

Building a Model Explaining the Social Nature of Online Learning

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ABSTRACT

Based on a framework emphasizing the social nature of learning, this research examines a model of how social constructs affect satisfaction within online learning using path analysis for students in higher education. The social constructs evaluated in this study include sense of community (SOC), social ability (SA), perceived ease of use (PEU) and usefulness (PU) of social awareness tools, and self-reported participation (SRP) in online courses. Students' social ability is predicted by perceived ease of use of social awareness tools and self-reported participation. Satisfaction with online learning is explained by sense of community, social ability, and self-reported participation. Sense of community is shown to be a mediator of the relationships between social ability and satisfaction ($SA \Rightarrow S$) and between perceived usefulness and satisfaction ($PU \Rightarrow S$). Additionally, students' social ability, perception of usefulness of social awareness tools, and self-reported participation serve as predictors for students' sense of community. The findings from the path analysis show the value of simultaneously examining the relationships among the multiple social constructs, rather than simply examining relationships of how one construct may predict another as has been shown in previous studies.

Keywords

Sense of community, Social ability, Technology Acceptance, Participation, Online learning satisfaction, Path analysis

Introduction

Online learning has become a pervasive part of higher education. Online enrollment increased from 1.98 million in 2003 to 2.35 million in 2004, and approximately 74 percent of public institutions of higher education identified online education as a critical long-term strategy in 2005 (Allen & Seaman, 2005). Many positive reports of online learning success show its impact and potential, such as relative equivalence in test-result outcomes with face-to-face courses (Talent-Runnels, et al., 2006), broad implementation and rapid growth across higher education, and provision of access for many students who would otherwise have to forego higher education. Although students appreciate the flexibility and convenience offered by online learning environments, online students do experience a sense of isolation (Abrahamson, 1998; Bessar & Donahue, 1996; Rahm & Reed, 1998), and express being more satisfied with face-to-face courses (Allen, Bourhis, Burrell, & Marbry, 2002; Simonsen, 1997; Klesius, Homan, & Thompson, 1997). In her study, Carr (2000) found higher dropout rates for distance education (10-20%) over traditional programs. Reasons given for the high dropout percentage of distance learners include limited support and service of distance education, dissatisfaction with teaching methods, unfamiliarity with the technology used, and student feelings of isolation. Hara and Kling (2000) also found that online students were frustrated by the communication and technical difficulties that impeded interaction. Arbaugh (2000) argues that the lack of social interaction was a factor that depressed student satisfaction in online learning. This dissatisfaction with online learning can be seen in high rates of attrition for online students (Chyung, 2001). Ashar and Skenes (1993) found that while adults were attracted to a higher education business program because of strong learning needs; those needs were not strong enough to retain them. However, retention was positively impacted by establishing a social environment within the program. Students need to feel involved and develop relationships with other students in an online course (Rovai, 2002a). Following from an appreciation of the social nature of learning, learning and cognitive development are recognized as substantially constituted through social participation and interaction (Vygotsky, 1978; Wenger, 1996). In order to understand how students' online learning satisfaction is affected by their social participation and interaction with others, the present study seeks to build a model of the elements that contribute to the social nature of online experience and influence satisfaction in online learning environments. We begin by framing our research with key social constructs for understanding the social nature of online learning. Next, we describe the use of path analysis, to examine the relationships among these constructs. Our results, present a model for explaining how these social constructs influence satisfaction in online courses.

Theoretical Perspectives

Advances in our understanding of how we learn show that context play a significant role in determining what we learn and how we will be able to use what we learn. Wenger (1998) describes social participation as a process for learning and knowing which is relevant “not just to local events of engagement in certain activities with certain people but to a more encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities” (p.4). In a community of practice, people learn by socially negotiating meaning of the world with what they see, who they know, and what they do. Through negotiation about practice people expand what they know and are able to do, as well as learn from others’ actions and feedback. Their growth of knowledge is represented not only in individual change but also in the shared values, relationships, networks, and knowledge produced when interacting with others. To be more specific, individual identity interacts with cognition and social relationships in a community of practice. Community practices influence individual identity, and individual identity and cognition contribute to the negotiation of new views of the community.

The social nature of educational practice influences students’ motivation to learn, ways of participating, negotiation of meanings for new knowledge and skills, and how new learning shapes self-identity and community membership. Online learning environments are social contexts, just as are face to face environments. However, these social activities and contacts are mediated by technology tools within a specific networked environment. Researchers studying online learning environments explore the social nature of learning in a variety of ways, such as students’ use of communication tools (Hara & Kling, 2000), students’ feeling of isolation (Abrahamson, 1998), students’ perception of a sense of presence (Picciano, 2002), and the relationship between students’ feeling a sense of belonging and their amount of social interaction (Rovai, 2002c). Little is known, however, about how usage of communication tools, sense of presence, and interaction are interconnected in the way they influence isolation, satisfaction, or other student outcomes. New knowledge is needed to understand how students experience the social aspects of their online courses, and how the tools and methods of online learning can foster sociality and social interaction. To explicate the social nature of online learning and how it influences students’ learning satisfaction, we examine four constructs of online social life: sense of community, social ability, technology acceptance, and participation.

Sense of community

McMillan and Chavis (1986) define sense of community as “a feeling that members have of belonging, a feeling that members matter to one another and to the group, and shared faith that members’ needs will be met through their commitment to be together” (p.9). Lave and Wenger (1991) argue “activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning. These systems of relations arise out of and are reproduced and developed within social communities, which are in part systems of relations among persons” (p. 53). Wenger implies the interrelationship between sense of community and social interaction when he describes the integration of community membership with personal identity. Researchers report a variety of benefits derived from a strong sense of community. Rovai (2001) found that the sense of classroom community was moderately and positively related to the number of messages posted to the discussion boards. In turn, the comments posted by learners provide evidence that more interaction and participation promoted sense of community in class. This increased sense of classroom community was attributed to how interaction and involvement lessened psychological distance of online students in the course activities. Rovai’s (2001) findings are aligned with previous research that found students with stronger sense of community tend to have a greater flow of information exchange with other members, have higher availability of support, and have a higher commitment and satisfaction to group work and collaboration (Wellman, 1999; Dede, 1996; Bruffee, 1993) as well as a greater sense of well being (Rovai, 2002a). Specifically, Tinto (1993) and Scott (2004) showed that students’ satisfaction with online courses increases when they feel involved and have strong relationships with members in the learning community. Sense of community has also been positively associated with students’ learning achievement, although these results were not from learning in online community (Bryk & Driscoll, 1988).

Sense of community is recognized as an important factor for fostering interactivity or interaction among participants in online learning environments; however, building and sustaining a sense of community in a virtual classroom is challenging. According to Rovai (2002a), the key for building and sustaining a sense of community is facilitating interaction among students. He observed students reported better sense of community in class when they felt higher

levels of interaction. Then, what can the online learning community do to foster interactivity or interaction among participants in online learning environments so that students can build a positive sense of community? Two types of interactions: task-driven interactions and socio-emotional interactions have been identified from previous study. Rovai (2001) argues that task-driven interactions may not be enough to foster a positive sense of community among participants and a supportive environment for socio-emotional interactions is critical for promoting a sense of community. Rovai (2002) found that helping students be aware of other members' activities is one way to support students' sense of community.

Social ability

Social ability represents how able members are in using the resources of the social context to achieve important goals (Laffey, Lin, & Lin, 2006). Social ability in online learning environments is determined by the fit among people, tools, and activities. For example an instructor may be able to work with a project group in a face-to-face classroom, but if the task is mediated by a chat tool which is unfamiliar or awkward for the instructor, the group may not advance as effectively as it could in a face-to-face context due to the poor fit between the instructor and the chat tool. Through several exploratory studies with online students, five components of social ability were explicated: written communication skills, peer social presence, instructor social presence, comfort with sharing personal information, and social navigation (Laffey, Lin, & Lin, 2006; Yang, Tsai, Cho, Kim, & Laffey, 2006; Lin, et al., 2006). In other words, students who have higher social ability in online courses tend to be more aware of and act upon peer and instructor's actions, to share personal information, and to communicate effectively with others in the written format. These capabilities have been shown to impact students' online learning processes and outcomes. In particular, written communication skills matter! Writing skills are a necessity in online environments, since online synchronous and asynchronous communication channels remain primarily text-based, especially in the most common online course tools like discussion board, email and chat. The ability to clearly communicate through writing has been recognized as a critical requirement and predictor of student success in online courses (Golladay, Prybutok, & Huff, 2000; Mandernach, Donnelly, & Dailey-Hebert, 2006). Students who have poor writing skills may experience difficulties expressing opinions and building relationship in online courses. In his observation of 20 graduate students, Rovai (2001) found that students' communication styles influence building a sense of community. Students who wrote a message using a supportive, helpful, and connected voice were more likely to feel a stronger sense of community than those with an impersonal, assertive, and independent voice. Since there are limited verbal exchanges in online courses, student learning and interaction heavily rely on written products of communication. More specifically, clearly communicating questions, sharing opinions, expressing concerns, and providing support in written forms are abilities that influence the social nature of online learning (Mandernach, et al, 2006).

Additionally, Garrison and Anderson (2003) argued that the formation of community requires a sense of social presence among members in the online environment. Social presence is defined as "an attribute of computer-mediated activity, derived from media studies about how effectively media (TV, etc.) convey the sense that mediated participants were really present (Short, Williams, Christie, 1976)" (Laffey et al., 2006, p.166). Reidl (2001) also stated that social presence was the degree of salience of another person in a social interaction, while Wise, Chang, Duffy and del Valle (2004) characterized social presence as the feeling that others are participating with you. Yang et al. (2006) found that students perceived peer and the instructor presence differently. Further, social ability also represents the capacity to connect and keep members engaged in interaction. Sharing personal information has been shown to foster the formation of sense of community by facilitating deeper and more meaningful interpersonal relationships in online communities (Swinth, Farham, & Davis, 2002). Moreover, the notion of social navigation defined as "a construct representing being aware of what others are doing as a primary guide for one's own action" (Laffey et al., 2006, p.166) means using information about the action of others to guide action and decision making. Thus, the capability of students to observe the "footprints" of others before making decisions has the potential to impact the efficiency and effectiveness of online learning and contribute to a greater sense of community.

Along with sense of community, previous research suggests that social ability is a key determinant of how students experience online learning. Lin et al. (2006) showed that social ability was a significant predictor for students' online learning satisfaction and was a critical construct for explaining students' changes from a peripheral into a central role in a community. Also, students' participation and interaction is somewhat determined by how well the tools scaffold their social needs and achievement of learning goals. Social ability as an indicator of the fit among person, task and tool is highly affected by the affordances provided by technology in a context.

Technology acceptance

Previous studies recognized that students' familiarity with the technology use and feeling of how they are supported by the communication and interaction tools influenced their satisfaction with online learning (Carr, 2000; Hara & Kling, 2000). Also, Gallini and Helman (1995) found that online learners need to be effective in communicating information particularly information related to others' actions in order to learn successfully. Since technology tools play a deterministic role in how well students can interact with others their acceptance by students influences satisfaction with online interaction and learning. The Technology Acceptance Model (TAM) has been one of the most influential models in predicting and explaining usage and acceptance of a new technology. According to Davis (1989), perceived usefulness and perceived ease of use are the two major factors affecting users' acceptance behaviors. Davis (1989) defines perceived usefulness as "the degree to which an individual believes that using a particular system would enhance his or her job performance" (p.320) and perceived ease of use as "the degree to which an individual believes that using a particular system would be free from physical and mental effort" (p.320). Davis argues that users accept and use a technology primarily because of the functions it performs for them, and secondarily because of how easily they can get the technology to perform the tasks.

In online environments, the use of technology tools is necessary for social interaction and subsequent learning. One of the key challenges of using technology in social interaction is awareness of who is available, what has happened, and what is going on. Without special design provisions using course management system can leave the student feeling socially blind and isolated. Dourish and Bly (1992) examined how synchronous and asynchronous computer mediated communication (CMC) tools deliver and support social awareness. They found successful delivery of social awareness via the CMC tools resulted in a sense of community through maintaining working relationships and informal communication. Also, Schwier (2002) indicated that accessibility and use of technology tools for online courses is critical to facilitating and building virtual learning community because technology tools provide a gathering space and mediated communication channel for students. Adapting TAM to examine students' online learning behavior, Lin (2005) found that students' intention to use technologies affected their usage behavior in online learning environments.

Participation

Wenger (1998) defines participation as "the social experience of living in the world in terms of membership in social communities and active involvement in social enterprises" (p.55). Wenger also states that "Knowledge, belonging, and doing are not separable: What we know, who we are and what we do seamlessly come together in one experience of participation" (Wenger, 1996, p.22). The learning process can be described as how students move from peripheral participants toward becoming core participants in a learning community. This transformation in the way they participate is also represented in how they perceive themselves in the learning community, and how they are perceived by others (Wenger, 1998). Thus, participation, learning and membership in a community are intertwined, and members' identities change through their participation. Since learning is constituted through social activities, sense of community, which describes students' sense of belonging and a social bond with others, has potential to critically and positively influence learner participation and interaction (Rovai, 2003; Carroll, 2001; Putnam, 2000). Reciprocally, students' active participation is often seen as the critical element in the formation of a learning community and building a sense of community in online classes (Wang, Sierra, & Folger, 2003).

Researchers have identified several methods to encourage student participation and interaction in online learning, such as instructional design for collaborative course activities (e.g. group work, debate, web polls, etc.), and the use of different types of synchronous and asynchronous communication tools (e.g. chat, discussion board, blog, etc) (Collins & Zane, 1996). Further, a qualitative study by Falvo and Solloway (2004) found that the online learning format, technology used for supporting learning, instructional design, and various social activities and relationships contribute to a sense of community recognized to be influential for student participation. They showed that explicit design of the learning environment to encourage students to identify with the course as a learning community both fostered discussion about what it means to be an online community, and an actual sense of community. Participants reported satisfaction with the format of online learning because of the advantages of learning anytime and anywhere and felt interested in using different types of technology for interaction among students and the instructor. Active participation through usage of the technology tools seems to be crucial for enabling learners to accomplish learning

tasks. How well learners appropriate the tools to socially interact with others or participate in activities and how they feel about themselves and others provide a basis for inviting and reinforcing participation.

Research Questions

In summary, previous literature about online learning has shown that failure to achieve a sense of community and feelings of isolation negatively affect acceptance of and satisfaction with online learning (Vonderwell, 2003; Woods, 2002). The current study seeks to test and build a model of social factors that are hypothesized to influence sense of community and further to see if this model also explains satisfaction with online learning. Path analysis is used to determine the extent to which key constructs, including self-reported participation, social ability, perceived ease of use and usefulness of social awareness tools, and sense of community explain satisfaction with online learning. The research questions of this study are:

- (1) To what extent does sense of community influence students' overall learning satisfaction in online learning?
- (2) How well does the final path model for social ability, self-reported participation, and technology acceptance explain sense of community?

Research Method

Participants

Near the end of Spring semester 2006, recruiting emails with links to an electronic consent form and the survey instruments were sent to 82 students who were enrolled in five online courses. The online courses mainly targeted learning to use technologies or learning to design learning systems. On average, each course has about 16 to 17 students. There was a 63.4% response rate, resulting in 52 participants who filled out the survey over the Internet. After initial data screening, one case was eliminated as a univariate outlier. Table 1 presents the demographic information for the 51 subjects.

Table 1. Demographic information for 51 subjects

| Demographic Information | | Number of Participants | Percentage (%) | Total |
|-------------------------|--------------------|------------------------|----------------|-------|
| Gender | Male | 23 | 45.1 | 51 |
| | Female | 28 | 54.9 | |
| Language | Native Speaker | 40 | 78.4 | 51 |
| | Non-native Speaker | 11 | 21.6 | |
| Academic Status | Undergraduate | 4 | 7.8 | 51 |
| | Graduate | 47 | 92.2 | |
| Previous Online Courses | 0-1 courses | 9 | 17.6 | 51 |
| | 2-5 courses | 17 | 33.3 | |
| | > 6 courses | 25 | 49.0 | |
| Hours Login(weekly) | < 5 hr. | 20 | 39.3 | 51 |
| | 6-10 hr. | 17 | 33.3 | |
| | > 10 hr. | 14 | 27.5 | |

Context

The data were collected from five online courses offered in a college of education in a mid-west university during Spring semester 2006. All five courses were delivered fully online through the Sakai 2.0 course management system. These five courses had similar course structures with a typical unit comprising a set of learning tasks that directed students to work individually or interactively with peers to accomplish assignments. Besides the course management system, a daily email digest (Appendix A) of course activity was implemented using CANS (Amelung, 2005). This email digest was a daily summary with detailed information about all the previous day's activities within the course site, and it was automatically sent out to all students at mid-night so that students received it each morning. The

actual content of an email digest is list of events for each of the main tools, such as discussion board, chat room, resources, announcement, and assignment tools. The purpose of providing the email digest for students is to support their social awareness of what others were doing in the course. Instead of needing to enter the course management system and browse through all of the site tools, reading the digest could inform the student that many students posted messages in a thread or uploaded files the day before. This sort of information could remind students about work to be completed or make them curious about what others were saying or doing.

Instruments

The instrument applied in this study is adapted from several instruments measuring the social constructs addressed in this study. Below is the explanation of how the items for measuring social constructs are adapted. The survey items of these social constructs applied in this study are presented in Appendix B.

Sense of Community. Sense of community was measured with 20 items using a 7-point Likert scale from the Classroom Community Scale (Rovai, 2002b). The Cronbach α reliability estimates from our data were .93 for the sense of community.

Social ability. An Online Learning Experience Study Questionnaire (OLESQ; Yang et al., 2006) consisting of 30 items that measure students' perceived social ability in online learning environments was used in this study. Results from the OLESQ show that five factors accounted for 61.86% of the variance in the measure: perceived peer social presence (10 items, $\alpha = .93$), perceived written communication skills (3 items, $\alpha = .90$), perceived instructor social presence (8 items, $\alpha = .910$), comfort with sharing personal information (3 items, $\alpha = .83$) and social navigation (6 items, $\alpha = .88$). The Cronbach α reliability estimates from our data were .92 (30 items) for social ability.

Technology Acceptance. Two main constructs, perceived ease of use and perceived usefulness, were selected from the Technology Acceptance Model (TAM; Davis, 1989) to measure students' acceptance of the email digest as an awareness tool. A total of 12 items, including six items per construct, were modified to fit the research context of this study. The participants were asked to answer these items based upon their use of the email digest. The Cronbach α reliability estimates from our data were .96 for perceived ease of use and .98 for perceived usefulness.

Self-Reported Participation. The OLESQ includes four self-report items that ask students to estimate their participation through the use of tools in the course management system, such as discussion board, chat, resource sharing space, etc. The Cronbach α reliability estimates from our data were .73.

Satisfaction. Four learning satisfaction questions were taken directly from the Zone Experience Study Questionnaire (ZESQ; Lin, 2005). One question of learning interest and four course evaluation questions were adapted from ZESQ to be the five course evaluation items in OLESQ. These nine OLESQ questions measured students' learning satisfaction and satisfaction with course materials and teaching in the online learning environments. The Cronbach α reliability estimates from our data were .87 for learning satisfaction and .89 for course evaluation.

Data analysis

The research questions were addressed through path analysis which helped us explore and determine the predictive relationships among social constructs. Since path analysis is a form of regression modeling for observed variables; therefore it requires normal regression assumptions, including univariate and multivariate outliers, linearity, normality, no multicollinearity, and homoscedasticity (Kline, 2005). Prior to path analysis, the data were examined for fit with the assumptions and no violations were found. Because the specification of directionality of path analysis requires a clear rationale and theory support, the literature review and correlation analysis were utilized to identify relationships among social constructs. According to the literature review, social constructs, such as sense of community, social ability, perceived ease of use, perceived usefulness, self-reported participation, and satisfaction, have interdependent relationships. The literature review provided insights about possible explanatory relationships among social constructs. Correlation analysis was implemented to identify significant relationships among social factors that could then be addressed in the path analysis model. Based on the literature review and correlation analysis, an initial path model of direct and indirect relationships among critical constructs was hypothesized and

examined. When exploring the predictive relationships, four correlated paths were discarded because their path coefficients indicated insignificant correlation ($p < 0.05$). After examining the path models via Mplus@, a final model with best model fit was found to demonstrate the predictive relationships among social constructs of online learning.

Results

Prior to analysis, 1 of 52 cases was found to be a univariate outlier with an extremely low z score ($z > 3.29$, $\alpha = .001$) while no multivariate outliers were found ($\chi^2(6) = 22.46$, $\alpha = .001$). The univariate outlier was deleted and left 51 cases for analysis. Also, the linearity of the variables was examined by checking scatter plots between any two of the 6 social constructs. A review of scatter plots indicated that every pair of variables had linear relationships. Further, the skewness and kurtosis of 6 variables were examined for normality. The skewness was found to be satisfactory (between .02 and -.47, $< \pm 3$) as well as the kurtosis (between 3.3 and -1.18, $< \pm 3$). Kolmogorov-Smirnov (K-S) values were found to be non-significant (greater than .01) and normal probability plot suggests no major deviations from normality. Overall, the data is distributed normally. Thus, there is no necessity for deletion or transformations of the variables. Additionally, Tolerance values with a cutoff value of 0.1 were utilized to assess multicollinearity. All the tolerance values were greater than 0.1 (between .39 and .65) which shows no violation of multicollinearity assumption. Lastly, a standardized residual plot indicated that the residuals were roughly rectangularly and evenly distributed around the 0 point of the standardized predicted value (X axis) which suggests no violation of the homoscedasticity assumption. These results show that the 51 cases meet the assumptions for path analysis.

Descriptive statistics for the research constructs are presented in Table 2. The findings indicate that students had positive perceptions of sense of community, social ability, perceived ease of use, perceived usefulness, self-reported participation, and satisfaction. Additionally, all constructs satisfied the criteria for reliability. Most constructs had Cronbach's alpha values close to or over .80 (Nunnally, 1978), while "self-reported participation" was the only construct showing only a moderate level of reliability ($\alpha = .73$).

Table 2. Descriptive Statistics and Reliability (N=51)

| Constructs | Overall | | Reliability (# of items) |
|-----------------------------------|---------|------|-----------------------------|
| | M | SD | |
| Sense of Community (SOC) | 4.75 | .94 | .93 (20) |
| Social Ability (SA) | 5.21 | .76 | .92 (30) |
| Perceived ease of use (PEU) | 4.49 | 1.28 | .96 (6) |
| Perceived usefulness (PU) | 4.09 | 1.45 | .98 (6) |
| Self-reported Participation (SRP) | 5.00 | 1.11 | .73 (4) |
| Satisfaction (S) | 5.49 | 1.07 | .92 (18) |

Table 3 presents a correlation matrix of all critical constructs. Students' sense of community, social ability, self-reported participation, and satisfaction have highly significant positive intercorrelations. Students' perceived ease of use with the awareness tool has significant positive correlation with sense of community, social ability, and satisfaction, while students' perceived usefulness of the awareness tool only has significantly positive correlations with sense of community and satisfaction. Self-reported participation does not have significant correlations with students' perceived ease of use or usefulness. To summarize, the results show that students' technology acceptance (perceptions of use of the awareness tool) is associated with sense of community, social ability, and satisfaction but has no significant relationship with the self-reported participation through using tools in the Sakai system.

Table 3. Intercorrelations among All Critical Constructs

| Variables | SOC | SA | PEU | PU | SRP | S |
|-----------------------------------|--------|--------|--------|-------|--------|---|
| Sense of community (SOC) | - | | | | | |
| Social ability (SA) | .609** | - | | | | |
| Perceived ease of use (PEU) | .358* | .324* | - | | | |
| Perceived usefulness (PU) | .340* | .011 | .570** | - | | |
| Self-Reported Participation (SRP) | .516** | .313* | -.069 | -.040 | - | |
| Satisfaction (S) | .786** | .573** | .316* | .303* | .563** | - |

Note. ** $P < .01$, * $P < .05$

The research path model was analyzed by Mplus@. In path analysis, the correlated paths of a prior path model are constructed based upon the significance of correlation coefficients. In the prior path model, social ability, perceived ease of use, perceived usefulness, and self-reported participation were hypothesized to predict students' sense of community and overall satisfaction with online learning. Similarly, perceived ease of use, perceived usefulness, and self-reported participation were hypothesized to predict social ability. When the correlations from the prior path model were examined, four direct correlation paths ($PEU \Rightarrow SOC$, $PEU \Rightarrow S$, $PU \Rightarrow S$, and $SA \Rightarrow LS$) were discarded because of insignificant correlation coefficients ($P < .05$). When dropping these 4 paths, chi-square change was not greater than $\chi^2(0) = 3.84$. After discarding the four non-significant paths, a final path model with best model-fit was found. The final model with R^2 values is presented in Figure 1. According to the criteria recommended by Hu and Bentler (1998), the chi-square value (χ^2) for the model was 7.89 ($p > .05$) suggesting that the data fit the model well. The comparative fit index (CFI) was .99 and the Tucker-Lewis Index (TLI) was .97, which also suggested that the data fit the model well. However, the root mean square error of approximation (RMSEA) was .08 and the confidence interval of RMSEA is from .00 to .21 (include .05), which suggest a marginal fit of the model. The fit indices of goodness are presented in Table 4. Overall, the data fits the final model well.

Table 4. Goodness of Fit Indicators

| Model | χ^2 | P | CFI | TLI | RMSEA | RMSEA 90% C. I. |
|----------------------------|----------|------|-----|-----|-------|-----------------|
| Criteria | N/A | >.05 | .90 | .90 | .10 | |
| Results of the Final Model | 7.89 | 0.25 | .99 | .97 | .08 | .00 ~ .21 |

In the final path model, students' overall satisfaction with learning in online courses is explained by students' sense of community, social ability, and self-reported participation. Additionally, social ability, perceived usefulness of social awareness tools, and self-reported participation were predictors of sense of community, which in turn predicted satisfaction. Moreover, perceived social ability is predicted by perceived ease of use and self-reported participation. Interestingly, students' perceived ease of use of social awareness tools is a direct predictor of social ability and perceived usefulness but not sense of community, while perceived usefulness of social awareness tools is a direct predictor of sense of community but not social ability. Except for the lower correlation coefficient between self-reported participation and satisfaction (significant at $p < 0.05$), the correlation coefficients range from .34 to .97 and are statistically significant at $p < 0.001$. The R^2 values indicated that approximately 66% of the variance in satisfaction is accounted for by sense of community and self-reported participation, 63% of the variance of sense of community is accounted for by social ability, perceived usefulness, and self-reported participation, 22% of the variance of social ability is accounted for by perceived ease of use and self-reported participation, and 33% of the variance of perceived usefulness of social awareness tools is accounted for by perceived ease of use.

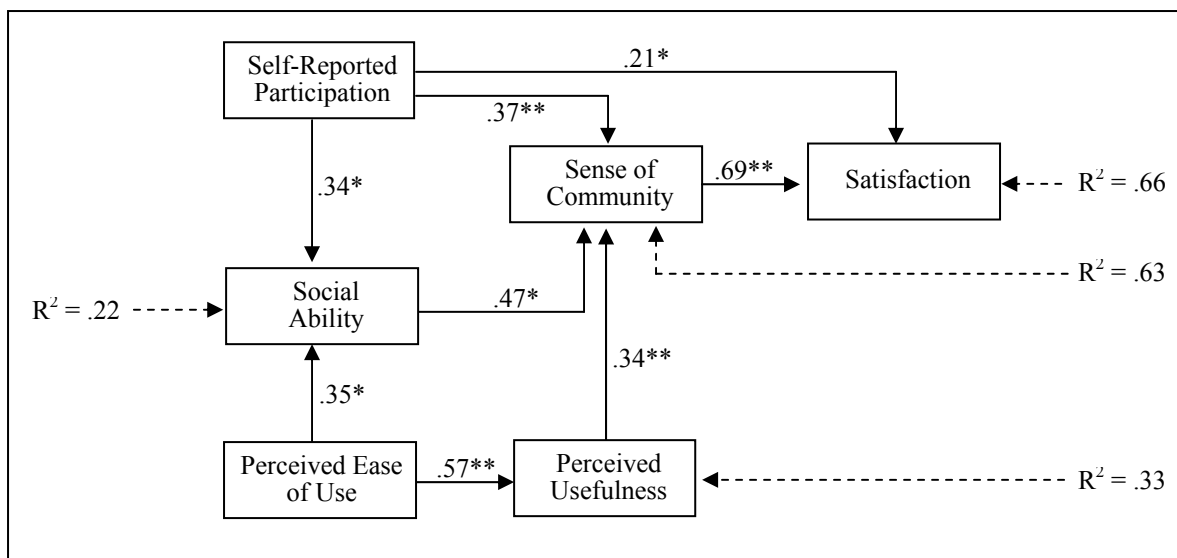


Figure 1. Final Path Analysis Model with R^2 Values (* $z \geq 1.96$, $p < 0.05$; ** $z \geq 3.29$, $p < 0.001$ statistically significant; \rightarrow represents significant path, \rightarrow represents variance explained)

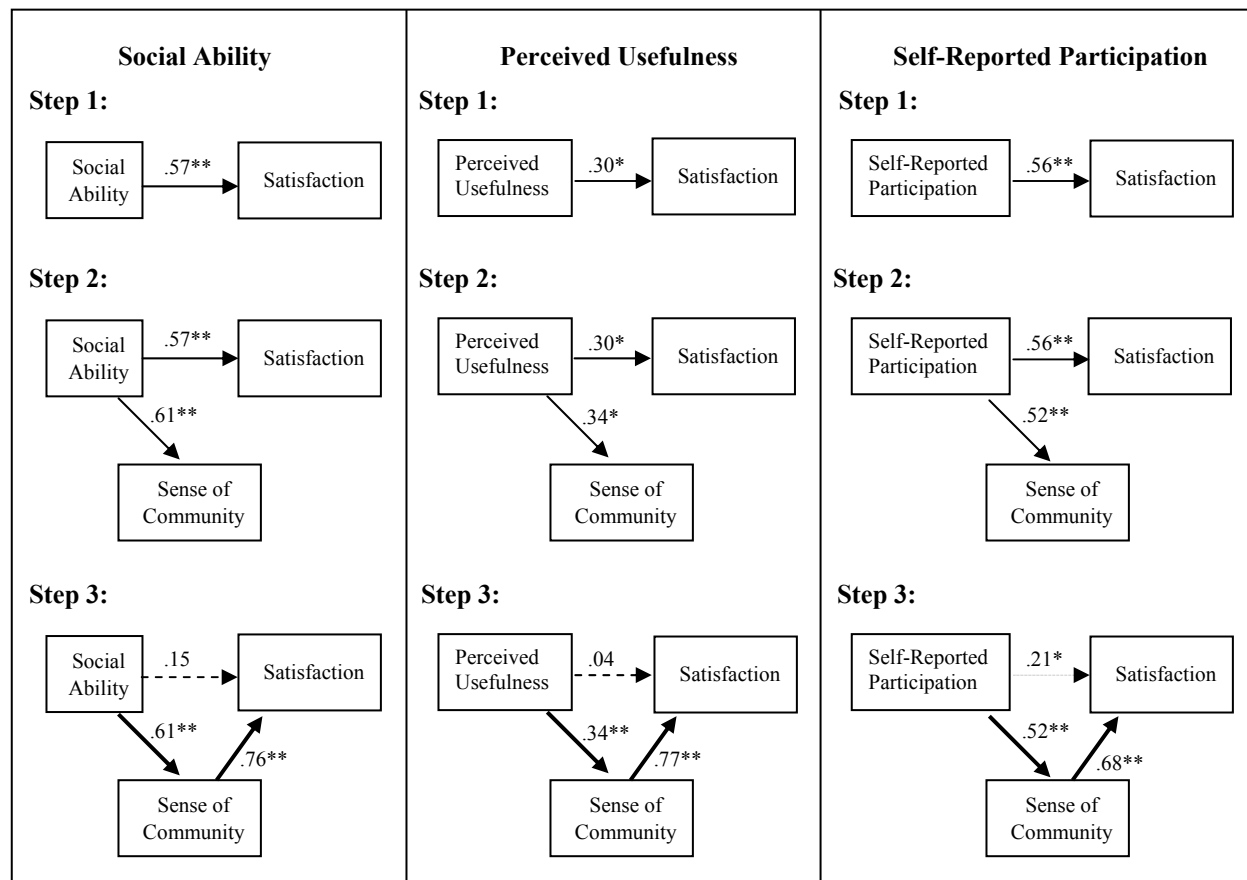


Figure 2. Mediator Identification (* $z \geq 1.96$, $p < .05$; ** $z \geq 3.29$, $p < .001$ statistically significant; ----- \rightarrow represents insignificant path, ——— \rightarrow represents weakened path with significant value, ——— \rightarrow represents significant path without decreasing strength)

Baron and Kenny (1986) defined mediator as a variable accounting for the relation between a predictor and a dependent variable. According to the steps for examining mediating relationships described in Cokley (2003), a mediator is identified when the relationship between a predictor and a dependent variable becomes insignificant while adding the mediator into the path relationship. Based on Cokely's steps, three potential mediating relationships were examined. The results of identifying mediators in the present study show that sense of community mediated the relationships between social ability and satisfaction ($SA \Rightarrow S$) and between perceived usefulness and satisfaction ($PU \Rightarrow S$); however, sense of community did not mediate the relationship between self-reported participation and satisfaction ($SRP \Rightarrow S$). Figure 2 shows how sense of community serves as a mediator for in two relationships but not the third. When the model only includes paths from social ability to satisfaction ($SA \Rightarrow S$) and social ability to sense of community ($SA \Rightarrow SOC$), there are significant relationships between social ability and satisfaction ($SA \Rightarrow S$, $b = .57^{**}$) and social ability and sense of community ($SA \Rightarrow SOC$, $b = .61^{**}$). After adding the path from sense of community to satisfaction ($SOC \Rightarrow S$, $b = .76^{**}$), the relationship between social ability and satisfaction ($SA \Rightarrow S$, from $b = .57^{**}$ to $.15$) decreased and became insignificant. Similarly, for the perceived usefulness model, the relationship between perceived usefulness and satisfaction ($PU \Rightarrow S$, from $b = .30^*$ to $.04$) decreased and became insignificant when the path between sense of community and satisfaction ($SOC \Rightarrow S$) was added. However, for the self-reported participation model, the relationship between self-reported participation and satisfaction ($SRP \Rightarrow S$, from $b = .56^{**}$ to $.21^*$) decreased but remained significant when the path between sense of community and satisfaction ($SOC \Rightarrow S$) was added. Thus, there was no mediating relationship found for the self-report participation model.

Discussion

According to the social theory of learning (Wenger, 1998), members learn by participating in activities and socially interacting with other members of their community. Previous studies have found that students' sense of belonging, communication styles, ways of appropriating tools, and having relationships with others influence their intentions toward participating in course activities and interacting with others. To better understand how social factors impact students' learning interdependently in online learning environments, one research question of this study addressed the influence of sense of community on satisfaction with online learning experience. Our study followed the approach to measuring satisfaction found in other studies of distance education and online courses (Lin, 2005; Alavi, Wheeler, & Valacich, 1995). We assessed students' satisfaction by measuring students' course evaluations and perceptions of learning satisfaction. Consistent with previous studies (e.g. Dawson, 2006; Rovai, 2002a; Rovai, 2002c), our results indicated that, students' perceived sense of community had a strong and positive influence on their overall satisfaction with online learning (Rovai, 2002a). In one study, Rovai (2002c) found that the online learners who had a stronger sense of community and perceived higher cognitive learning felt less isolated and had greater satisfaction with their academic program. Moreover, Dawson (2006) found that students who have more interaction with their peers as well as their instructor had higher degrees of sense community, and it influences them to have higher levels of satisfaction with their courses. It is critical to establish students' sense of community in order to promote their participation and interaction in online learning.

In addition to previous studies, we examine the relationships among social constructs simultaneously. This examination shows how sense of community serves as a mediator for other social constructs (e.g. social ability and perceived usefulness of social awareness tools) to online learning satisfaction. The mediating role of variables shows the importance of examining social constructs simultaneously. Compared to previous studies which have examined one-by-one relationships between social constructs within online learning, we found the relationships among social constructs changed when examining the social constructs simultaneously. A path analysis indicated that sense of community mediates the influence of social ability and perceived usefulness of social awareness tools on satisfaction with online learning. In contrast with a previous study (Lin et al., 2006), we identified social ability as an indirect predictor of satisfaction with online learning, and determined that sense of community is a more direct predictor of satisfaction than social ability. Lin et al. (2006) examined the relationship between social ability and satisfaction without considering the interaction effects from other social constructs; however, we found the social constructs to be interdependent and intertwined. Rather than examining the relationship between social constructs separately, new insights can be gained by studying the intertwined relationships simultaneously.

Further, the final path model not only shows what social constructs contribute to building a sense of community and social ability but also reveals the importance of how students' perceptions of social awareness tools are important to social ability and sense of community. Students' acceptance of social awareness tools as easy to use contributes to their social ability and to their perceived usefulness of these tools. Aligned with Hara and Kling's (2000) finding that students' interaction in online learning was diminished when experiencing difficulties using tools, we found students' social ability affected by their perceptions and feelings about the social awareness tools. Students need to feel that the tool is easy to use before they judge whether the tool is useful for their learning. Also, perceived ease of use was found to directly and positively influence students' social ability, while students' perception of tool usefulness played a direct role in their sense of community. These findings indicate that students appreciate the social awareness tool as they discover it is beneficial to their learning and increases connectivity among community members. However, although students can use tools easily to interact with others in class, if there is no sense of community then their participation and interaction tend to be restrained. This finding confirms the theoretical insights of the social theory of learning in that students' growth not only includes cognition changes about a subject matter but also their identity and sense of belonging, which in turn influences students' further participation and interaction. These findings also serve to remind system designers that a system needs to be developed beyond simple ease of use and usefulness for access to information to also consider supporting socio-emotional interactions that may promote a sense of community.

Finally, our findings illustrate the positive, direct impact of participation on both social ability and sense of community. This result suggests that the more students use the communication tools of the online learning environment, the more they may develop social ability and sense of community in the online context. Therefore, so as to increase social ability and sense of community, online instructors may want to thoughtfully encourage greater use of communication tools in their instructional designs. Although our findings extend previous literature on online

learning by revealing complex relationships among key constructs related to the social nature of online learning, these findings should be applied with care, as more research is required. We have three specific cautions. First, the sample used in this study is a convenience sample and is relatively small. The small sample size constrains the path analysis to include only 6 social constructs in the model, which left 5 sub-constructs of social ability out of the model. However, it would be interesting to investigate how sub-constructs of social ability related to other social constructs individually. Thus, having randomly drawn larger sample sizes would allow the addition of more parameters in path analysis and a more complete examination of the interdependent relationships among social constructs in online learning. Second, only self-reported data were used to measure key constructs used in the model. For example, self-reported participation was used to estimate students' participation and it might not address the meaning of participation addressed by Wenger thoroughly. Self-reported participation can be different from actual participation and the participation perceived by others in classes. Further study should strive to include other data forms such as actual logs of participation activity and content analysis of communication and student products to measure students' level of participation and interaction. Third, there are still some personal variables (e.g., age, gender, and academic level) and course variables (task types, course structures, and instructor experience) not addressed by this study. Further study should try to explore more about how different age, gender, or course related variables influence the relationships of social constructs regarding students' online learning experiences. Addressing these limitations should increase the generalization of the findings about relationships among social constructs to other learning situations.

Educational Importance of the Study

Our study contributes to online education research in several ways. First, our findings support literature that shows sense of community is highly and positively related to student online learning satisfaction. Second, we have built new knowledge that advances the theory of how sense of community develops in online environments, which in turn provides guidance to foster and sustain students' sense of community. The findings illustrate that sense of community is built through students' participation in online activities, positive perceptions toward others in the course, and positive attitudes toward social awareness tools. These findings provide online instructors with an improved sense of how to best support students. Additionally, our findings also identified the impact and need for students' perceptions of social awareness supports/tools influencing the development of students' online learning satisfaction. The result showing that students' perceptions of ease of use and usefulness of social awareness tools affect social ability and sense of community differently provide guidance for systems developers to improve mechanisms of awareness information. Lastly, the results of this study show the importance of examining the relationships among social constructs of online learning simultaneously. Path analytic techniques help uncover the interdependencies among constructs within an overall explanation of outcomes. Future research will consider how the sub-factors (e.g. social presence, social navigation, etc) associated with social ability might relate to other constructs in the model and how behavioral measures of participation can enhance the model. Additionally qualitative methods will contribute to broadening understanding about potential other factors as well as deepening understanding of what it means to be in an online learning environment under different social conditions.

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Appendix A: An example of a daily email digest

CANS notification digest for Friday, April 28, 2006

Intro Web Dev FS06

<https://sakai.school.edu/portal/site/29c7cdc6-e9d6-4f75-0008-05e680708825>

Discussion

| | | | |
|-------------|--------|----------------------------|----------|
| Gary Arndt | posted | "Strength_Arndt" | 16:00:18 |
| Amy Burns | posted | "Re:For the Final Project" | 13:43:40 |
| Anna Duncan | posted | "Re:For the Final Project" | 12:38:36 |
| John Turner | posted | "Strengths_Duncan" | 10:08:28 |

Resource

| | | | |
|-----------|---------|--|----------|
| Amy Burns | created | "unit10_assignment.pdf" | 11:09:29 |
| Amy Burns | created | "unit10_assignment.pdf" | 11:08:39 |
| Amy Burns | created | "62a20e58-f083-4b47-0057-0884600251c8" | 11:08:39 |

Chat

| | | |
|-------------|---------|----------|
| Amy Burns | created | 13:45:31 |
| Allison Kim | created | 12:33:16 |
| Amy Burns | created | 11:59:30 |
| Amy Burns | created | 11:52:24 |
| Amy Burns | created | 11:52:10 |
| Allison Kim | created | 11:51:44 |
| Allison Kim | created | 11:48:12 |
| Amy Burns | created | 10:37:43 |

Announcement

| | | |
|----------------|--------|----------|
| Kimberly White | posted | 00:57:44 |
| Amy Burns | posted | 00:40:32 |

This automatic notification message was sent to users of the CANS Email Digest (<http://cans.school.edu>) To unsubscribe, send an email to zone@school.edu

Appendix B: Online Learning Experience Study Questionnaire (OLESQ)

Directions: The following questions use the rating scales from “strongly disagree” to “strongly agree” as end points. Remember there is no right or wrong answer just answer as accurately as possible. For example, if you strongly agree with the statement, select 7; if you strongly disagree, select 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes your opinion.

Sense of Community

1. I feel that students in this course care about each other
2. I feel that I am encouraged to ask questions
3. I feel connected to others in this course
4. I feel that it is hard to get help when I have a question
5. I do not feel a spirit of community
6. I feel that I receive timely feedback
7. I feel that this course is like a family
8. I feel uneasy exposing gaps in my understanding
9. I feel isolated in this course
10. I feel reluctant to speak openly
11. I trust others in this course
12. I feel that this course results in only modest learning
13. I feel that I can rely on others in this course
14. I feel that other students do not help me learn
15. I feel that members of this course depend on me
16. I feel that I am given ample opportunities to learn
17. I feel uncertain about others in this course
18. I feel that my educational needs are not being met
19. I feel confident that others will support me
20. I feel that this course does not promote a desire to learn

Social Ability

Factor 1: Perceived peers social presence

1. I feel connected to other students in this course
2. My interactions with other students are sociable and friendly
3. My online interactions with other students seem personal
4. In my interactions with other students I am able to be myself and show what kind of classmate I really am
5. I feel like I am a member of a group during the course activities
6. I feel comfortable expressing my feelings to other students
7. When I log on I am usually interested in seeing what other students are doing or have done
8. I trust the other students in this course to help me if I need it
9. The actions of other students in the course are easily visible in our online system
10. When I see that other students are confused I offer help

Factor 2: Perceived written communication skills

11. I am concerned that my writing ability limits how well other students can get to know me
12. I am concerned that my writing ability limits how well my instructor can get to know me
13. I am concerned that my writing ability limits how effective I can be in this course

Factor 3: Perceived instructor social presence

14. My interactions with the instructor are sociable and friendly
15. I feel comfortable expressing my feelings to the instructor
16. My online interactions with the instructor seem personal
17. The actions of the instructor in the course are easily visible in our online system
18. In my interactions with the instructor I am able to be myself and show what kind of student I am really am
19. I trust the instructor in this course to help me if I need it
20. When I log on I am usually interested in seeing what the instructor is doing or has done

21. I feel connected to the instructor in this course

Factor 4: Comfort with sharing personal information

22. I feel uncomfortable with the amount of information about myself that I had to share with other students in this course
23. I feel uncomfortable with the amount of information about myself that I had to share with the instructor in this course
24. I feel uncomfortable interacting with others in the course because these interactions are recorded

Factor 5: Social navigation

25. Knowing what other students in the course have done helps me know what to do
26. Knowing that other students in the course are aware of my work usually influences how hard I work and the quality of my work
27. The actions of other students in the course influence the quality of my work (such as trying to write better messages or working more carefully)
28. Interacting with the instructor helps me accomplish assignments with higher quality than if I were working alone
29. Interacting with other students helps me accomplish assignments with higher quality than if I were working alone
30. The actions of the instructor in the course influences the quality of my work (such as trying to write better messages or working more carefully)

Technology Acceptance: Perceived Ease of Use

1. Learning to use Notification (widget or digest) was easy for me
2. Notification was flexible to interact with
3. I find it's easy to get Notification to do what I want to do
4. It's easy for me to become skillful at using Notification
5. My interaction with Notification is clear and understandable
6. Notification is easy to use

Technology Acceptance: Perceived Usefulness

1. Using Notification helps me learn about & accomplish the course requirements quickly
2. Using Notification helps me to be a productive student
3. Using Notification enhances my effectiveness in the course
4. Using Notification makes it easy to do the course coursework
5. Using Notification improves my academic performance
6. I find Notification a useful tool for my learning in this course

Directions: The following questions use the rating scales from “never used” to “a great extent” as end points. Throughout this questionnaire we use the term “courseware.” By courseware we mean the software system you use for your course, e.g., Sakai, Blackboard or WebCT. Remember there is no right or wrong answer just answer as accurately as possible. For example, if you have performed the action a lot, select 7; if you have never performed the action, select 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes your level of activity.

Self-Reported Participation

Please indicate the extent to which you did the following Course-Related activities

1. Posted messages on the discussion board
2. Read messages on the discussion board
3. Sent Emails to others
4. Uploaded files into the courseware system

Directions: The following questions use the rating scales from “strongly disagree” to “strongly agree” as end points. Remember there is no right or wrong answer just answer as accurately as possible. For example, if you strongly

agree with the statement, select 7; if you strongly disagree, select 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes your opinion.

Satisfaction with Learning in Online

1. I developed knowledge and competencies in this course
2. The course activities were a good fit for the way I like to learn
3. The course activities met my expectations for what I had hoped to learn
4. The knowledge and competencies taught through the course activities are personally meaningful and important to me
5. Course learning objectives were clear
6. I usually have a clear idea of where I am going and what is expected of me in this course
7. The teaching materials for this course are good at explaining things
8. The course tries to get the best out of all the students
9. I'll be happy to take another online course similar to the one I am taking now