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# Role of social presence and cognitive absorption in online learning environments

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This article investigates the relationships between social presence, cognitive absorption, interest, and student satisfaction in online learning. A hypothesized structural equation model was developed to study these critical variables that may influence interaction in online learning environments. Contrary to expectations, the study determined that social presence does not impact satisfaction directly. However, the study concludes that while social presence is related to student satisfaction, its impact is not direct but rather mediated by cognitive absorption. In addition, the study clarified the impact of students' interest on social presence, cognitive absorption, and satisfaction. The results of this study indicate that interest affects social presence and satisfaction directly. Additionally, interest appears to influence satisfaction indirectly through social presence and cognitive absorption. Contrary to expectations, this study did not reveal any significant relationship between interest and cognitive absorption.

**Keywords:** social presence; cognitive absorption; interest; online student satisfaction

## Introduction

Distance education has grown substantially over the last several decades. Although distance education provides many positives for students, such as increasing access to educational opportunities, attrition in distance education courses can pose a significant problem. Dropout rates for online learning courses are believed to be 10–20% higher than for traditional courses (Carr, 2000; Frankola, 2001). To improve retention in online distance education courses, efforts must be made to understand and enhance student satisfaction with online learning environments. Unraveling all the elements that influence student satisfaction in online learning environments is a difficult task; however, researchers have studied many factors that have been shown to influence student satisfaction.

In a study about factors contributing to student satisfaction in online learning environments, Bolliger and Martindale (2004) determined that instructor variables, such as communication, feedback, preparation, content knowledge, teaching methods, encouragement, accessibility, and professionalism; technical issues; and interactivity were the most important factors. They contended that being a good instructor and having reliable technology equipment are critical in online environments. Additionally,

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it is crucial that students have ample opportunities to participate in discussions in order to be engaged in online courses.

Similarly, Leong, Ho, and Saromines-Ganne (2002) identified five dimensions of online student satisfaction: interaction, instructor aspects, system-wide technology, workload/difficulty, and function-specific technology. Further, they found four of these five dimensions significantly influence overall student satisfaction with online courses: instructor aspects, system-wide technology, workload/difficulty, and interaction. Shea, Fredericksen, and Pickett (2000) also determined that the level of students' interaction with the instructor and classmates was significantly correlated with the level of satisfaction and perceived learning in online learning courses. The implication of these studies is that instructors of online courses may be able to increase their online students' satisfaction by addressing the appropriate factors underlying student satisfaction.

Among the factors that influence student satisfaction, social presence has been found to be a strong predictor of satisfaction in online learning environments (Gunawardena, Lowe, & Anderson, 1997; Gunawardena & Zittle, 1997; Hostetter & Busch, 2006; Richardson & Swan, 2003). Although social presence has a strong influence on student satisfaction in online learning environments, the picture is more complex. An area that has been overlooked is the influence of cognitive absorption. The purpose of this study was to empirically investigate the role of social presence and cognitive absorption in online learning environments. Specifically, this study developed a hypothesized structural equation model (SEM) to investigate the relationship between social presence and student satisfaction with online learning as mediated by cognitive absorption. In addition, the study clarified the impact of students' interest on both cognitive absorption and satisfaction. The study investigated the following questions:

(1) What is the relationship between social presence and student course satisfaction?
(2) What is the relationship between cognitive absorption and student satisfaction?
(3) What is the relationship between social presence and cognitive absorption in online learning environments?
(4) What is the relationship between students' interest and cognitive absorption and satisfaction?

## Background

Interaction is a ubiquitous term in technology-mediated distance education literature. It has been identified as one of the major constructs in distance education research (McIsaac & Gunawardena, 1996; Moore, 1989; Saba, 2000; Wagner, 1994). The basic premise is that learners learn most effectively when they are actively engaged as opposed to passively reading or listening (Brooks, 1997).

Researchers studying interaction in online learning environments have used social presence theory to analyze interaction, communication, and collaborative learning (Gunawardena, 1995; Gunawardena & Zittle, 1997; Swan, 2002; Tu, 2000; Tu & McIsaac, 2002). Social presence is defined as 'the degree of salience of the other person in the interaction' (Short, Williams, & Christie, 1976, p. 65). Most of these studies applied a semantic differential technique to measure the four dimensions of social presence proposed by Short et al.: personal–impersonal, sensitive–insensitive, warm–cold, and sociable–unsociable. Several shortcomings associated with the use of

Short et al.'s social presence instrument have led to the development and validation of an instrument that more accurately measures social presence in online learning environments (Tu, 2002). In this study we used Tu's validated survey to measure students' perception of the level of social presence in online learning environments. Although social presence has been shown to influence student satisfaction, considering social presence in isolation may oversimplify a complex psychological process.

A discussion of social presence and satisfaction in online learning environments should also consider cognitive absorption theory. Cognitive absorption is defined as 'a state of deep involvement with software' (Agarwal & Karahanna, 2000, p. 673) and is derived from Csikszentmihalyi's theory of flow (1990), which describes 'the state in which people are so involved in an activity that nothing else seems to matter' (p. 4). Agarwal and Karahanna created and validated an instrument to measure the five dimensions of the cognitive absorption construct: temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity.

Cognitive absorption has been found to be a proximal antecedent of two important beliefs about adoption of new information technologies (Agarwal & Karahanna, 2000; Agarwal, Sambamurthy, & Stair, 1997). A precursor concept to cognitive absorption, cognitive engagement, was determined to be a significant learning outcome in technology-mediated distance learning (Webster & Hackley, 1997). Hence, cognitive absorption may also be a significant learning outcome, as measured by student satisfaction, in online learning environments.

Although this background section briefly highlights the factors of social presence and cognitive absorption, these constructs will be discussed in more depth in the following section along with the additional constructs of interest and student satisfaction. Too often these constructs have been examined in isolation of each other. Studying the interaction of these constructs and the influence of each on the other may lead to a richer understanding of how to enhance student satisfaction in online learning environments.

## Literature review

Many factors influence an online learning environment. These interrelated factors, in turn, will impact course design and pedagogy. This section describes and examines the following three factors that literature suggests have an impact on student satisfaction in online learning environments: social presence, cognitive absorption, and interest.

### *Social presence*

Researchers studying interactions in computer-mediated communication (CMC) systems have used social presence to study interaction, communication, and collaborative learning (Gunawardena, 1995; Gunawardena & Zittle, 1997; Swan, 2002; Tu, 2000; Tu & McIsaac, 2002). According to Short et al. (1976), social presence is the degree to which a person is aware of another person in a technology-mediated communication setting. They believe social presence to be a feature or characteristic of the communication medium. They also contend that communication media differ in their degree of social presence and that these variations affect the nature of the interaction. Furthermore, social presence of a medium is a 'perceptual or attitudinal dimension of the user, a "mental set" towards the medium' (Short et al., 1976, p. 65). Therefore, although social presence is dependent on the objective qualities of a

communication medium, it is a subjective quality of the medium as perceived by the user. Short et al. believe that it is imperative to know how users perceive the medium, what their feelings are, and what their 'mental set' is (1976, p. 65).

Research suggests social presence is strongly related to online interaction, raising implications for online community building (Gunawardena, 1995; Gunawardena & Zittle, 1997; Tu & McIsaac, 2002). Rafaeli (1988, 1990) further contends that social presence exists only when interactivity, which is the 'actual quality of a communication sequence or context' (Gunawardena, 1995, p. 152), is realized and when users notice it.

The most common way of measuring social presence is through the semantic differential technique (Osgood, Suci, & Tannenbaum, 1957), which uses a series of bipolar scales to measure the four dimensions of social presence proposed by Short et al. (1976): personal–impersonal, sensitive–insensitive, warm–cold, and sociable–unsociable. Tu (2002) argued that current instruments used to measure social presence (Gunawardena & Zittle, 1997; Short et al., 1976) fail to adequately capture perceptions of social presence because they do not take into account various other important variables, such as privacy, recipients, tasks, and topics. These shortcomings have led to the development and validation of an instrument that more accurately measures social presence in an online learning environment.

Tu (2002) determined that social presence is comprised of three dimensions: social context, online communication, and interactivity. The five variables that make up the social context dimension are CMC as a social form, as an informal and casual way to communicate, as a personal communication form, as a sensitive means for communicating with others, and as comfortable with familiar persons. The dimension of online communication includes five variables: CMC conveys feelings and emotion, and the language used in CMC is stimulating, expressive, meaningful, and easily understood. Interactivity comprises four variables: CMC as pleasant, immediate, responsive, and comfortable when dealing with familiar topics.

Studies have demonstrated the positive relationship between students' perception of social presence and their level of perceived satisfaction with online courses (Gunawardena et al., 1997; Hostetter & Busch, 2006; Richardson & Swan, 2003). Swan and Shih (2005), in particular, found positive associations between social presence and satisfaction within online discussions. In a study designed to examine the effectiveness of social presence as a predictor of overall student satisfaction in a text-based CMC environment, Gunawardena and Zittle (1997) determined that social presence explained about 60% of the variance in the overall learner satisfaction.

Social presence theorists posit that there exists a relationship between social presence and online interaction and that social presence strongly impacts the overall student satisfaction in CMC environments (Gunawardena, 1995; Gunawardena & Zittle, 1997; Hostetter & Busch, 2006; Richardson & Swan, 2003; Tu & McIsaac, 2002). Consequently, the first hypothesis of this study is:

**Social presence will be positively related to student satisfaction with online courses.**

Although social presence is hypothesized to influence student satisfaction, a promising line of research that has been overlooked in online learning environments is cognitive absorption. To understand the complexity of student satisfaction, it may be necessary to investigate the influence and interaction of different factors rather than exclusively relying on the previously demonstrated impact of social presence.

### *Cognitive absorption*

Cognitive absorption, a state of deep involvement or a holistic experience that an individual has with information technology (Agarwal & Karahanna, 2000), is rooted in psychology and derived from two closely interrelated concepts of flow (Csikszentmihalyi, 1990) and cognitive engagement (Webster & Hackley, 1997). Agarwal and Karahanna defined cognitive absorption as a convergence of flow (Trevino & Webster, 1992) and cognitive engagement (Webster & Hackley, 1997) with an additional dimension, temporal dissociation. Agarwal and Karahanna also identified and described the five dimensions of the cognitive absorption construct: temporal dissociation, or the inability to register the passage of time while engaged in interaction; focused immersion, or the experience of total engagement where other attentional demands are, in essence, ignored; heightened enjoyment, capturing the pleasurable aspects of the interaction; control, representing the user's perception of being in charge of the interaction; and curiosity, tapping into the extent the experience arouses an individual's sensory and cognitive curiosity (Malone, 1981, as cited in Agarwal & Karahanna, 2000).

Although to date no work has directly examined the relationship between cognitive absorption and student satisfaction in online learning environments, cognitive engagement, a predecessor concept to cognitive absorption, has been found to be a significant learning outcome in technology-mediated distance learning (Webster & Hackley, 1997). This suggests that cognitive absorption may significantly influence student satisfaction in online learning environments and that it should be investigated further. Additionally, flow (from which cognitive absorption is derived) leads to increased learning, increased creativity, perceived behavioral control, exploratory mindset, and positive affect (Chen, 2000; Ghani, 1995; Hoffman & Novak, 1996). Hence, the second hypothesis of this study is:

**Cognitive absorption will be positively related to student satisfaction with online courses.**

To date, no work has examined the relationship between social presence and cognitive absorption. However, since both social presence and cognitive absorption are hypothesized to be positively related to and are antecedents to satisfaction, it stands to reason that one of the two constructs could be a mediator variable to the other.

Pace (2004) suggested that there exists a relationship between flow (from which cognitive absorption is derived) and telepresence. One of the defining characteristics of flow is time distortion. When a person experiences flow, hours seem to transform into minutes while seconds may last for hours. Another concept that is closely related to the distortion in time perception is the distortion of the sense of space. Heeter (1992) described the sense of presence that a person experiences when he/she is physically removed from the scene (e.g., in an online discussion) as telepresence. Researchers studying the role of flow in online environments (e.g., Chen, 2000; Novak, Hoffman, & Yung, 2000; Skadberg & Kimmel, 2004) have identified telepresence as an antecedent to flow in their flow models. Furthermore, Heeter contended that telepresence is composed of three basic components: personal presence, social presence, and environmental presence. This suggests that social presence may be an antecedent to cognitive absorption and that cognitive absorption acts as a mediator variable between social presence and student satisfaction. Therefore, the third hypothesis of the study is:

**Social presence is an antecedent to cognitive absorption and will be positively related to cognitive absorption.**

Although social presence, cognitive absorption, and the combined influence may substantially explain student satisfaction, students' interest must not be ignored.

### *Interest*

The terms interest and intrinsic motivation have been used interchangeably and many researchers assume the effects of both interest and intrinsic motivation to be very similar (Naceur & Schiefele, 2005). Research studies (Naceur & Schiefele, 2005; Schiefele, 1991; Schiefele & Csikszentmihalyi, 1994, 1995) have found that interest may influence learning and, consequently, student satisfaction. Schiefele and Csikszentmihalyi (1994) determined that interest influences the quality of classroom experience. In 1995, Schiefele and Csikszentmihalyi also examined the relationship between interest and math achievement. Following Schiefele (1991), this study defined interest as a content-specific concept because it fits well with theories of knowledge acquisition and is probably readily amenable to instructional influence.

A corollary to the investigation of the role of social presence and cognitive absorption in learner satisfaction with online courses is the aspect of students' interest in the topic covered in the online course. Many studies determined that interest may impact student satisfaction (Naceur & Schiefele, 2005; Schiefele, 1999; Schiefele & Csikszentmihalyi, 1995). In addition, Csikszentmihalyi and LeFevre (1989) contended that intrinsic motivation is positively related to the flow experience (from which cognitive absorption is derived). Hence, it stands to reason that interest should also have an impact on cognitive absorption. Consequently, the fourth and final hypothesis of this study is:

**Interest will be related to cognitive absorption and student satisfaction with online courses.**

The review of literature established the possible role of social presence, cognitive absorption, and interest in student satisfaction. The purpose of this study was to develop and test a model to investigate the relationships between social presence, cognitive absorption, interest, and student satisfaction with online learning environments. Hence, this research study proposed the model shown in Figure 1.

## Method

### *Participants*

Since the main objective of this study was to investigate the role of social presence and cognitive absorption in online learning environments, we used an online survey to collect data. To maintain ecological validity and ensure that the sample represented the online student population, the sampling frame was based on students who were taking a predominantly online course that could include some face-to-face sessions (online hybrid) but excluded traditional face-to-face courses supplemented by some online course components. The participants consisted of 294 students who were enrolled in 19 online or online hybrid courses of the University of Hawaii

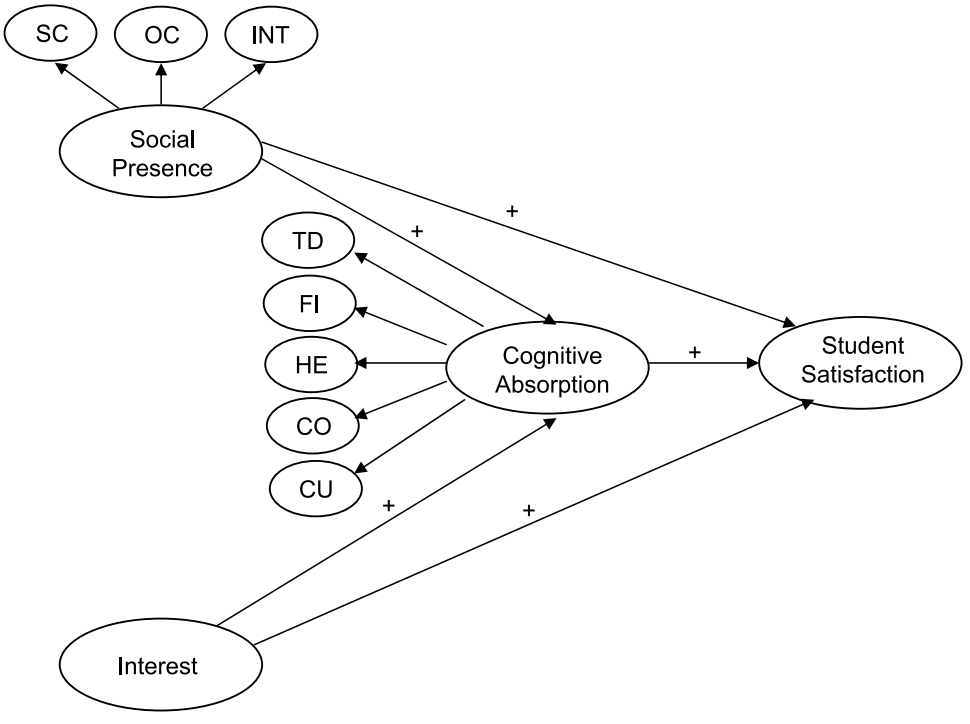


Figure 1. The proposed theoretical model.
Note: SC = Social Context; OC = Online Communication; INT = Interactivity; TD = Temporal Dissociation; FI = Focused Immersion; HE = Heighten Enjoyment; CO = Control; CU = Curiosity.

system and Hawaii Pacific University during the Spring 2005 and Fall 2005 semesters. The 19 courses spanned a wide range of content areas (numbers in parenthesis): Astronomy (1), Business Management (2), Computer (1), English (4), Educational Technology (2), History (1), Art (1), Mathematics (1), Nursing (1), and Education (5).

### *Measure*

To test the hypotheses and the model proposed by the study, we developed an instrument based on validated survey instruments to measure social presence (Tu, 2002) and cognitive absorption (Agarwal & Karahanna, 2000). The survey questionnaire consisted of 44 statements that determined students' perception of social presence, cognitive absorption, interest, and satisfaction with online courses. Students' interest in the subject matter covered in the online courses they were taking was measured using three statements developed based on general student course evaluations. Student satisfaction was measured based on students' responses to five survey questions derived from Tallman's student satisfaction questionnaire (1994). Table 1 summarizes all the variables measured for the study's main constructs. For each statement, students were asked to evaluate the extent of their agreement with each statement. Throughout the survey instrument, a 7-point, Likert-type scale ranging from strongly disagree to strongly agree was used.

Table 1. Original measured items of study's main constructs.

| Construct (source) | Dimension | Measure item | Item # in survey |
|---|---|---|---|
| Social Presence, SP (Tu, 2002) | Social Context (SC) | Online learning environment (OLE) provides a social form of communication (SC1) | 1 |
| | | OLE provides an informal and casual way to communicate (SC2) | 2 |
| | | OLE is impersonal (SC3) | 3 |
| | | OLE provides a sensitive means of communicating (SC4) | 4 |
| | | OLE as being comfortable with familiar persons (SC5) | 5 |
| | | OLE as being uncomfortable with unfamiliar persons (SC6) | 6 |
| | Online Communication (OC) | OLE conveys feeling and emotion (OC7) | 7 |
| | | Language used in OLE is stimulating (OC8) | 8 |
| | | Difficulty in expressing oneself in OLE (OC9) | 9 |
| | | Language used in OLE is meaningful (OC10) | 10 |
| | | Language used in OLE is easily understood (OC11) | 11 |
| | Interactivity (INT) | Using OLE to communicate is pleasant (INT12) | 12 |
| | | Replies in OLE are immediate (INT13) | 13 |
| | | OLE users are normally responsive (INT14) | 14 |
| | | OLE as being comfortable with familiar topics (INT15) | 15 |
| | | OLE as being uncomfortable with unfamiliar topics (INT16) | 16 |
| Cognitive Absorption, CA (Agarwal & Karahanna, 2000) | Temporal Dissociation (TD) | Time appears to go by quickly when in OLE (TD17) | 17 |
| | | Lose track of time when in OLE (TD18) | 18 |
| | | Time flies when in OLE (TD19) | 19 |
| | | End up spending more time than planned when in OLE (TD20) | 20 |
| | | Often spend more time in OLE (TD21) | 21 |
| | Focused Immersion (FI) | Able to block out most distractions while in OLE (FI22) | 22 |
| | | Absorbed in what one is doing while in OLE (FI23) | 23 |

Table 1. (*Continued*).

| Construct (source) | Dimension | Measure item | Item # in survey |
|---|---|---|---|
| | | Immersed in task being performed while in OLE (FI24) | 24 |
| | | Easily distracted by other attentions while in OLE (FI25) | 25 |
| | | Attention does not get diverted easily while in OLE (FI26) | 26 |
| | Heightened Enjoyment (HE) | Have fun interacting in OLE (HE27) | 27 |
| | | OLE provides a lot of enjoyment (HE28) | 28 |
| | | Enjoy using OLE (HE29) | 29 |
| | | OLE bores user (HE30) | 30 |
| | Control (CO) | Feel in control when using OLE (CO31) | 31 |
| | | Have no control over interaction in OLE (CO32) | 32 |
| | | OLE allows control over computer interaction (CO33) | 33 |
| | Curiosity (CU) | Using OLE excites curiosity (CU34) | 34 |
| | | Interacting with OLE makes one curious (CU35) | 35 |
| | | Using OLE arouses imagination (CU36) | 36 |
| Interest | (ITR) | Interested in the course subject matter (ITR37) | 37 |
| | | Read widely in subject covered prior to course (ITR38) | 38 |
| | | No interest in content covered in course (ITR39) | 39 |
| Student Satisfaction (Tallman, 1994) | (SS) | Beneficial learning experience (SS40) | 40 |
| | | Contribution to academic development (SS41) | 41 |
| | | Would take another online course (SS42) | 42 |
| | | Would recommend online courses to friends (SS43) | 43 |
| | | Personally rewarding educational experience (SS44) | 44 |

### *Data analysis*

Prior to any data analysis, we transformed negatively phrased items to ensure comparability of data. The primary data analysis methodology was two-step SEM:

(1) Measurement model – confirmatory factor analysis (CFA) to determine constructs.
(2) Causal links – to verify the proposed model.

SEM is a way to test a model of relationship among theoretical constructs. We used a two-step approach to SEM (Anderson & Gerbing, 1988). Firstly, we purified the measurement model by eliminating measured variables that did not fit well by CFA. Secondly, we fit a theoretically based model followed by a series of revisions. We used the SAS® PROC CALIS procedure to test the fitness of the proposed theoretical model and maximum likelihood estimation to fit the SEM model.

## Results

### *Construct validity*

As the survey instrument was adapted from scales used in previous studies, issues of the validity of the instrument are discussed and verified in this section. We assessed construct validity of multidimensional constructs using CFA. Reliabilities of unidimensional constructs used in the study are reported.

#### *CFA of social presence*

The social presence instrument used for this study was based on the social presence and privacy questionnaire (SPPQ) developed by Tu (2002) to measure social presence and privacy in CMC. According to Tu (2000), social presence is comprised of three dimensions: social context, online communication, and interactivity. The SPPQ also measures two types of online privacy: system privacy and perception of privacy. Although Tu (2002) determined, using exploratory factor analysis, that the two privacy dimensions were distinct factors and that there was a significant but weak correlation between online privacy and social presence, he could not conclude that online privacy was a dimension of social presence. Hence, this study excluded the online privacy dimensions. Table 1 lists the variables measured for the study's major constructs including the social presence construct. Six variables make up the social context dimension. The dimension of online communication included five variables, while the third dimension, interactivity, comprised five variables.

To date, only exploratory factor analysis has been performed to identify the three dimensions of social presence: social context, online communication, and interactivity (Tu, 2000, 2002; Tu & McIsaac, 2002). Tu (2002) found significant inter-correlations among the three dimensions (ranging from .209 to .494). These correlations confirm that the three were adequately distinct from one another. However, Tu (2002) acknowledged that the Cronbach alpha coefficients obtained were in the medium–low value range (from .74 to .85) and suggested that further validation work should be done.

We assessed convergent and discriminant validity of the social presence instrument for this study by CFA using the SAS® PROC CALIS procedure. We used maximum likelihood estimation to fit the CFA model using the sample of 294 respondents. Figure 2 presents the measurement model for the social presence construct for this study. The figure shows that the social context dimension (SC) is measured by manifest variables 1 through 6; the online communication dimension (OC) is measured by manifest variables 7 through 11; and the interactivity dimension (INT) is measured by variables 12 through 16.

Table 2 provides a summary of the goodness of fit indices for the social presence CFA model. The goodness of fit measures used were chi-square/degrees of freedom ($\chi^2$/df) ratio, Bentler's comparative fit index (CFI) (1989), Bentler and Bonett's

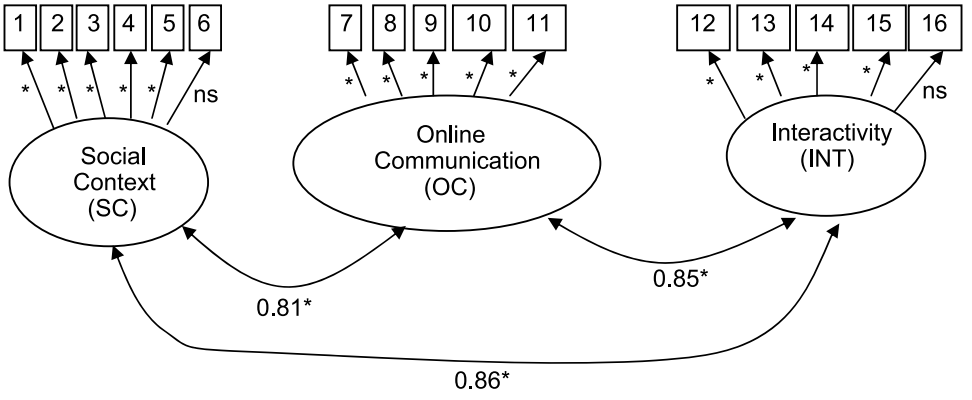


Figure 2. The measurement model for the social presence construct. n.s. = non-significant; *$p < .001$.

Table 2. Goodness of fit indices for the social presence CFA model.

| Fit measures | CFA model |
|---|---|
| Bentler's comparative fit index (CFI) (1989) | 0.801 |
| Bentler and Bonett's non-normed fit index (NNFI) (1980) | 0.763 |
| Bentler and Bonett's normalized fit index (NFI) (1980) | 0.760 |
| Goodness of fit index (GFI) | 0.829 |
| GFI adjusted for degrees of freedom (AGFI) | 0.770 |
| Chi-square/degrees of freedom ($\chi^2$/df) | 4.53 |

normed fit index (NFI) (1980), Bentler and Bonett's non-normed fit index (NNFI) (1980), goodness of fit index (GFI), and GFI adjusted for degrees of freedom (AGFI).

The $\chi^2$/df ratio for this model was 4.53, much higher than the desired value of less than 2.0 (Hatcher, 1994). The CFI and the NNFI were 0.801 and 0.763, respectively. All indices were below the commonly accepted value of 0.9 required to be indicative of a good model fit. Overall, the CFA results for the social presence construct did not provide a good fit.

Convergent validity seeks to confirm that the items are measuring more or less the same construct. Overall, the properties of the social presence measurement model shown in Table 3 provide evidence for convergent validity for the social presence construct. The composite reliabilities for the three dimensions of social presence ranged from .67 to .84, which were in the medium–low value range.

However, closer examination of the obtained *t*-values indicated that the factor loadings for two of the manifest variables, SC6 ($t = 1.80$) and INT16 ($t = 0.66$) were not significant at $p < .05$. This led to the decision to remove these two variables from further consideration as they were not significantly associated with their respective latent factors.

The purpose of discriminant validity is to verify that the items from different construct scales do not measure the same construct. To assess the discriminant validity of the dimensions of social context, online communication, and interactivity, we examined the correlations among the dimensions. There were very high inter-correlations (see Figure 2) among the three dimensions (ranging from .81 to .86) making them

Table 3. Properties of the social presence measurement model.

| Construct and indicators | Standardized loading | *t*-value[a] | Reliability/$r^2$ |
|---|---|---|---|
| Social Context (SC) | | | .667[b] |
| SC1 | .692 | 12.52 | .479 |
| SC2 | .673 | 11.96 | .453 |
| SC3 | .325 | 5.22 | .106 |
| SC4 | .661 | 11.68 | .437 |
| SC5 | .467 | 7.73 | .218 |
| SC6 | .115 | 1.80 (n.s.) | .013 |
| Online Communication (OC) | | | .843[b] |
| OC7 | .752 | 14.48 | .566 |
| OC8 | .816 | 16.31 | .666 |
| OC9 | .547 | 9.64 | .299 |
| OC10 | .784 | 15.36 | .615 |
| OC11 | .687 | 12.82 | .472 |
| Interactivity (INT) | | | .671[b] |
| INT12 | .832 | 16.12 | .692 |
| INT13 | .602 | 10.63 | .362 |
| INT14 | .554 | 9.62 | .307 |
| INT15 | .570 | 9.94 | .325 |
| INT16 | .042 | .66 (n.s.) | .002 |

[a]All *t*-values significant at $p < .001$ unless otherwise indicated.
[b]Cronbach's alpha for composite reliability, proportion of variance accounted for ($r^2$) for individual items.

practically indistinguishable. The results indicate a lack of discriminant validity, which may lead to the problem of high multicollinearity for subsequent SEM.

### *CFA of cognitive absorption*

Agarwal and Karahanna (2000) identified and described the five dimensions of the cognitive absorption construct: temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity. Using a multistage iterative process, they developed scales to measure cognitive absorption, which consisted of five statements tapping into temporal dissociation, five items capturing focused immersion, four items measuring heightened enjoyment, three items capturing control, and three items measuring curiosity. Using CFA, they established the psychometric validity of the scales and the multidimensionality of the cognitive absorption construct. All five dimensions demonstrated good internal consistency with their composite reliabilities: ranging from .83 for control to .88 for focused immersion and .93 for curiosity, heightened enjoyment, and temporal dissociation. Table 1 lists the variables measured for the study's major constructs including the cognitive absorption construct.

Similarly, we assessed convergent and discriminant validity of the cognitive absorption instrument for this study by CFA using the SAS® PROC CALIS procedure. We used maximum likelihood estimation to fit the CFA model using the sample of 294 respondents. Figure 3 presents the measurement model for the cognitive

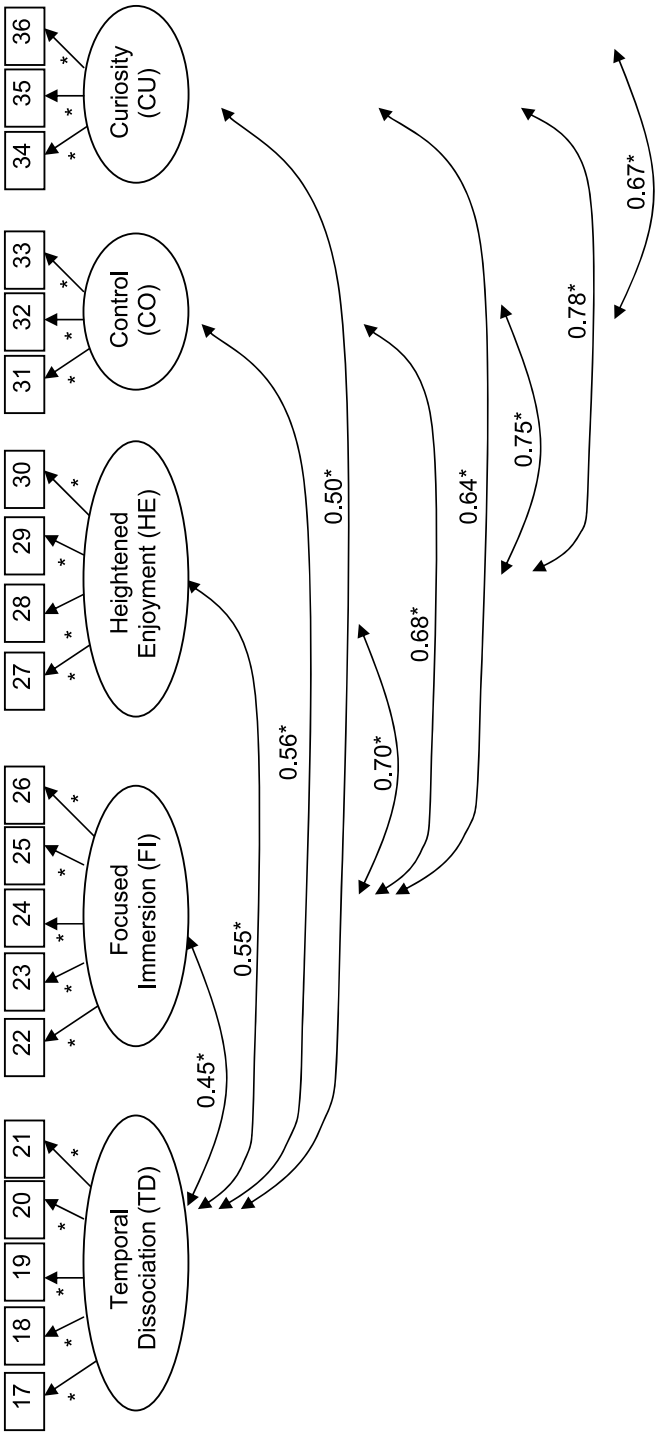


Figure 3. The measurement model for the cognitive absorption construct. *$p < .001$.

absorption construct for this study. The figure shows that the temporal dissociation dimension (TD) is measured by manifest variables 17 through 21; the focused immersion dimension (FI) is measured by manifest variables 22 through 26; the heightened enjoyment dimension is measured by variables 27 through 30; the control (CO)

Table 4. Goodness of fit indices for cognitive absorption CFA model.

| Fit measures | CFA model |
|---|---|
| Bentler's comparative fit index (CFI) (1989) | 0.889 |
| Bentler and Bonett's non-normed fit index (NNFI) (1980) | 0.869 |
| Bentler and Bonett's normalized fit index (NFI) (1980) | 0.858 |
| Goodness of fit index (GFI) | 0.815 |
| GFI adjusted for degrees of freedom (AGFI) | 0.757 |
| Chi-square/degrees of freedom ($\chi^2$/df) | 3.96 |

Table 5. Properties of the cognitive absorption measurement model.

| Construct and indicators | Standardized loading | *t*-value[a] | Reliability/$r^2$ |
|---|---|---|---|
| Temporal Dissociation (TD) | | | .827[b] |
| TD17 | .794 | 15.56 | .630 |
| TD18 | .693 | 12.94 | .480 |
| TD19 | .903 | 18.78 | .816 |
| TD20 | .497 | 8.61 | .247 |
| TD21 | .568 | 10.07 | .322 |
| Focused Immersion (FI) | | | .872[b] |
| FI22 | .824 | 16.85 | .678 |
| FI23 | .897 | 19.28 | .804 |
| FI24 | .874 | 18.48 | .764 |
| FI25 | .517 | 9.16 | .267 |
| FI26 | .647 | 12.04 | .419 |
| Heightened Enjoyment (HE) | | | .904[b] |
| HE27 | .893 | 19.38 | .797 |
| HE28 | .929 | 20.73 | .863 |
| HE29 | .879 | 18.89 | .773 |
| HE30 | .627 | 11.70 | .394 |
| Control (CO) | | | .725[b] |
| CO31 | .777 | 14.19 | .604 |
| CO32 | .533 | 8.96 | .284 |
| CO33 | .729 | 13.13 | .532 |
| Curiosity (CU) | | | .940[b] |
| CU34 | .942 | 21.36 | .888 |
| CU35 | .962 | 22.19 | .926 |
| CU36 | .839 | 17.64 | .704 |

[a]All *t*-values significant at $p < .001$.

[b]Cronbach's alpha for composite reliability, proportion of variance accounted for ($r^2$) for individual items.

dimension is measured by variables 31 through 33; and the curiosity dimension (CU) is measured by variables 34 through 36.

The overall goodness of fit for the cognitive absorption CFA model was better compared to the social presence construct. Table 4 provides a summary of the goodness of fit indices for the cognitive absorption CFA model.

The $\chi^2$/df ratio of 3.96 for this model was also higher than the desired value of less than 2.0 (Hatcher, 1994). The CFI (0.889) and the NNFI (0.869) were slightly lower than the commonly accepted value of 0.9 required to be considered a good model fit. The CFA results for the cognitive absorption construct provided evidence for an acceptable fit to the data.

Convergent validity seeks to confirm that the items from construct measurement scales are measuring the same construct. Overall, the properties of the cognitive absorption measurement model shown in Table 5 provide evidence for convergent validity for the cognitive absorption construct. The composite reliabilities for the five dimensions of cognitive absorption exhibited good internal consistency ranging from .73 to .94, which were comparable to Agarwal and Karahanna's findings (2000).

To assess the discriminant validity of the cognitive absorption dimensions, we examined the correlations among the dimensions. There were moderately high intercorrelations (see Figure 3) among the dimensions (ranging from .45 to .78). The results indicated an acceptable level of discriminant validity.

*Reliability analysis for the satisfaction and interest constructs*

We measured student satisfaction based on students' responses to five survey questions derived from Tallman's student satisfaction questionnaire (1994): beneficial learning experience, contribution to academic development, would take another online course, would recommend online courses to friends, and personally rewarding educational experience. We measured students' interest in the subject matter covered in the online courses they were taking using three statements based on general student course evaluations.

Table 6 shows the Cronbach's alpha results for the constructs of student satisfaction and interest. Cronbach's alpha measures the internal consistency of the scales used to measure these constructs (Cronbach, 1951). The Cronbach's alpha values for both constructs were judged to be acceptable, ranging from .64 to .90. These alpha values indicate good internal consistency among items within the satisfaction construct but only marginal internal consistency among items within the interest construct.

### *The final revised model*

Figure 4 depicts the final revised model. The final model retained 28 of the original 44 variables (63.64% of the items kept). This smaller set of indicator variables is consistent with the recommendations of Hatcher (1994) and Bentler and Chou (1987) on the adequacy of indicator variables. Hatcher contended that a maximum of 20–30 indicator variables will be effectively considered when performing path analysis with manifest variables. Similarly, Bentler and Chou recommended against becoming too grandiose when developing structural models and that smaller data sets of 20 indicator variables or fewer are preferable.

The final model consisted of four latent variables: social presence, cognitive absorption, interest, and satisfaction. Two of these, social presence and cognitive

Table 6. Reliability analysis.

| Construct | Item # in survey | Cronbach's $\alpha$ |
|---|---|---|
| Interest | 37–39 | 0.64 |
| Student Satisfaction | 40–44 | 0.90 |

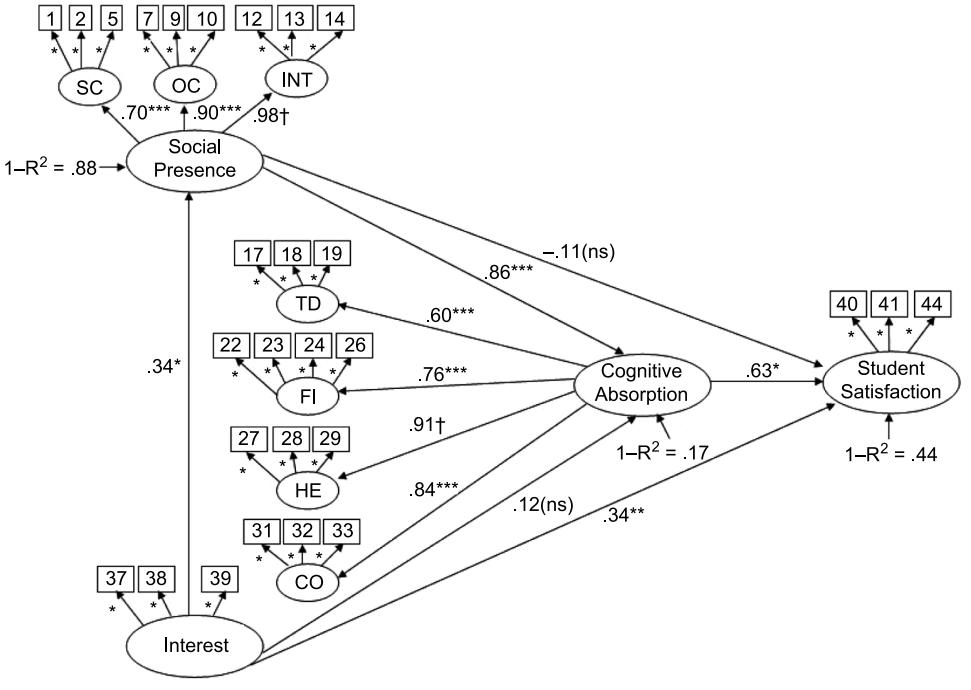


Figure 4. The final revised model.

absorption, were multidimensional constructs. Each of the dimensions was measured by at least three manifest variables. Table 7 lists the indicator variables retained for the final revised model.

With the exception of the paths from social presence to satisfaction and interest to cognitive absorption, the standardized path coefficients in Figure 4 were all significant at $p < .05$. All significant coefficients were in the predicted direction. Of particular interest is the emergence of the significant path from interest to social presence (ITR → SP), which was not part of the initial proposed model. This significant path has remained quite stable through the numerous model modifications.

### *Goodness of fit statistics*

We used maximum likelihood estimation to fit the SEM model. The structured equation results of the proposed theoretical model did not provide an acceptable fit to the data. To improve the fit of the model, we conducted a series of model revisions

Table 7. Measured items in the revised model.

| Construct | Dimension | Measure item |
|---|---|---|
| Social Presence (SP) | Social Context (SC) | OLE provides a social form of communication (SC1) |
| | | OLE provides an informal and casual way to communicate (SC2) |
| | | OLE as being comfortable with familiar persons (SC5) |
| | Online Communication (OC) | OLE conveys feeling and emotion (OC7) |
| | | Difficulty in expressing oneself in OLE (OC9) |
| | | Language used in OLE is meaningful (OC10) |
| | Interactivity (INT) | Using OLE to communicate is pleasant (INT12) |
| | | Replies in OLE are immediate (INT13) |
| | | OLE users are normally responsive (INT14) |
| Cognitive Absorption (CA) | Temporal Dissociation (TD) | Time appears to go by quickly when in OLE (TD17) |
| | | Lose track of time when in OLE (TD18) |
| | | Time flies when in OLE (TD19) |
| | Focused Immersion (FI) | Able to block out most distractions while in OLE (FI22) |
| | | Absorbed in what one is doing while in OLE (FI23) |
| | | Immersed in task being performed while in OLE (FI24) |
| | | Attention does not get diverted easily while in OLE (FI26) |
| | Heightened Enjoyment (HE) | Have fun interacting in OLE (HE27) |
| | | OLE provides a lot of enjoyment (HE28) |
| | | Enjoy using OLE (HE29) |
| | Control (CO) | Feel in control when using OLE (CO31) |
| | | Have no control over interaction in OLE (CO32) |
| | | OLE allows control over computer interaction (CO33) |
| Interest | (ITR) | Interested in the course subject matter (ITR37) |
| | | Read widely in subject covered prior to course (ITR38) |
| | | No interest in content covered in course (ITR39) |
| Student Satisfaction | (SS) | Beneficial learning experience (SS40) |
| | | Contribution to academic development (SS41) |
| | | Personally rewarding educational experience (SS44) |

Table 8. Goodness of fit indices.

| Types of goodness of fit index | Initial theoretic model | Final model |
|---|---|---|
| Bentler's comparative fit index (CFI) (1989) | 0.791 | 0.924 |
| Bentler and Bonett's non-normed fit index (NNFI) (1980) | 0.777 | 0.914 |
| Bentler and Bonett's normalized fit index (NFI) (1980) | 0.718 | 0.864 |
| Goodness of fit index (GFI) | 0.684 | 0.854 |
| GFI adjusted for degrees of freedom (AGFI) | 0.647 | 0.823 |
| Chi-square/degrees of freedom ($\chi^2$/df) | 3.01 | 2.09 |

following a set of specific guidelines. The goodness of fit indices are given in Table 8 for the initial as well as the final revised model. The goodness of fit indices for the final revised model, namely, the CFI (0.924) and the NNFI (0.914), were not only above .9 but were also higher than those displayed by the proposed theoretical model. The root mean square error of approximation (RMSEA) is another statistic for measuring the fit of the model to the data. Browne and Cudeck (1993) suggested that a RMSEA of 0.05 or less indicates a close fit and that values up to 0.08 represent reasonable errors of approximation. For the final model, the RMSEA was 0.061 with a 95% confidence interval of (0.055, 0.067). Overall, the final revised model provides an acceptable model fit to the data. About 55.6% of the variance in student satisfaction can be accounted for by the final revised model, which is quite substantial.

## Discussion

The literature on the impact of social presence on student learning and satisfaction in online learning environments suggests that social presence has a direct relationship or impact on student satisfaction (Gunawardena & Zittle, 1997). Contrary to expectations, the results of this study indicate that while social presence influences student satisfaction, its impact is not direct, but rather mediated by cognitive absorption. The magnitude of the indirect positive impact of social presence on satisfaction as mediated through cognitive absorption was 0.54, which is rather substantial. This is the most significant finding of this study.

In the final revised model, social presence was found to have a non-significant effect on satisfaction. Instead, it appears that social presence strongly influences cognitive absorption, and cognitive absorption in turn influences satisfaction. Research studies have explored the relationship between social presence and student outcomes and between cognitive absorption and student outcomes separately. This study suggests that to better understand what constitutes an interactive, compelling online learning environment, these two constructs need to be taken into consideration simultaneously. Future research on online learning environments should study both social presence and cognitive absorption concurrently.

It was hypothesized that students' interest in the subject matter covered in the online courses would be related to learner satisfaction and cognitive absorption. Research studies (Naceur & Schiefele, 2005; Schiefele, 1999; Schiefele & Csikszentmihalyi, 1995) have found that interest may influence learning and, consequently, student satisfaction. As expected, this study has determined the direct impact of interest on student satisfaction.

Csikszentmihalyi and LeFevre (1989) contended that intrinsic motivation is positively related to the flow (from which cognitive absorption is derived) experience. Hence, it was hypothesized that interest should also have a positive impact on cognitive absorption. However, contrary to expectations, both the proposed theoretical model and the final revised model of this study did not reveal any significant relationship between interest and cognitive absorption. This could be due to the fact that the study defined interest more narrowly as a content-specific concept (Schiefele, 1991). In addition, it is possible that interest impacts some of the dimensions of cognitive absorption (e.g., temporal dissociation and focused immersion) but not necessarily the overall cognitive absorption construct.

Interestingly, this study has found a significant relationship between interest and social presence. Although not part of the initial proposed model, the significant path from interest to social presence has remained quite stable through the numerous model modifications. This could be attributed to the fact that students who have a keen interest in the subject area covered in the online course would share more in common with each other thus leading to a higher level of social presence.

In summary, the results from this study indicate that interest affects social presence and satisfaction directly. Additionally, interest also appears to positively impact satisfaction indirectly through social presence and cognitive absorption. The magnitude of this indirect impact was 0.18. The total effect of interest on satisfaction (both directly and indirectly through social presence and cognitive absorption) was 0.52, which is quite substantive.

**Limitations of the study**

Although the findings of this study have both theoretical and practical implications, this study has a few limitations. One limitation is the threat to external validity. This study's model was developed based on the assumption of the most prevalent form of online courses, that is, predominantly asynchronous text-based and facilitated through the use of a course management system, such as WebCT. It may not be generalizable to other online learning environments, especially those that use two-way synchronous interactive technologies, such as audio-video conferencing.

In addition, this study was limited to a convenient sample of students enrolled in online and online hybrid courses in the University of Hawaii system and Hawaii Pacific University and may not be representative of the online student population. Students were encouraged by their instructors to participate in the online survey, but participation was entirely voluntary. Presumably, students who responded to the survey perceive online courses more positively. As such, the study may not have adequately captured the perceptions of students who were dissatisfied with their online course experience.

Another limitation of the study is the use of only one data point in this study. Students' perceptions were measured only once at the end of a semester of study. Pearce, Ainley, and Howard (2005) argue that overall-state measures of flow might reflect recency effects (last activities) as well as retrospective measures may be influenced by one particular activity, a 'challenging event' effect (p. 767). Unfortunately, this limitation is unavoidable because of the logistical difficulty of surveying a relatively large number of students repeatedly over the course of a semester. Nevertheless, the results of this study should contribute towards a more holistic approach to understanding online students' internal experiences and the

psychological processes that underlie their perceptions of interactivity in online learning environments.

## Conclusions and implications

Contrary to expectations, this study has determined that social presence does not impact satisfaction directly. It concludes that while social presence influences student satisfaction, its impact is not direct but rather mediated by cognitive absorption. In addition, the results of this study indicate that interest affects social presence and satisfaction directly. Additionally, interest appears to influence satisfaction indirectly through social presence and cognitive absorption. Contrary to expectations, this study did not reveal any significant relationship between interest and cognitive absorption.

One of the major contributions of the study is the elucidation of the relationships among social presence, cognitive absorption, and student satisfaction with online learning environments. This study provided evidence that social presence is related to student satisfaction, and that its impact, contrary to contemporary research, is not direct but rather mediated by cognitive absorption. Research studies have explored the relationship between social presence and student outcomes and between cognitive absorption and student outcomes separately. This study suggests that these two constructs need to be taken into consideration simultaneously to better understand what contributes to an interactive, compelling online learning environment.

Many research issues pertaining to interest were subsumed into theories of intrinsic motivation (e.g., Berlyne, 1949, 1960). This research study integrated interest as an independent factor that could contribute to the creation of an interactive, compelling online learning environment. This study determined that interest affects social presence and satisfaction directly. Furthermore, interest appears to influence satisfaction indirectly through social presence and cognitive absorption. The present study suggests that increasing students' interest in the subject matter may result in higher quality of online learning experience. Therefore, online instructors should perhaps focus more on facilitating interest by emphasizing the importance and relevance of the online course subject matter in students' daily life and employing instructional activities that are more active and student-centered (Schiefele & Csikszentmihalyi, 1995).

Another contribution of this study is the practical implications it offers for the design and development of interactive online learning environments. The conclusions of this study can help guide instructors in designing more effective online learning environments. If online instructors and instructional designers develop online learning environments that enhance opportunities for social presence and cognitive absorption, online students will have a more positive attitude towards their online learning. Several general but practical recommendations are provided for online course designers to facilitate the occurrence of social presence and cognitive absorption to increase student satisfaction with online learning environments.

An online instructor can facilitate social presence by employing several strategies. It could be as simple as getting students to introduce themselves using discussion postings or more elaborate online ice-breaker activities at the beginning of an online course. This provides the opportunity for online students to get acquainted and promotes trust in relationships early in the course. According to Gunawardena (1995), students' perception of social presence is influenced by the instructor's skills

in facilitating online conversations with introductions and salutations. Therefore, online instructors should develop facilitation skills that create a sense of social presence.

Instructors may be able to increase their online students' satisfaction by addressing the most appropriate factors underlying social presence. For example, the dimension of interactivity is made up of these items: using online learning environment to communicate is pleasant; replies in online learning environment are immediate; and online learning environment users are normally responsive. It may be possible for online instructors to influence student satisfaction by providing more timely feedback, and making themselves more accessible to their students. Tu (2000) found that when an immediate response is expected but is not received, the sense of social presence declines. Additionally, in their study on students' frustration with Web-based courses, Hara and Kling (1999) found a lack of immediate feedback from the instructor and ambiguous instructions to be main causes of students' frustration.

Chan (2000) contended that instructional design has been hampered by the lack of good theoretical framework, which has led designers to 'often assume that good quality instruction is itself motivating' (p. 54). This view is shared by Spitzer (1996), who maintained that 'many (if not most) education and training failures occur because of the lack of concern for the "motivational side" of learning' (p. 45).

Furthermore, Chan (2000) proposed that the structural variables of flow theory could be manipulated by a designer to enhance the likelihood that a learner will be motivated intrinsically. By the same token, we argue that the dimensions of cognitive absorption can be manipulated to increase the level of student satisfaction in online learning environments. Two dimensions of cognitive absorption may be predisposed to being manipulated to enhance student satisfaction: heightened enjoyment, which deals with how users perceive using the online learning environment as being enjoyable; and control, which captures users' perception of being in charge of the interaction.

In addition, as social presence is an antecedent to cognitive absorption, it behooves online instructors to provide opportunities that create a sense of social presence early in the course before attending to the cognitive absorption factors to enhance student satisfaction in online learning environments. Ideally, both social presence and cognitive absorption should be planned for in totality and with rigor in the instructional design process.

To improve retention in online distance education courses, efforts must be made to enhance student satisfaction with online learning environments. The results of this study suggest that we may do so by attending to three factors: social presence, cognitive absorption, and interest. By drawing on these factors to design and develop online learning environments that are capable of sustaining a sense of community and keeping learners engaged or absorbed, perhaps online instructors may be able to increase student satisfaction and retention in e-learning programs.

## Notes on contributor

Peter Leong is an assistant professor of educational technology at the University of Hawaii–Manoa. His research interests include student satisfaction with online learning, faculty support for technology integration, technologies for distance education, and video games and virtual worlds for teaching and learning.

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