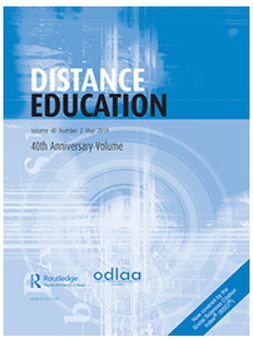

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Exploring presence in online learning through three forms of computer-mediated discourse analysis

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ABSTRACT

This case study examined patterns in online communication using computer-mediated discourse analysis to better understand how teaching presence, social presence, and cognitive presence are manifested in an online learning environment. The findings indicate that study participants actively participated in the discussion. The instructor and facilitators displayed high teaching presence through posting encouraging social words and maintaining a positive emotional tone, which created an open communication environment for student discussion. To promote students' cognitive development, the acts that their words described included to "inform" and "elaborate" to help students construct knowledge by providing factual information and extending or embellishing upon points made. Students displayed social presence by using more social and positive emotion words, and tone, which signaled that they were satisfied with the discussion. Students' cognitive presence was manifested through making claims, providing information and elaboration on posted comments.

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Online learning; computer-mediated discourse analysis; teaching presence; social presence; cognitive presence

Introduction

As online education is increasing in higher education, a variety of efforts have been made to improve students' learning experiences and outcomes (Ertmer & Koehler, 2015; Garrison, Anderson, & Archer, 2000; Richardson et al., 2015). Online discussion forums have been used as a promising medium to promote collaborative learning and higher order thinking (Harman & Koohang, 2005). To examine the effectiveness of online discussions, various approaches have been explored. Studies indicate that meaningful and effective learning is related to collaborative communities of inquiry (CoI) (Akyol & Garrison, 2011a; Garrison & Anderson, 2003; Garrison et al., 2000).

CoI research has shown that the framework provides an important conceptual perspective for examining communication and interaction in online education (e.g., Akyol et al., 2009; Garrison et al., 2000). Arbaugh (2008) found that the CoI framework can predict both students' perceived learning and their satisfaction in online courses. However, other researchers have argued that CoI research provides scant evidence that social, teaching, and cognitive presence lead to meaningful learning in online

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environments (Annand, 2011; Rourke & Kanuka, 2009). Moreover, Gonyea (2005) notes that CoI research tends to rely too heavily on students' self-reported data, leading to serious potential limitations.

Therefore, unpacking the actual discourse in online discussion forums to examine participation in online discussion and students' learning behaviors has increasingly drawn researchers' attention. One of the approaches for analyzing online discourse is computer-mediated discourse analysis (CMDA), which adapts methods from language-focused research to analyze computer-mediated communication (Herring, 2004). For example, Yoo and Kim (2014) found that there is a predictive relationship between the linguistic characteristics of discussion and student learning performance. Given such findings, it is vital to design and refine new methods for capturing how students interact in CMDA environments.

Literature review

CoI in online learning

CoI is a comprehensive framework for designing online courses to support critical thinking, critical inquiry, and discourse among students and instructors (Garrison et al., 2000). The theoretical background of this framework is social constructivism (Akyol et al., 2009; Akyol & Garrison, 2011b; Akyol, Ice, Garrison, & Mitchell, 2010; Shea et al., 2011; Swan, Garrison, & Richardson, 2009; Swan & Ice, 2010). Social constructivism emphasizes that learning happens when students interact with others in a sociocultural context (Oldfather, West, White, & Wilmarth, 1999). Not surprisingly, Akyol et al. (2009) argued that the CoI framework emphasizes the learning process rather than solely the outcomes of that process.

The framework includes three interdependent dimensions, namely (a) social presence, (b) cognitive presence, and (c) teaching presence (Garrison et al., 2000). These presences can foster engagement and communication, which Garrison and his colleagues deem necessary for deep and meaningful learning in online courses.

Social presence describes relationships and the social climate in a learning community, which involves meaningful and trustful communication (Rourke, Anderson, Garrison, & Archer, 2007). It indicates the extent to which participants feel an affective connection to each other and is considered to be one of the important elements in a CoI (Garrison, Cleveland-Innes, & Fung, 2010). The extent of emotional expression, open communication, and group cohesion can indicate the level of social presence (Garrison et al., 2000).

Cognitive presence covers the learning phases from the initial practical inquiry to the eventual problem resolution. It indicates the extent to which online students construct knowledge and meaning through communication and thinking (Garrison, Anderson, & Archer, 2001). Cognitive presence is manifested when learners explore the most effective and efficient ways to solve a problem and put the solutions into action. Building on Dewey's (1993) practical inquiry model, Garrison et al. (2001) indicate that cognitive presence consists of four phases, which are (1) the problem definition (i.e., a triggering event), (2) the exploration of different ideas (i.e., the exploration phase), (3) the construction of the meaning of the solutions (i.e., integration phase), and (4) the selection of the best solutions for application (i.e., resolution phase).

Research has found that the exploration stage is more common compared to the resolution and integration stages (e.g., Arnold & Ducate, 2006; Garrison et al., 2001; Kanuka, Rourke, & Laflamme, 2007). The importance and frequency of exploration is considered to be due to an interrelationship between cognitive presence and teaching presence (Garrison, 2007; Garrison & Arbaugh, 2007; Garrison & Cleveland-Innes, 2005; Vaughan & Garrison, 2005), as teachers usually facilitate learners in exploring as many different ideas as possible. Garrison and Arbaugh (2007) emphasized the roles of instructional design and facilitation in stimulating the integration and resolution stages of cognitive presence. This perspective indicates that teaching presence is needed to achieve higher levels of cognitive presence (Garrison & Akyol, 2013).

Teaching presence refers to the instructional role during learning (Anderson, Liam, Garrison, & Archer, 2001). It involves "the design, facilitation, and direction of cognitive and social presences for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001, p. 5). Thus, teaching presence includes the design of instruction as well as the facilitating of discourse (Akyol & Garrison, 2008).

The purpose of teaching presence is to encourage and maintain cognitive and social presence (Garrison et al., 2000); thus, teaching presence brings the components of a CoI together for improving learning outcomes (Garrison, 2011). As such, teaching presence is considered a vital component of educational communities of inquiry (Garrison & Akyol, 2013). However, teaching presence is not only limited to instructors' behavior; it can extend to any participants in a CoI (Garrison, 2011), including teaching assistants, instructional guests and expert volunteers, and other facilitators.

In an attempt to foster a sense of teaching presence, the use of reciprocal teaching (Palinscar & Brown, 1984), which was initially proposed to guide students' reading comprehension through summarizing, questioning, clarifying, and predicting, provides a possibility for students to play a teacher's role and increase teaching presence. Reciprocal teaching has been advocated in online education (Anderson, 2004; Milligan & Griffin, 2016; Trentin, 2001) as a means to encourage students to articulate and share their opinions as well as interpret the readings, thereby elevating teaching presence. For example, Milligan and Griffin (2016) mentioned that reciprocal teaching can encourage students to recognize and acknowledge peers' leadership contributions as well as help foster an open mindset to learn from diverse sources.

CMDA

Computer-mediated discourse (CMD) refers to language use in computer-mediated communication (CMC) (Herring, 2001). Herring (2007) proposed a faceted classification scheme for CMD. Interaction in online and blended courses often takes place by means of social discourse in a discussion forum. Importantly, online discussion forums are considered one type of CMD in Herring's (2007) scheme. In online environments, where there is a lack of face-to-face interaction, ideas are typically exchanged and negotiated through online language exchanges in virtual communities (Akyol, Vaughan, & Garrison, 2011; Kolko, 1995; Kozan & Richardson, 2014).

To analyze CMC, CMDA was developed by adopting methods from language-focused disciplines (Herring, 2004). CMDA focuses on verbal interaction, and can entail

qualitative or quantitative analysis (Herring, 2004). Herring (2004) categorized CMDA applications into four levels which are: (a) structure, (b) meaning, (c) interaction, and (d) social behavior. The structural level focuses on the use of typography, orthography, word formations, and sentence structures (Herring, 2012). According to Herring (2012), the meaning level refers to the meanings of words and utterances (e.g., speech acts such as a request). The third level, interaction, examines phenomena such as of turn-taking, topic development, and idea generation. The social behavior level includes linguistic expressions of play, conflict, and power. In addition to these four domains, online participation patterns (e.g., the frequency and length of messages posted) are considered the fifth domain of CMDA analysis. Herring and Nix (1997) used meaning-level CMDA analysis to classify Internet relay chat utterances as speech acts in order to examine differences associated with teacher and other roles, as well as differences between educational and recreational uses of Internet relay chat.

CMDA in online education

Given the evolution of the social-constructivist perspective on learning and knowledge construction (Bonk & Cunningham, 1998; Brown & Adler, 2008) and the advantages of CMDA for the analysis of online communication, it is not surprising that some studies have used CMDA for understanding online discussion participation and learning performance. For example, research has been conducted on linguistic differences in discussion contributions as shown by linguistic inquiry and word count (LIWC) metrics (Joksimovic, Gasevic, Kovanovic, Adesope, & Hatala, 2014; Xu, Murray, Woolf, & Smith, 2013) and their relationship to student learning outcomes (Yoo & Kim, 2014). Specifically, Kovanović et al. (2016) used LIWC tools (Tausczik & Pennebaker, 2010) to examine cognitive presence in online discussion. Wen, Yang, and Rosé (2014) also showed that LIWC word categories (most directly, cognitive words, first-person pronouns, and positive words) could be used to measure the level of student motivation and cognitive engagement. Similarly, Cui and Wise (2015) examined the types of contributions that are most likely to be acknowledged by instructors through simple word frequency analysis. These studies provide examples of how to explore online interactions through a linguistic perspective.

In these previous studies, most of the interactions were carried out through online learning discussion forums. Such analyses of actual online interactions and language use provide a rich and deep understanding on what is going on in online courses. However, there is a lack of research examining all three CoI presences through discourse analysis. Therefore, this study examined key discourse features such as participation and speech acts to better understand how social presence, cognitive presence, and teaching presence are manifested in three weeks of an online discussion forum in a graduate-level course in a Midwestern university.

Specifically, the following research questions are addressed in this study:

(1) To what extent do the instructor and students participate in the online discussion?

(2) How is teaching presence manifested in the discussion?

(3) How is students' social presence manifested in the online discussion?

(4) How is students' cognitive presence manifested in the online discussion?

Methods

To answer these research questions, we utilized a case study approach to empirically analyze persons, events, decisions, and projects in a real-life context (Thomas, 2011; Yin, 1994). Case study methodology can provide an in-depth and detailed examination of the situation and its contextual conditions.

Context

The context of this study is a graduate-level online course in an instructional technology program in a Midwestern university that took place during Fall 2017. This course introduced basic concepts, background, theory, and research in the field of instructional technology. The instructor, the third author of this study, had taught in the university for over 25 years. He is an expert in the educational technology field. The students were online master's and doctoral education students in an instructional technology program, most of whom had a full-time job at the time that they took the course. A weekly online discussion, which accounted for 40 out of 200 total points, was one of the six assignments in this course. The number of online students who participated in the discussion varied somewhat over time: 14, 11, and 13 students participated in Week 2, Week 10, and Week 14, respectively.

A reciprocal teaching strategy, which involves peer questioning, clarifying, and summarization, was used in this course. At the beginning of the semester, each student signed up to be a facilitator of one week of discussion. Typically, each week had one facilitator except Week 14, which had two facilitators based on their interest. The role of the facilitator was to post a set of questions each week as a discussion starter and moderate the ensuing discussion of that week's articles and other resources. As the designated closer, the facilitator also wrapped up discussion at the end of the week. In starting the discussion, the facilitators were required to post their questions by 10 a.m. Sunday of their chosen week. All students were required to reply to the posts of at least two other students in Canvas by the end of Friday each week. For instance, in Week 2, the facilitator posted the following four discussion questions:

(1) According to Januszewski and Persichitte (2008), the evolving definitions of educational technology have used a variety of labels such as "theory," "field," "process," "study," "practice," and "profession." Based on the strengths and weaknesses of each definition as described in the reading material, which would you choose as the most accurate descriptor of educational technology and why?
(2) Molenda and Boling (2008) describe how the definition of educational technology has changed in response to the ascendance of learning theories such as behaviorism, Gestalt/cognitive psychology, and constructivism. The current AECT definition uses the term "facilitating" to incorporate a constructivist approach. However, the methodology of educational technology is still described in "systems" or "process" terms. This implies that "the systems approach remains the guiding paradigm at the strategic level, but at the tactical level some constructivist techniques can be employed" (p. 128). Do you think that this approach will become viewed as a "two-headed monster" in the future or is it possible to hold both approaches to instructional design and technology in tension?

(3) According to Januszewski and Persichitte (2008), Finn was instrumental in the emergence of educational technology by establishing the need for a new body of content and theoretical framework (p. 263). How successful has educational technology as a discipline been in reaching Finn's goals?
(4) Some of the authors of the reading material this week have used the terms "educational technology" and "instructional technology" as different concepts, while others have treated them as synonyms. Do you think they should be used differently? Which is your preferred term?

The instructor decided whether postings were acceptable by reviewing their quality and quantity throughout the semester. Importantly, he and his teaching assistant actively participated in the weekly online discussions.

Data collection

The study employed a purposive sampling method to collect data to best represent the online discussion of this course. Selected for analysis in the present study were three weeks of online discussion forum data comprising 277 posts from the online course. The three weeks comprise Week 2, with the discussion topic of "Instructional Technology Overview;" Week 10, with the discussion topic of "Trends and Issues in IT;" and Week 14, with the topic of "Career and Professional Development." Weeks 1 and 15 were not selected due to the fact that Week 1 was devoted to self-introduction, and Week 15 was a discussion with no specific topic that mainly involved the sharing of final projects and papers. Therefore, the first and last online discussion weeks with specific course topics were Week 2 and Week 14. Week 10 was selected to represent the discussion in the middle of the semester.

Data analysis

CMDA was used to analyze the online discussion data (Herring, 2004). Specifically, research question (RQ) 1 was addressed by using participation analysis and LIWC analysis. For RQs 2, 3, and 4, both LIWC and speech act analysis were utilized. The specific methodological procedures of each analysis are described below.

Participation analysis

Herring (2004) includes participation analysis as a level of CMDA. Some participation metrics for the participation patterns include frequency and length of messages posted. We first analyzed the frequency of messages and utterances (speech acts) each week. In addition, the average length of the messages was calculated.

LIWC

We then analyzed word frequencies using the licensed version of LIWC (LIWC2015). This tool was originally developed by Pennebaker, Francis, and Booth (2001). Importantly, LIWC2015 has a default dictionary that defines the words that should be counted in the target document. Previously, Pennebaker, Mehl, and Niederhoffer (2003) used this tool to identify gender differences in language use. In 2015, LIWC was updated to LIWC2015.

The present study mainly adopted automated counts of nine key linguistic features, consisting of the initial five categories—(a) *first person singular pronouns*, (b) *social words*, (c) *positive emotions*, (d) *negative emotions*, and (e) *cognitive processes*—as well as additional four composite categories that were added in the 2015 version of the LIWC —(f) *analytic*, (g) *clout*, (h) *authenticity*, and (i) *emotional tone*. Based on Pennebaker, Booth, Boyd, and Francis (2015) and the LIWC2015 operator's manual, a high score for analytic signifies that the language is formal and logical, and involves hierarchical thinking, whereas a lower score in this category indicates more informal, personal, and narrative thinking. The clout score, in contrast, indicates to what extent the author's language is confident and reflective of high expertise. Authenticity indicates to what extent the author's language is honest, personal, and disclosing. Finally, a higher score for emotional tone indicates more positive expression, whereas a lower score indicates more negative expression, suggesting, for example, that the author is anxious or sad.

These nine linguistic features relate to some extent to the three CoI presences. Categories such as first person singular pronouns, social words, positive emotions, negative emotions, authenticity, and emotional tone were used for analyzing social presence. For example, social words and simple phrases like "Hi everyone" and "Hope you all take a break" can increase the sense of social presence. Other categories such as cognitive processes and analytic were examined as indicators of cognitive presence. All nine features were used to analyze teaching presence. The study ran LIWC for the messages from female students, male students, the facilitator, and the instructor separately.

Speech act analysis

In addition, this study adopted speech act analysis to analyze the intended meaning of utterances (Levinson, 1983). Specifically, the CMC act taxonomy developed by Herring, Das, and Penumarthy (2005) was used to classify speech acts. The CMC act taxonomy was created by combining and simplifying Bach and Harnish's (1979) classic classification of speech acts and Francis and Hunston's (1992) classification scheme for acts used in spoken conversation, modified to fit online communication situations such as that in this particular study.

The CMC act taxonomy consists of 16 speech acts: *inquire, request, direct, invite, inform, claim, desire, elaborate, accept, reject, react, repair, apologize, thank, greet*, and *manage*. Acts that indicate social presence include accept, react, thank, and greet, as these relate to social interaction. Inquire, request, inform, claim, elaborate, and manage indicate cognitive presence, because these acts are associated with cognitive activity. Finally, all 16 acts can indicate teaching presence, because all the acts can potentially be used in the instructor's and facilitator's practice of facilitating online discussion. Each utterance was categorized as a single act; in cases where a message might fit more than one act (e.g., claim and reject), the most specific applicable label was assigned (in this case, reject). For example, one student's expression of disagreement, "I do not think that the use of 'facilitate' implies a full-on constructivist orientation," was categorized as reject. All of the discussion posts were manually coded by the first author using Herring et al.'s (2005) CMC act taxonomy, for which definitions and examples are displayed in Table 1. Forty sample utterances were also coded by the second author, resulting in an interrater agreement of 90%.

Table 1. Taxonomy of CMC acts (from Herring et al., 2005).

Acts	Definitions and examples
Inquire	(Seek information) Inquiry, neutral/marked proposal e.g., If you are currently in an instructional designer role, are your main responsibilities to design, train, manage and support?
Request	(Seek action politely) Direct or indirect request e.g., Please do not forget to cite the source or provide a link to it, so other classmates can access it too.
Direct	(Attempt to cause action) Require, prohibit, permit, strongly advise e.g., Do not push too hard.
Invite	(Seek participation/acceptance by the addressee) Solicit input, include, suggest, offer (provide goods or opportunity) e.g., Let's role play a scenario.
Inform	(Provide "factual" information; verifiable in principle, even if untrue) Inform, state e.g., On page 42 it states, "The reuse ratio typically remains around 50, which is a healthy ratio."
Claim	(Make a subjective assertion; unverifiable in principle) Assert, guess, speculate e.g., I think PD is helpful to repeat in some instances.
Desire	(A cover term including three categories of situation) Desire, need (desiderative); hope, wish, dream, speculate (hypothetical, counterfactual); promise (future action) e.g., We're hoping this will help to keep a flow going and help to organize our conversation.
Elaborate	Comment on, explain, paraphrase a previous utterance (usually one's own) e.g., students will be able to take classes online from different teachers if they are not offered at their schools.
Accept	Concur, agree, acquiesce e.g., I agree with you that instead of asking what or how, teachers should ask why to use technology.
Reject	Disagree, dispute, challenge e.g., I did not say that life purpose and career are the same.
React	(Show listenership, engagement—positive, negative, or neutral) Endorse, approve e.g., Wow, Beth! That's great!
Repair	Return, clarify, correct misunderstanding e.g., Your statement: "Technology is the most powerful when it is used to enhance learning." What did you mean?
Apologize	Humble oneself, self-deprecate e.g., I apologize I missed it.
Thank	Appreciate, express gratitude e.g., Thanks Sophie! I appreciate the article!
Greet	Greeting, leave taking, inquiries about/wishes for well-being e.g., Hi Maggie!
Manage	(Manage discourse) Organize, prompt, focus, open or close discussion, preamble, etc. e.g., Here are a few strategies that I have used to foster relationships with faculty and increase buy-in.

Results

Participation metrics

During the three weeks of this analysis, 227 messages were posted in 24 days (8 days each week, from Sunday to the next Sunday), or approximately 12 posts per day (see Figures 1–3). The posts averaged about 123 words in length. The students who signed up to be facilitators for the week generated the most posts (n = 62), followed by the instructor (n = 44). On average, facilitators posted three times as many posts as the students, whereas the instructor posted twice as many posts as the students. These findings demonstrated that both the weekly facilitator(s) and the instructor were actively involved in the online discussion.

In all three weeks, the instructor posted a prompt at the beginning of the week and participated most heavily in the discussion toward the end of the week. Compared to the instructor, posts from facilitators were more evenly distributed over the week. Interestingly, students posted primarily in the first part of Weeks 2 and 10, but in Week 14, they posted mainly at the end of the week (Figures 1–3).

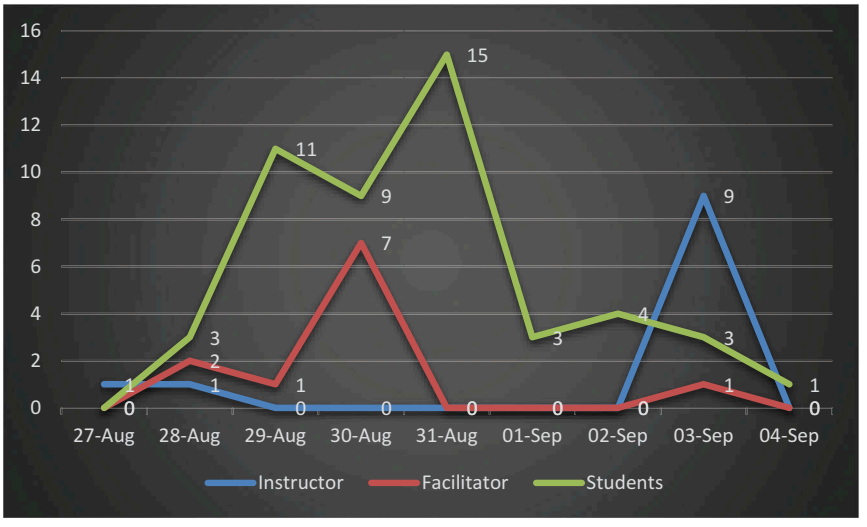

Figure 1. Number of posts each day in Week 2.

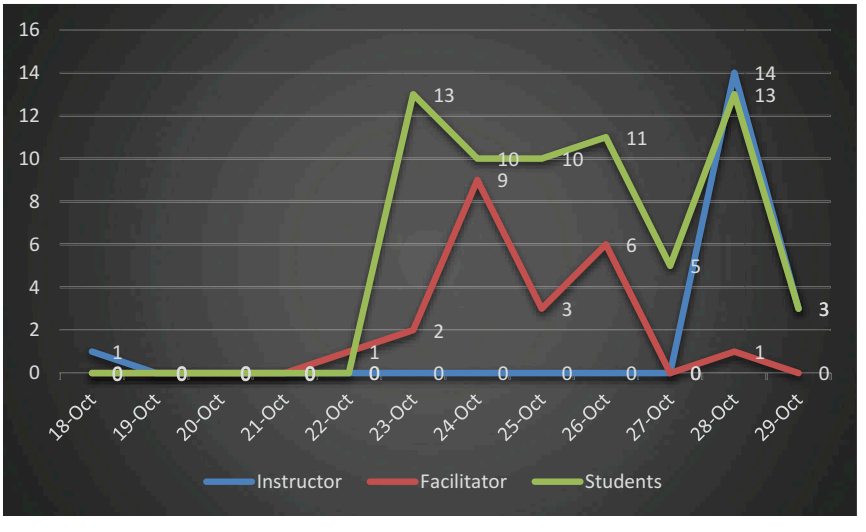

Figure 2. Number of posts each day in Week 10.

The 277 posts include 1784 utterances in total. On average, each person posted 6.79 posts and 44 utterances per week, although the number of participants and the average posts and utterances per person varied for each week (see Tables 2–4). The number of participants in Weeks 2, 10, and 14 was respectively 15, 12, and 14.

The number of instructor posts increased from 11 in Week 2 to 18 in Week 10, and then decreased to 15 in Week 14 (Tables 2–4). The average number of facilitator posts increased from 11 in Week 2 to 22 in Week 10, and then decreased to 14.5 during Week 14 due to having two facilitators in Week 14. The average number of student posts also increased slightly in Week 10.

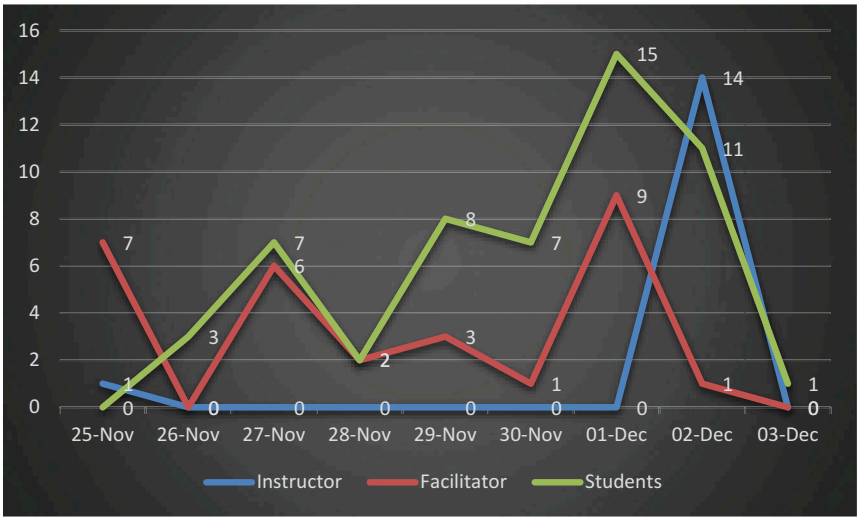

Figure 3. Number of posts each day in Week 14.

Table 2. Number of posts and utterances in the discussion forum in Week 2.

Role	Participants	Total posts	Av. posts per person	Total utterances	Av. utterances per person
Instructor	Male (1)	11	11	62	62
Facilitator	Male (1)	11	11	53	53
Students	Female (11)	43	3.9	360	32.7
	Male (2)	9	4.5	64	32
Total	15	74	4.9	539	35.9

Table 3. Number of posts and utterances by each person in Week 10.

Role	Participants	Total posts	Av. posts per person	Total utterances	Av. utterances per person
Instructor	Male (1)	18	18	88	88
Facilitator	Female (1)	22	22	193	193
Students	Female (8)	49	6.1	250	31.3
	Male (2)	16	8	87	43.5
Total	12	105	9.5	618	51.5

Table 4. Number of posts and utterances by each person in Week 14.

Role	Participants	Total posts	Av. posts per person	Total utterances	Av. utterances per person
Instructor	Male (1)	15	15	80	80
Facilitator	Female (1) Male (1)	29	14.5	167	83.5
Students	Female (9)	46	5.1	314	34.9
	Male (2)	8	4	66	33
Total	14	98	7	627	44.8

The utterances of the instructor increased from 62 in Week 2 to 88 in Week 10, and then decreased to 80 during Week 14 (Tables 2–4). The utterances of the facilitator surged from 53 in Week 2 to 193 in Week 10, and then decreased to 83.5 during Week 14. However, the number of student utterances did not vary much from week to week.

Overall, during these time periods, the facilitators produced the most utterances per person (n = 329.5), followed by the instructor (n = 230) and the female students (n = 103.3) (Tables 2–4). The male students had the fewest utterances per person (n = 94).

Word counts

From the word frequency counts in Table 5, we can see overall language use differences among the different roles in the discussion forum. Students, especially female students, used more first person singular pronouns overall (3.84) than the instructor (2.01) or facilitator (2.28). Both female students (51.27) and male students (46.00) used more authenticity words than the instructor (32.48) or facilitators (34.03), suggesting that students described more personal experiences in the discussion and were more ego-centered. Conversely, the instructor (62.45) and facilitators (76.54) used more clout words than either female students (51.88) or male students (50.80), indicating that the instructor and the facilitator displayed more authority in the discussion. This sense of

Table 5. Word frequency counts (values normalized per 100 words).

Items	Week	Count	Scientific writing	Social media	Instructor	Male	Female	Facilitator
First-person singular pronouns	Total	3.19	0.63	5.51	2.01	2.6	3.84	2.28
	W2				0.58	2.67	2.97	3.01
	W10				2.01	2.21	3.84	1.76
	W14				3.52	3.03	4.66	2.50
Social words	Total	6.99	7.62	9.71	6.24	5.95	6.49	9.69
	W2				5.67	4.99	4.57	6.21
	W10				5.88	5.3	5.72	7.92
	W14				7.19	7.64	8.74	12.63
Positive emotions	Total	3.59	2.32	4.57	3.45	4.62	3.11	4.52
	W2				2.69	2.32	2.28	3.20
	W10				4.18	4.04	3.88	4.25
	W14				3.52	7.48	3.44	5.25
Negative emotions	Total	0.60	1.45	2.1	0.68	0.98	0.52	0.58
	W2				0.51	0.52	0.34	0.29
	W10				1.01	1.01	0.74	0.62
	W14				0.54	1.35	0.56	0.65
Cognitive processes	Total	15.22	7.52	10.77	11.43	16.05	15.71	15.51
	W2				62.65	15.40	16.92	16.68
	W10				11.91	17.55	15.21	17.56
	W14				9.64	14.73	14.86	13.17
Analytic	Total	71.51	92.57	55.92	77.08	78.72	70.86	64.72
	W2				87.33	88.95	80.46	64.43
	W10				70.42	80.25	70.23	62.72
	W14				70.01	63.02	60.61	66.66
Clout	Total	57.97	68.17	55.45	62.45	50.80	51.88	76.54
	W2				64.48	47.93	48.10	57.69
	W10				59.78	47.22	45.59	64.04
	W14				62.89	57.89	59.01	89.58
Authenticity	Total	45.14	24.84	55.66	32.48	46.00	51.27	34.03
	W2				31.07	57.39	48.53	51.61
	W10				25.73	38.14	51.16	27.88
	W14				41.20	45.38	53.88	33.76
Emotional tone	Total	83.05	43.61	63.35	76.86	88.00	74.12	90.59
	W2				67.03	60.02	62.57	78.97
	W10				82.52	80.64	82.16	87.78
	W14				80.00	89.00	78.57	95.02

Scientific writing refers to how often such types of words are used in scientific prose.Social media refers to how often such types of words are used in social media such as Facebook, Twitter, and blog.

authority or clout could have occurred when the instructor and facilitator acted their role and addressed students' questions or commented on students' posts.

Compared to the other student participants, the facilitator employed more social words per 100 words overall (9.69) than the female students (6.49) or male students (5.95). The facilitator also displayed more positive emotion (4.52), higher (positive) emotional tone (90.59), and authority (76.54) in the discussion. It makes sense that the facilitator acted in the role that he/she was assigned. He/she had to encourage other students to engage in the discussion, address questions that other students asked, and act more like an instructor than a student. However, the facilitator used fewer analytic words (64.72) compared to the instructor (77.08), male students (78.72), and female students (70.86).

Changes over time

From Week 2 to Week 14, the instructor utilized more first person singular pronouns and social words, and fewer cognitive processes and analytical words, the former of which dropped off sharply from Week 2 to Week 10 (Table 5). These changes in word usage could have resulted from the instructor building closer relationships with students over time, enabling him to share more personal views and experiences in the discussion rather than just commenting on academic issues. For example, the instructor shared his own experience when he discussed professional development with students. He posted "I changed careers too … but it was in my 20s .. from accounting to educational psychology."

Each week different students were assigned as the facilitator. However, it seems that those who took on the role of facilitator later in the course demonstrated more sociability, positive emotion, high emotional tone, and clout (authority).

Both male and female students generally used more social, positive words and high emotional tone during the last part of the semester. Their use of clout language also increased in Week 14. It seems that students felt more comfortable in the discussion and were more social and confident by the end of the course.

CMC acts

During Week 2, the CMC act analysis revealed that claim (n = 182), and elaborate (n = 90) were the top two most frequent acts overall, followed by manage (n = 58), inform (n = 45), and greet (n = 41). For the other two weeks, claim and inform were the top two most frequent acts, followed by elaborate (see Figure 4).

Most of the instructor's utterances in Week 2 were claim (24%) and manage (21%) acts, followed by inform (15%) and desire (10%). For example, the instructor used a claim utterance, "love the concept map of the discussion," to express his opinion. As the instructor, one of his tasks was to post the initial forum prompt to manage the online discussion; therefore, he used many manage acts to organize the discussion.

In contrast, in Week 10, the instructor's postings included more elaborate (18%), inform (17%), and inquire (15%) acts. For example, after a claim that "expensive technology is not always better technology," he elaborated upon it by expressing his opinion: "stated another way, money is not really the only factor of importance here." During Week 14, he used more desire acts (15%) due to the topic being on career and professional development, where he expressed his hopes for the future. For example, he posted an encouraging recommendation

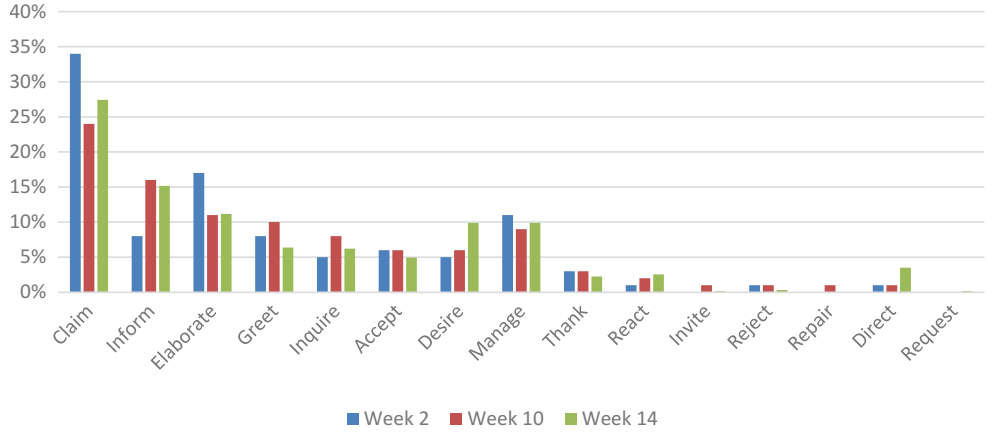

Figure 4. Percentage of each speech act during Weeks 2, 10, and 14.

to a student: "you might be able to turn this one into a newsletter article or magazine article or something."

In the students' utterances during Week 2, the act claim was used most (37%), followed by elaborate (19%), manage (9%), and greet (9%). For example, one female student asserted the claim: "I think Dr. Reeves made a very good point about research that needs to be both rigorous and relevant." The same acts were also the most prevalent during Week 10 and Week 14. However, no clear patterns emerged from the act analysis in terms of student gender.

Of the 539 utterances posted during Week 2, 10% were posted by the facilitator. Like the other students' utterances, the facilitator most often posted claim (23%) utterances, but also posted more inquire (19%) utterances than any other role. For example, one facilitator asked students the question "How successful has educational technology as a discipline been in reaching Finn's goals?" to encourage them to think. The next most popular acts of the facilitator were manage (13%), inform (9%), and elaborate (9%). However, during Week 10, greet (19%) types of utterances were the most frequent for the facilitator, followed by claim (15%), and inform (13%). It appears from these data that the facilitator in Week 10 used greetings such as "hello all" to build social rapport in the discussion. This facilitator also posted the most utterances (n = 193), compared to Week 2 (n = 53) and Week 14 (n = 83.5) (Tables 2–4). This facilitator was a female who did not have a full-time job at the time; as a result, she spent more time engaged in the online discussion.

Overall, the discussion had more accept (6%) than reject (1%) and direct (1%) types of utterances. It seems that the participants used more friendly acts, and the atmosphere was generally warm.

Discussion

RQ1: to what extent do the instructor and students participate in the online discussion?

All the participants actively participated in the discussion. On average, each student contributed five posts per week, which is much higher than the minimum requirement

of two postings per week. Meanwhile, the instructor posted around 16 messages per week, while the weekly facilitators posted 21 messages per week each, signaling that the instructor and the facilitators were actively involved in the online discussion. Student participation took place mostly during the first part of the week, whereas the facilitator posts were more evenly distributed over the week. In contrast, the instructor mainly posted toward or at the end of the week. The posting behaviors of the instructor were perhaps due to the fact that the instructor used peer teaching to transfer the responsibility for facilitating the discussion to the facilitators and to anyone in the class who took offered advice or suggestions to others. The result of this shifting of control was that the facilitators were highly engaged in the weekly discussions.

RQ2: how is teaching presence manifested in the discussion?

Teaching presence relates to the instructional role during learning (Anderson et al., 2001). Teaching presence is not limited to just the instructor's behavior, it can extend to any participants in a CoI (Garrison, 2011). For example, Anderson et al. (2001) argued that student facilitators play an important role in teaching presence. In this online course, at least one student was assigned each week as a facilitator for peer teaching. Thus, teaching presence was manifested in the behavior of both the instructor and the facilitators. The results of this study indicate that the facilitators were the most engaged participants in the online discussion, which might indicate that reciprocal teaching can engage students' online learning.

Previous studies have examined reciprocal teaching from different perspectives. For example, Raslie, Mikeng, and Ting (2015) argued that reciprocal peer teaching significantly improved student reading comprehension and self-efficacy compared with direct instruction from the teacher. In addition, many other research studies have investigated the effectiveness of reciprocal teaching in traditional education (Hart & Speece, 1998; Le Fevre, Moore, & Wilkinson, 2003). Some studies have emphasized the benefits of peer teaching, such as creating a safe supportive learning environment, increasing confidence of learners (Irvine, Williams, & McKenna, 2018; Rosenshine & Meister, 1994), and improving learning performance (Palinscar & Brown, 1984). Correspondingly, Shadiev et al. (2014) suggested applying reciprocal teaching strategies to encourage learner-learner interaction and facilitate the learning process. Whereas most studies of reciprocal teaching focused on fostering learner metacognitive skills in face-to-face classrooms, Raslie et al. (2015) and the current study provided a new instance of using reciprocal teaching in online learning environment. More studies might be needed to investigate the use of reciprocal teaching in online courses.

The instructor and the facilitators used more social words, positive emotions, and emotional tone to encourage social presence. They each tended to use greet, accept, and thank speech acts. Their words as well as the acts performed through their words contributed to creating a safe and comfortable learning community.

To encourage cognitive presence, the instructor and the facilitators used manage and inquire acts to prompt students to think and engage in further inquiry. They often started their comments by posting articles or other resources related to the topic of discussion for students to read. Additionally, they fostered cognitive presence by posting discussion questions to solicit critical and deep thinking.

RQ3: how is students' social presence manifested in the online discussion?

Student social presence was manifested by using first person singular pronouns and authenticity words. Students showed open communication by sharing their own learning or work experiences with the community. For example, one student used her own experience to explain the importance of using educational technology: "I am also a violin teacher, and I can see all kinds of applications for both instructional and educational (based on the above definition) technology in studio music teaching." As students' social and clout words increased from Week 2 to Week 14, it appeared that students felt more confident and comfortable in the learning community. This observation is in line with Seenan, Shanmugam, and Stewart's (2016) finding that reciprocal peer teaching helped increase students' confidence in communication. In addition, Liu, Gomez, and Yen (2009) argued that social presence is a substantial component for predicting course retention and final grade in online environment. Therefore, they recommended establishing integrated social and learning communities. In examining approaches to increase social presence, Kim, Kwon, and Cho (2011) found that media integration and the instructor's quality of teaching were substantial predictors of both social presence and learning satisfaction. As social presence is a vital element of the quality of the online learning experience (Cobb, 2009), it might be beneficial to build a learning community that encourages students open discussion and dialogue.

From the speech acts analyses, this study found that students used accept and thank acts in their discussion to support each other's opinions and create a comfortable discussion environment.

RQ4: how is students' cognitive presence manifested in the online discussion?

Overall, students used more analytical words than the facilitators, and in Week 14, students used more cognitive words than both the facilitators and the instructor. However, the frequency of both word categories decreased in Week 14. This decrease might be due to the fact that students used more social words for emotional expression, with a consequent decrease in cognitive and analytical words.

As noted earlier, Garrison et al. (2001) categorized cognitive presence into four phases: (1) the problem definition, (2) exploration of different ideas, (3) construction of the meaning of the solutions, and (4) selection of the best solutions. In this study, the first phase was mainly initiated by the instructor and the facilitator through raising discussion questions. The exploration phase involved providing evidence through acts of informing. The construction of meaning, the third phase, was manifested by elaboration. And the fourth phase, theselection of best solutions, was mainly in the form of claims. The speech acts analysis showed that students used claim most compared to inform and elaborate, which means they were attempting to find solutions or offer conclusions. These results differ from the findings of previous studies (Arnold & Ducate, 2006; Kanuka et al., 2007) where the exploration stage was more common than the resolution and integration stages. The results of our study, in contrast, might reflect the fact that students proposed more opinions and personal ideas and solutions compared with less exploration and integration of different ideas.

Research indicated that cognitive presence is related to learners' perceived and actual learning outcomes (Akyol & Garrison, 2011b). To increase cognitive presence, Darabi, Arrastia, Nelson, Cornille, and Liang (2011) found that using authentic learning scenarios to prompt discussion can facilitate cognitive presence. Meanwhile, learners' reflective inquiry, self-direction, and metacognition (Garrison, 2003), and the instructor's design and facilitation are vital for online learners' high cognitive presence and meaningful learning (Garrison & Cleveland-Innes, 2005). Therefore, instructors might consider facilitation strategies to encourage learners to explore a variety of approaches and to elaborate on them before reaching final conclusions.

Limitations

This study has several important limitations. First, we selected and analyzed only three weeks of messages out of 15 weeks of online discussion in this class. If the data from additional weeks were included in the analyses, it would likely have offered more insights into social, cognitive, and teaching presence. Second, we did not analyze individual students' messages. If we had identified each individual student's initial contributions and associated changes in posting behavior or content during the semester, it might have proven highly interesting to see whether taking on the role of facilitator in the discussion forum influences the approaches taken in the student's later online contributions. Finally, this study used an online discussion forum as the only data source. The study could have benefited from student retrospective analyses of their posting behaviors and decision making, as well as explicitly focused interview and focus group discussions. Learner and instructor surveys might also have been employed to help triangulate the data.

Conclusions and future studies

A unique contribution of this study is the use of three complementary measures of CMDA to understand how social presence, cognitive presence, and teaching presence are manifested in an online learning environment. Participation analysis (Herring, 2004), the LIWC tool from Pennebaker et al. (2001), and the CMC speech act taxonomy (Herring et al., 2005) together proved helpful in revealing key insights into the posting behaviors of learners, facilitators, and the course instructor during three weeks of online discussion. These analyses revealed how social presence, cognitive presence, and teaching presence are performed through online discourse. They also provided empirical measures of how patterns associated with each type of presence changed over the duration of the course. In contrast, most previous discourse-oriented studies of online discussion, including Kovanović et al. (2016), Wen et al. (2014), and Cui and Wise (2015), relied solely on word frequency analyses to examine learning activities in online discussion forums. However, word counts alone cannot offer a comprehensive view of the meaning and dynamics of online interactions. Thus, this study demonstrates that the triangulation of methods such as word counts combined with participation metrics and speech act analysis can offer enhanced understandings of learning activities in an online discussion forum. Of course, this is just one step; as online and blended forms of learning continue to proliferate, more

such CMDA method combinations need to be investigated to further understand and explain dynamic patterns of interaction in learners' meaning-making processes.

As was apparent from the discourse measures that we employed, all participant roles actively contributed to the discussion. Of the three forms of presence, teaching presence was especially high in this particular learning community. The instructor motivated students' participation by using a strategy of transferring the responsibility to students to facilitate the discussion. At the same time, the facilitators played a vital role in both teaching presence and social presence. Both the instructor and the facilitators displayed their teaching presence through the use of authoritative clout words as well as encouraging, social words. Along these same lines, they utilized a positive emotional tone to create an open communication environment to encourage student discussion.

Meanwhile, students used many social and positive emotion-based words, as well as a positive tone, indicating that they might be satisfied with the direction of the discussion. At the end of the semester, students used more clout words, which indicates, at least in part, that they had become more confident in their communication abilities. It can also signal that there were increasing enhancements in the functioning of the online discussion forum and overall level of comfort to post within it. These findings align with Abdous and Yen's (2010) research as well as Shin's (2003) study, which found a positive relationship between teaching presence and student-perceived learning, as well as teaching presence and student satisfaction. Meanwhile, it seems that students invoked personal and authentic experiences in the online discussion. Surprisingly, however, students' cognitive processes decreased relative to social presence at the end of the semester, which is probably because students talked more casually at the end of semester. In terms of the cognitive development, students used the speech act claim the most, which might be due to their attempts to come to conclusions or share their own opinions.

Future studies might examine how being a facilitator influences students' online behaviors as well as their overall confidence in mastering course content. Second, it would be well worth exploring students' perceptions of the differences in teaching presence between the instructor and the facilitators. Finally, as indicated above, follow-up research might usefully expand the scope of this study to other disciplines, larger sized classes, and more weeks of discussion data.

Disclosure statement

No potential conflict of interest was reported by the authors.

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