> • 17 bi-polar scales 	Not reported
Gunawardena & Zittle (1997)	GlobalEd Survey Questionnaire, v. 2 developed for this study (Gunawardena & Zittle, 1997)	<ul style="list-style-type: none"> • 53 five-point Likert scale • 14 items for social presence • One dimension for social presence; immediacy 	$\alpha = 0.88$ for social presence subscale
de Greef & Ijsselsteijn (2001)	IPO Social Presence Questionnaire (IPO-SPQ) (de Greef & Ijsselsteijn, 2001)	<ul style="list-style-type: none"> • 12 seven-point Likert scale • Two different approaches to measure social presence: agree-disagree items and semantic differential items 	$\alpha = 0.72$ for social presence (agree-disagree items) $\alpha = 0.90$ for social presence (semantic differential items)
Biocca, Harms, & Gregg (2001)	The Networked Minds Questionnaire (Biocca, Harms, & Gregg, 2001)	<ul style="list-style-type: none"> • 69 seven-point Likert scale • Three dimensions of social presence; co-presence, psychological involvement, and behavioral engagement 	$\alpha = 0.69$ to 0.87
Tu (2002a)	Social Presence and Privacy Questionnaire (SPPQ; Tu, 2002a), based on the CMC attitude instrument (Steinfeld, 1986) and perceived privacy (Witmer, 1997)	<ul style="list-style-type: none"> • 17 five-point Likert scale items for social presence • Three dimensions of social presence; social context, online communication and interactivity 	$\alpha = 0.74$ to 0.85
Tu & McIsaac (2002)	The CMC Questionnaire (Tu, 2002a) (aka Tu's SPPQ instrument)		$\alpha = 0.71$ to 0.82 for social contexts, online communication, interactivity, system privacy, and feeling of privacy
Picciano (2002)	Researcher-developed scale based on the Inventory of Presence Questionnaire developed by the Presence Research Working Group and Tu's work (2001)	<ul style="list-style-type: none"> • 11 seven-point Likert scale items for social presence 	Not reported

Richardson & Swan (2003)	Social Presence Survey (Gunawardena & Zittle, 1997)	<ul style="list-style-type: none"> • 16 six-point Likert scale • Two dimensions for social presence: intimacy and immediacy 	Not reported
Garrison, Cleveland-Innes, & Fung (2004)	Researcher-developed scale (Garrison, Cleveland-Innes, & Fung, 2004)	<ul style="list-style-type: none"> • 10 five-point Likert scale for a social presence subscale 	$\alpha = 0.92$ for social presence subscale
Wise, Chang, Duffy, & del Valle (2004)	Perceived Instructor Social Presence Survey (Wise, Chang, Duffy, & del Valle, 2004)	<ul style="list-style-type: none"> • 26 five-point Likert scale • Three dimensions of social presence: message friendliness, instructor friendliness, and knowing instructor 	$\alpha = 0.85$ for message friendliness $\alpha = 0.96$ for instructor friendless $\alpha = 0.93$ for knowing instructor
Swan & Shih (2005)	Social Presence Survey (Swan & Shih, 2005) based on Richardson & Swan (2003) and Shih (2004)	<ul style="list-style-type: none"> • 19 five-point Likert scale • Eight items for perceived social presence of peers • Five items for perceived social presence of instructors 	not reported
Laffey, Lin, & Lin (2006)	Social Ability Instrument (Laffey et al., 2006) based in part on Picciano (2002) and Tu (2001)	<ul style="list-style-type: none"> • 12 seven-point Likert scale • Four items for social presence 	$\alpha = 0.84$ for social presence
Hostetter & Busch (2006)	Researcher-developed scale based on Richardson & Swan (2003) and Gunawardena & Zittle (1997)	<ul style="list-style-type: none"> • 10 six-point Likert scale 	$\alpha = 0.87$
Mykota & Duncan (2007)	The Computer-mediated Communication Questionnaire (CMCQ) (Tu, 2005)	<ul style="list-style-type: none"> • 24 five-point Likert scale 	Not reported
Kang, Choi, & Park (2007)	Researcher-developed scale (Kang, Choi, & Park, 2007)	<ul style="list-style-type: none"> • 19 five-point Likert scale • Three dimensions for social presence: co-presence (5 items), influence (7 items) and cohesiveness (7 items) 	$\alpha = 0.74$ for co-presence $\alpha = 0.76$ for influence $\alpha = 0.73$ for cohesiveness

Arbaugh, et al. (2008).	Community of Inquiry survey (CoI survey) (Arbaugh et al., 2008)	<ul style="list-style-type: none"> • 34 five-point Likert scale • nine items for the social presence subscale • Three dimensions of social presence; open communication, group cohesion, and affective expressions 	$\alpha = 0.91$ for social presence subscale
Arbaugh (2008)	Researcher-developed scale (Arbaugh, 2008)	<ul style="list-style-type: none"> • 22 seven-point Likert scale • Eight items for social presence 	$\alpha = 0.87$ for social presence
Boston, Diaz, Gibson, Ice, Richardson, & Swan (2009)	The CoI survey (Arbaugh et al., 2008)	<ul style="list-style-type: none"> • 34 five-point Likert scale • nine items for the social presence subscale • Three dimensions of social presence; open communication, group cohesion, and affective expressions 	Not reported
Liu, Gomez, & Yen (2009)	The Social Presence and Privacy Questionnaire (SPPQ) (Tu, 2002a, 2002b)	<ul style="list-style-type: none"> • 87 five-point and 3 two-point Likert scale 	Not reported
Cobb (2011)	Social Presence scale from the GlobalEd Questionnaire, v. 2 (Gunawardena & Zittle, 1997)	<ul style="list-style-type: none"> • 14 five-point Likert scale 	$\alpha = 0.87$ for social presence
Kim (2011)	Researcher developed Social Presence scale (Kim, 2011)	<ul style="list-style-type: none"> • 19 five-point Likert scale • Four dimensions for social presence: mutual attention & support, affective connectedness, sense of community and open communication. 	$\alpha = 0.82$ to 0.87 for the four dimensions

Leong (2011)	Social Presence and Cognitive Absorption survey adopted from Tu (2002a) and Agarwal & Karahanna (2000)	<ul style="list-style-type: none"> • 44 seven-point Likert scale • 16 items for social presence • Three dimensions of social presence; social context, online communication, and interactivity 	$\alpha = 0.67$ for social context $\alpha = 0.84$ for online communication $\alpha = 0.67$ for interactivity
Joo, Lim, & Kim (2011)	The scale by Garrison, Cleveland-Innes, & Fung (2004) translated into Korean	<ul style="list-style-type: none"> • 26 five-point Likert scale • six items for social presence subscale 	$\alpha = 0.84$ for social presence
Kim, Kwon, & Cho (2011)	Researcher developed scale based on Kim (2011)	<ul style="list-style-type: none"> • 18 five-point Likert scale • Four dimensions of social presence; attention and support, affective connectedness, sense of community, and open communication 	$\alpha = 0.897$
Strong, Irby, Wynn, & McClure (2012)	The Social Presence Scale (Short et al., 1976)	<ul style="list-style-type: none"> • 14 five-point Likert scale 	Ex post facto $\alpha = 0.94$
Hostetter & Busch (2013)	Social Presence Survey (Richardson & Swan, 2003)		Not reported
Reio & Crim (2013)	Social Presence Survey based on Gunawardena & Zittle (1997)	<ul style="list-style-type: none"> • 12 five-point Likert scale 	$\alpha = 0.93$
Kang & Im (2013)	Learner-Instructor Interaction Survey (Kang, 2009)	<ul style="list-style-type: none"> • 27 five-point Likert scale • Five dimensions: guidance and facilitating learning, social intimacy, instructional communication, presence of instructor, and instructional support 	$\alpha = 0.96$ for overall scale $\alpha = 0.82$ to 0.92 for learner-instructor interaction

Note. *Studies listed in chronological order by publication date. * α = Cronbach's alpha for internal consistency reported for their study sample.

Table 3

List of Studies included in the Meta-Analysis

Author(s)	Year	Course Length (weeks)	Subject Area	Scale	Outcome	N	r
Akyol & Garrison	2008	16	Ed	CoI	PL	15	0.46
					SAT	15	0.54
Alaulamie	2014		O	CoI	SAT	814	0.50
Arbaugh	2008		B	Richardson & Swan (2003)	PL	656	0.19
Catron	2012		O	CoI	SAT	252	0.43
Cobb	2011	12	O	CoI	SAT	128	0.63
					SAT	128	0.69
					PL	128	0.61
Crim	2006	16	O	Gunawardena & Zittle (1997)	SAT	280	0.72
					PL	241	0.72
					SAT	270	0.72
					PL	280	0.55
Gunawardena & Zittle	1997	16		Gunawardena & Zittle (1997)	SAT	50	0.78
Horzum	2015		O	Gunawardena & Zittle (1997)	SAT	205	0.60
Hostetter	2012			Richardson & Swan (2003)	PL	121	-0.41
Jones	2007		B	Gunawardena & Zittle (1997)	PL	150	0.43
					PL	150	0.34
					PL	148	0.42
					PL	148	0.41
Joo, Lim, & Kim	2011	16	O	Garrison, Cleveland-Innes, & Fung (2004)	SAT	709	0.41
Kang, Liew, Kim, & Park	2014	16	Ed	Kang, Choi, & Park (2007)	PL	63	0.18
					SAT	63	0.38
					SAT	47	0.63
					PL	47	0.29

(Continued)

Table 3

List of Studies included in the Meta-Analysis

Author(s)	Year	Course Length (weeks)	Subject Area	Scale	Outcome	N	r
Kang, Kim, Kim, Yoo & Kim	2012	10	Ed	Kang, Park, Jung, Park (2009)	SAT	53	0.23
Kang, Park, & Choi	2006	6	Ed	Kang, Park, & Choi (2006)	SAT	71	0.69
					PL	71	0.02
Kim, Kwon, & Cho Newberry	2011	16	Ed	Kim (2011)	SAT	81	0.41
	2004	16	O	Biocca, Harms, & Gregg (2001)	SAT	94	0.34
					SAT	51	0.06
					SAT	51	0.58
Nyachae	2011	6	Ed	CoI	PL	81	0.76
					SAT	81	0.82
Richardson & Swan	2003	16		Richardson & Swan (1997)	PL	95	0.68
					SAT	95	0.60
					PL	94	0.83
					PL	74	0.55
					PL	45	0.50
					PL	93	0.46
					PL	39	0.80
					PL	86	0.40
Rockinson-Szapkiw	2009	8 & 16	O	CoI	PL	347	0.49
Spears	2012	--	O	Gunawardena & Zittle (1997)	SAT	159	0.73
Strong, Irby, Wynn, & McClure	2012		Ed	Richardson & Swan (2003)	SAT	109	0.22
					PL	14	0.56
Swan & Shih	2005	--	Ed	Richardson & Swan (2003)	PL	51	0.70
					PL	51	0.74
					SAT	51	0.56
					SAT	51	0.81
Teng	2005	--	Ed	Adaption of Shih (2004)	PL	46	0.69
					SAT	46	0.57

Table 3

List of Studies included in the Meta-Analysis

Author(s)	Year	Course Length (weeks)	Subject Area	Scale	Outcome	N	r
Wise, Chang, Duffy, & del Valle	2004	--	Ed	Perceived Instructor Social Presence	PL	13	0.75
					SAT	14	0.44
					PL	13	0.64
					SAT	13	0.61
					PL	40	0.22
					SAT	40	0.14

Note. -- = not reported, O=other, Ed=Education, B=Business, SAT=satisfaction, PL=Perceived Learning, N = primary study sample size, r = Pearson's correlation between social presence and the outcome

Table 4

Summary of Coded Variables for Online Course Characteristics and the Number of Studies (k) Reporting Characteristics

Variable	Code	k
Course design elements	Welcome messages	4
	Include student profiles	2
	Incorporate audio	4
	Limit class size	0
	Structure collaborative learning activities	6
	Individual assignments	3
	Self-tests	2
	Written assignments	4
	Lectures/notes/readings	3
Instructor behaviors	Contribute to discussion boards	6
	Promptly answer e-mail	3
	Provide frequent feedback	3
	Strike up a conversation	3
	Share personal stories and experiences	3
	Use humor	2
	Use emoticons	3
	Address students by name	3
	Allow students options for addressing the instructor	0
	Include instructor profile	1
	Share personal values, beliefs, and attitudes	2
	Salutations and greetings	1
	Accommodating diverse learners	0

Table 5
Results of the Moderator Analyses

Variable	Category	Satisfaction			Perceived Learning		
		<i>r</i>	<i>k</i>	Q_{between}	<i>r</i>	<i>k</i>	Q_{between}
Publication type	Journal article	0.50	10	1.90	0.51	13	2.49
	Unpublished conference paper	0.60	5		0.16	3	
Target audience of the course	Graduate	0.59	12		0.59	10	
	Undergraduate	0.52	5	2.36	0.47	5	7.69*
	Other (e.g., mix, certification)	0.42	3		0.35	4	
Discipline area	Education	0.60	8		0.59	9	
	Business	0.42	7	11.92*	0.42	7	11.92*
	Other	0.32	3		0.32	3	
Course length	6 weeks	0.62	8		0.62	8	
	8 weeks	0.48	3	18.26*	0.45	3	7.19*
	16 weeks	0.72	2		0.49	2	
Scale	Author (2003)	0.53	9		0.58	11	
	Gunawardena & Zittle (1997)	0.73	3	15.89*	0.39	4	4.51
	CoI (2008)	0.58	8		0.60	8	
	Other	0.62	4		0.52	4	
		0.39	9		0.43	7	

* $p < 0.05$

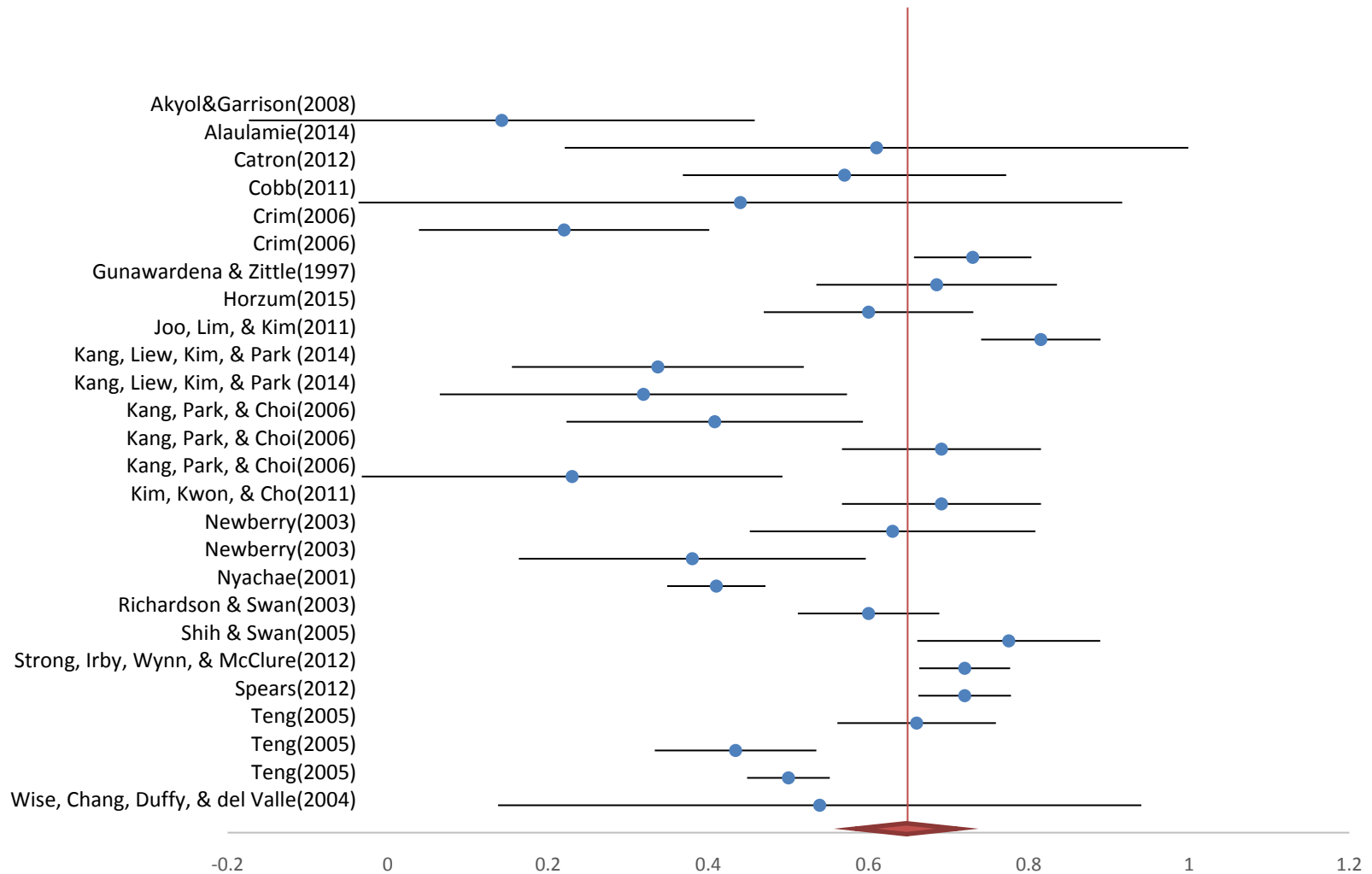


Figure 1. Forest plot of correlation of social presence and students' satisfaction

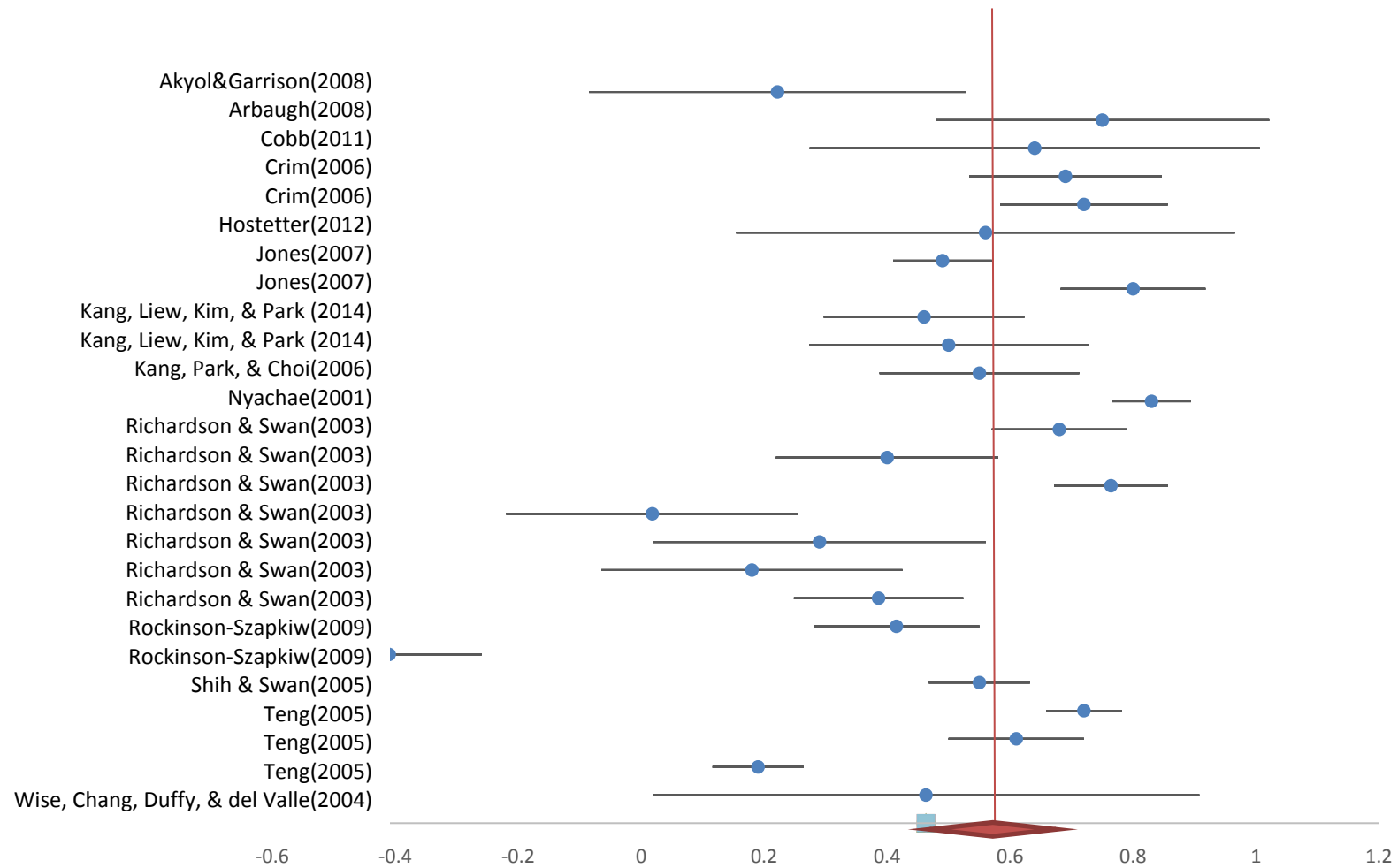


Figure 2. Forest plot for correlation of social presence and students' perceived learning

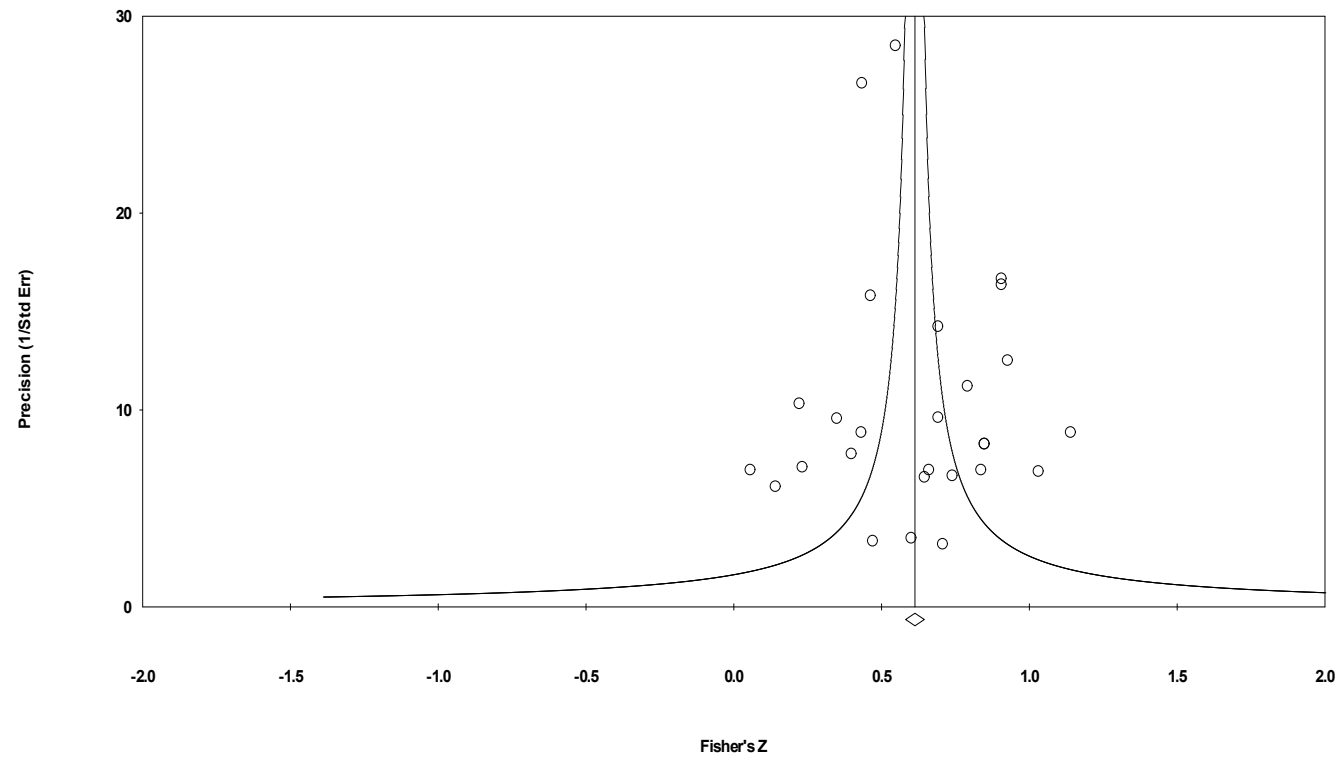


Figure 3. Funnel plot for correlation of social presence and students' satisfaction ($k = 26$)

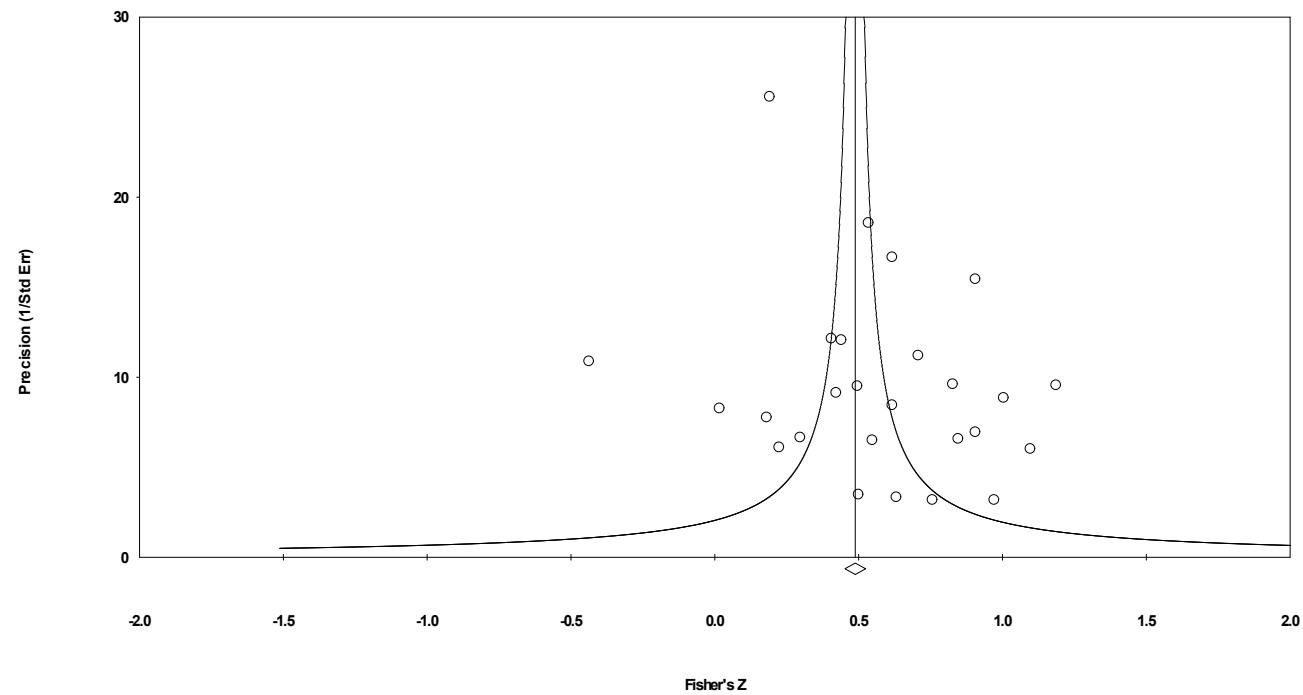


Figure 4. Funnel plot for correlation of social presence and students' perceived learning ($k = 26$)