

Effects of Peer Interaction Facilitated by Computer-Mediated Conferencing on Learning Outcomes

Deborah K. LaPointe, Instructor
Albuquerque Technical Vocational Institute

Introduction

Social interaction has always been a defining characteristic of education, training, and more generally of learning. Learning is characterized by the exchange of ideas, thoughts, and feelings among people, resulting in new ways of viewing the world or ways of acting (Lauzon, 1992). Learner-learner interaction, also known as peer interaction, facilitated through computer-mediated conferencing is believed to lead to higher levels of learning and has been hailed as the potentially defining characteristic of distance education in the post-industrial age (Garrison, 2000). Research, however, has reported inconsistent results regarding the use of peer interaction in online courses. This study tested a model of critical variables that may influence peer interaction and learning outcomes in an online course.

Literature Review

Several learning theories including social constructivism, socio-cultural theory, and the communities of practice theory rely, in part, on social interaction to explain how learning occurs. In social constructivism, students co-construct meaningful understandings of the world they experience through interaction with others. According to socio-cultural learning theory, learning occurs as students engage in learning activities that use the social, cultural, and historical contexts and tools of the environments in which students exist. One of these tools is social interaction. Through peripheral participation in discussion with practitioners in the field, students learn best practices and solve relevant problems, becoming integrated into the community through interaction (Lave and Wenger, 1991). Saying that individuals think or learn independently is misleading as the thoughts within an individual's mind (a) actually reflect engagement with ideas that other members of the community had thought previously (Zerubavel, 1997) and (b) are affirmed and reinforced through conversation with others (Kolb, 2002). In other words, individuals are always interacting with others.

Learner-learner interaction involves communication between one learner and other learners, alone or in group settings, with or without the presence of an instructor (Moore and Kearsley, 1996). In online environments, communication is conducted through computer-mediated conferencing (CMC).

Research studies have reported many benefits of peer interaction. CMC fosters the uniquely adult types of learning, wherein learners reflect, share experiences and interpretations, synthesize, and apply content in group learning situations. Awareness of differences of opinions, reconciliation of different viewpoints, engagement with others' ideas, and monitoring the clarity of ideas and effectiveness of learning strategies are behaviors associated with sophisticated learners. Explaining to others identifies missing knowledge, reveals the need for clarification, and promotes higher-order learning and better decisions.

However, research studies have also reported that peer interaction sometimes creates obstacles to learning. Interaction causes information overload. Student discussion behaviors such as reading and responding only to unread and simple messages lead discussions off topic. Students who post monologues without taking the time to read or respond to other students' messages negate the purpose of CMC and limit its potential. Students express disappointment when their classmates post messages with too much agreement and unreflective commenting. Learners who perceive participation is *busy work* soon choose not to participate.

Connecting peers through CMC provides no assurance that students will interact or that discussion and learning at higher levels will occur. Learners do not learn because participation is required; they learn when they perform activities that initiate specific learning processes.

Purpose

Researchers have called for the development of predictive models that identify the critical variables in the online environment to explain the relationships among those variables. The purpose of this study was to develop and test a model of five constructs derived from a review of the literature that impact and shape peer interaction facilitated by CMC in order to determine the effects of peer interaction on learning outcomes. The review of the literature established five major constructs shaping and influencing peer interaction within CMC. The five constructs were (a) individual learner characteristics (measured by self-construal), (b) teaching style, (c) task design, (d) course requirements, and (e) prior CMC experience.

Research Question

This study posed one major research question: Are the constructs represented in Figure 1—learner characteristics, teaching style, task design, course requirements, and prior CMC experience—an effective model of the relationships influencing peer interaction and learning outcomes in an online course?

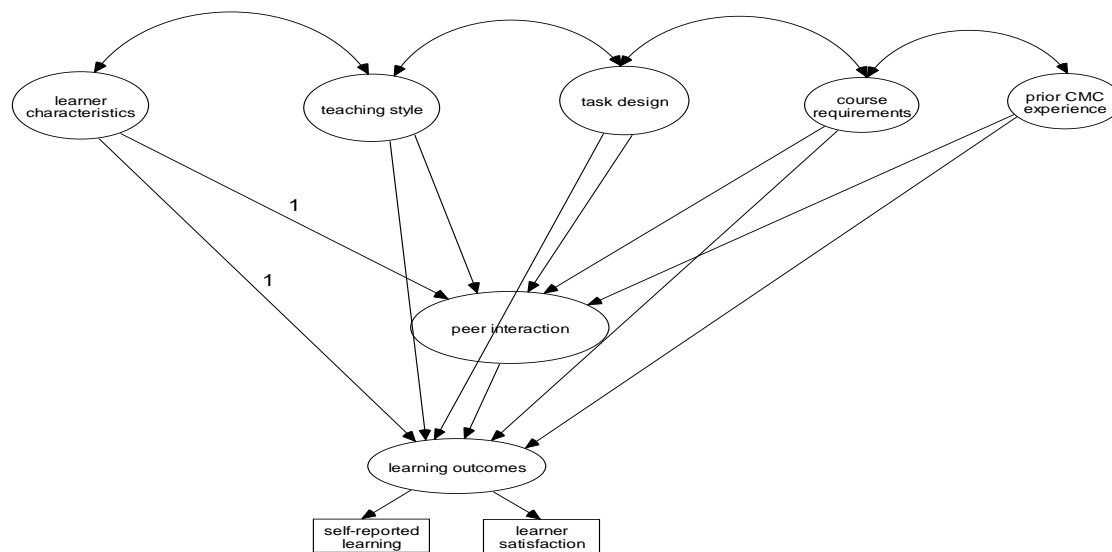


Figure 1. Conceptual Model of Peer Interaction in an Online Environment

Methodology

Structural equation modeling is a way to test a model of relationships among theoretical constructs. Structural equation modeling (SEM) was used in this study to empirically test (a) the constructs and variables represented in an overall model of peer interaction and (b) the model's individual parameters. The data entered into the model was collected through survey and quantitative content analysis methods. AMOS 4.0 was the SEM software used to determine whether the proposed model was consistent with the data collected.

Procedures

The five constructs were measured through 14 observed variables. The sense of self-construal was measured by Gudykunst's (1996) Self-Construal Scale. Factor analysis of the Self-Construal Scale resulted in two indicators of self-construal—(a) an independent sense of self-construal and (b) an interdependent sense of self-construal. Teaching style was measured by Anderson et al.'s (2001) Teaching Presence model. Factor analysis of the Teaching Presence model produced three indicators of teaching presence—(a) course design, (b) facilitation of discussion, and (c) direction of instruction. Task design was measured through content analysis applying Marzano's Taxonomy (2001) to messages assigning the online tasks to the learners. Coders' analyses were reduced to one overall mode per course. The course requirements data were gathered by content analysis of the syllabi. The prior CMC construct was measured with Gunawardena and Duphorne's (2002) Learner Readiness scale. The factor analysis of the Learner Readiness scale resulted in two indicators—(a) the learner's belief in CMC's capacity to conduct academic discussions and (b) the learner's preparation for using CMC.

Peer interaction was measured by the Final Peer Interaction scale developed by the researcher. Factor analysis of the scale produced two indicators of final peer interaction—(a) frequency of participation and (b) nature of the messages posted.

The learning outcomes construct was measured by (a) self-reported learning and (b) learner satisfaction with learning through peer interaction. Self-reported learning was measured by the Self-reported Learning scale developed by the researcher. The factor analysis of the Self-reported learning scale produced two indicators—(a) content and skills learned and (b) a value of learning. Learner satisfaction was measured by Gunawardena and Zittle's (1997) satisfaction scale within the GlobalEd Questionnaire. The factor analysis of the learner satisfaction scale produced two indicators—(a) behavioral efforts of participating in peer interaction and (b) value of peer interaction.

Sample

This study examined 228 learners enrolled in 22 online courses taught at six American colleges and universities and one Canadian university during the Spring and Summer 2002 semesters. The academic level of the courses ranged from associate degree to Ph.D., and course content ranged from basic html coding to qualitative feminine research. Of the 228 responding participants, 178 were female (78%) and 43 were male (19%). Learners completed three online questionnaires during the semester.

Results

With the first run of the model, multicollinearity problems indicated that intercorrelations among some of the variables were so high that certain mathematical operations were impossible (Kline, 1998). The correlation between the two learning outcomes variables—(a) self-reported learning and (b) satisfaction with learning—was $.87, p < .01$. The strong correlation among the two learning outcome measurements indicated that, according to the proposed model, these two variables were redundant and measuring the same construct (Kline, 1998). A factor analysis was rerun combining the GlobalEd Satisfaction scale and the Self-reported Learning Scale. One combination learning outcomes indicator was used in the model.

The second run of the model indicated that although it was theoretically possible to calculate a unique estimate of every one of the model's parameters, the five-construct model was too complex for the amount of data collected. While a sample size of 228 participants usually constitutes a medium sample size for SEM, SEM requires a ratio of participants to free model parameters of 10:1. This study had a ratio of 5:1. Therefore, dropping paths and some variables were necessary to simplify the model.

The self-construal, the task design, and the course requirements constructs were dropped due to reliability problems. Correlations among the constructs were eliminated. Two constructs were replaced by their observed indicators. The respecified model is shown in Figure 2.

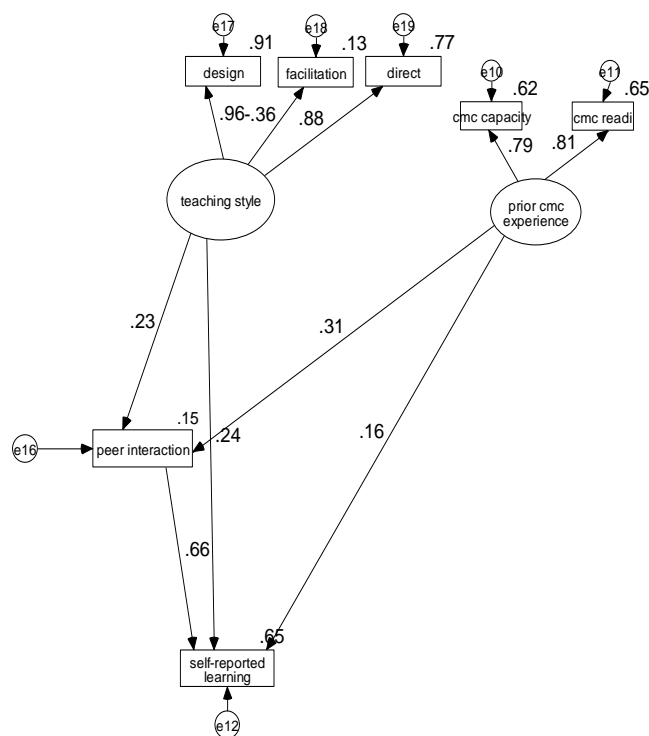


Figure 2. The two-construct model of peer interaction in an online environment

Findings and Conclusion

The strength of the relationship between peer interaction and learning outcomes in the two-construct model was .66, indicating a large significant direct effect of peer interaction on learning outcomes. For every one standard deviation change in peer interaction, learning outcomes are expected to improve by .66 standard deviation. Goodness of fit indices indicated the two-construct model fit the data. The connection between peer interaction and learning outcomes as shown in the two-construct model is a significant finding and shows that peer interaction is strongly related to learning outcomes. What is also of interest is that the construct learning includes both affective and cognitive outcomes. The strong correlation among learning and satisfaction suggests the cognitive dimension of learning cannot be separated from its affective dimension.

Teaching style and prior CMC experience together in the two-construct model explained 15% of the variance of peer interaction. These two variables measured influences of the instructor and learner's prior experience with CMC and explained only a small percentage of peer interaction. The small percentage explained by the two variables suggests important variables are missing from the model. One of the missing variables may be the measurement of a learner characteristic that influences communication with others in an academic setting—learning style, motivation, or preference for working alone or with others.

Teaching style and prior CMC experience plus peer interaction accounted for 65% of the variance in learning outcomes. The 35% unexplained variance in learning outcomes also may be related to influential individual learner characteristics that were missing from the model.

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Biographical Sketch

Deb LaPointe is an instructor in the Business Occupations Department at TVI in Albuquerque, NM.

Address: 739 Solar Road NW
Albuquerque, NM 87107

E-mail: debla@tvi.edu

Phone: 505.224.3887;

Fax: 505.224.3850