

The relationships between higher order thinking skills, cognitive density, and social presence in online learning



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ABSTRACT

Despite a considerable amount of research about online learning presences, the quality of cognitive presence, the value of social presence, and the relationship between them have yet to be comprehensively studied. The purpose of the current study was to investigate the correlation between cognitive presence density and higher order thinking skills as well as the relationship between cognitive and social presences. The study examined online discussion board messages ($N = 672$) posted by two groups of college students ($N = 23$) using quantitative content analysis. The Community of Inquiry (CoI) model was used as a framework to classify and analyze the data. By comparing the cognitive and social presences of the two groups' messages, the study confirmed that high cognitive presence density did not guarantee the promotion of higher order thinking skills but that social presence was positively related to the quality of cognitive presence.

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1. Introduction

Within the framework of constructivism, it is impossible to separate learning from the concepts of collaboration, interaction, and community. As Akyol and Garrison (2011a,b) articulated, “learning in an educational context is socially situated and therefore involves community and sharing thinking” (p. 189). Within the community, the participants learn from each other, negotiate meaning, and co-construct knowledge. Thus, collaboration, interaction, and the learning community are the driving forces to sustain motivation for learning and even the paths to learning. In other words, the social domain is as important as the cognitive domain in learning, and the social context influences the learner's cognitive development.

These key constructivist concepts are also critical considerations in online learning. Merely using an online tool does not guarantee meaningful interactions that can induce higher-order thinking skills and ultimately lead to learning. Thus, previous research has investigated important variables and identified the factors that influence the effectiveness and success of online collaborative learning, including pedagogical strategies, facilitator roles, the technological interface, the nature of the tasks and group interaction processes (Arbaugh, 2008; Archibald, 2010; Daradoumis, Martinez-Mones, & Xhafa, 2006; McKenzie & Murphy, 2000). A variety of models and conceptual frameworks have been proposed to explain and interpret online learning by using these five variables, such as Gunawardena, Lowe, and Anderson's (1997) interaction analysis model and Harasim's (2007) model of conceptual change.

Among the various models, Garrison, Anderson, and Archer's (2001) Community of Inquiry (CoI) framework has been the most frequently

researched, tested, and cited in studies. The authors proposed that learning occurs in a community of inquiry as a result of the interaction between three essential elements: cognitive presence, social presence, and teaching presence. Cognitive presence refers to the extent to which the participants in a community are able to construct meaning through sustained communication. Social presence refers to the ability of participants in the community to project their personal characteristics, thereby presenting themselves to the other participants as real people. Teaching presence refers to the design of the educational experience and facilitation. Garrison et al.'s model proposes that these elements should be combined with each other in any community of inquiry, stating that the interaction among the elements brings a distinct experience to the teaching and learning outcomes.

Many studies have investigated the relationships among the three elements of the CoI model, but the results appear contradictory. In particular, the relationship between cognitive presence and social presence has not been yet fully defined, and the value of social presence in online learning is still uncertain. Given the uncertainty about these presences, the present study investigated cognitive and social presences in online discussion boards developed by two college student groups and examined the relationship between the two presences. This study employed Garrison et al.'s (2001) CoI model because CoI has been widely and empirically tested in various learning contexts by many researchers and thus has gained a certain amount of reliability and validity. The study addressed the following questions:

- Does the group with higher cognitive presence density have better quality learning experiences and promote higher order thinking skills?
- What is the correlation between cognitive and social presences?
- Is CoI a viable means to evaluate cognitive and social presences in online learning?

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2. Theoretical perspectives

Garrison and Arbaugh (2007) defined cognitive presence as “the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse” (p. 161), rooted in Dewey’s (1933) construction of practical inquiry. Dewey viewed reflection as essential to learning and proposed the idea of a model of inquiry and reflective thinking. Dewey explained that the learning cycle is initiated with the perception of a problem and, through exploration of relevant knowledge, moves forward to construction of meaningful explanations and a solution. Based on Dewey’s practical inquiry model, Garrison, Anderson, and Archer (2000) and Garrison et al. (2001) further developed the CoI model. The model is split into the private world (where reflection mostly occurs) and the shared world (where discourse occurs). These two worlds are shaped by the interactions between the two dimensions. One dimension includes deliberation (applicability) and action (practice) as points on the axis, and the other dimension includes perception (awareness) and conception (ideas). This model categorizes cognitive presence into four phases: a triggering event (an issue is identified for inquiry), exploration (exploring the issue through discussion and critical reflection), integration (constructing meaning from the ideas developed through exploration), and resolution (applying new knowledge into a real world context). Garrison et al. (2001) further suggest descriptors for each phase (see Appendix A).

McKlin, Harmon, Evans, and Jones (2002) analyzed cognitive presence displayed in an online discussion board based on linguistic cues using their own neural network analysis model, which is similar to the CoI model. The majority of messages fell into the exploration phase with fewer messages in the integration phase, some messages in the triggering phase and none for resolution. Other studies also found that students had difficulty moving beyond the exploration phase (Celentin, 2007; Vaughan & Garrison, 2005). Previous studies (Garrison & Arbaugh, 2007; Garrison et al., 2001; Luebeck & Bice, 2005; Meyer, 2003) have pointed to teaching presence as a crucial element in promoting student learning at the highest levels of inquiry, indicating that the instructor should play a major role in the process, including facilitating, directing, and designing effective tasks.

In addition to teaching presence, social presence also supports cognitive objectives through the ability to instigate, sustain, and support critical thinking in a community of learners. Social presence, therefore, tends to correlate with successful learning outcomes (Arbaugh & Hwang, 2006; Lambert & Fisher, 2013). Social presence is defined as the ability of learners to project themselves socially and affectively into a community of inquiry (Rourke, Anderson, Garrison & Archer, 2001). Gunawardena (1995) describes social presence as “the degree to which a person is perceived as a real person in mediated communication” (p.151). Garrison and Arbaugh (2007) explain it as “the ability of learners to project themselves socially and emotionally, thereby being perceived as ‘real people’ in mediated communication” (p. 159).

Many researchers view social presence as essential to promoting knowledge-building and collaborative learning and as a predictor of learner satisfaction (Annand, 2011; Gunawardena, 1995; Tu, 2002). Garrison (2003) also emphasized the importance of social presence in the CoI model. He viewed social presence as “an essential element of any educational experience, since, by definition, it is a socially sanctioned and shared process” (p. 54). Garrison et al. (2000) also argued for the importance of social presence because it functions as “support for cognitive presence, indirectly facilitating the process of critical thinking carried on by the community of learners...and is a direct contributor to the success of the educational experience” (p. 89). Akyol, Garrison, and Ozden (2009) expanded Garrison, Anderson, and Archer’s idea of social presence and considered it as “an important antecedent to collaboration and critical discourse because it facilitates achieving cognitive objectives by instigating, sustaining, and supporting critical thinking in a community of learners” (p. 67). Boston et al.’s (2009) analysis of survey results found

social presence to be positively linked to some aspects of online learning experiences. According to Garrison et al. (2000), “the primary importance of this element is its function as a support for cognitive presence, indirectly facilitating the process of critical thinking carried on by the community of learners” (p. 89). Social presence, hence, should be considered a mediating variable between teaching and cognitive presence (Garrison, Anderson, & Archer, 2010).

In addition, prior studies also developed diverse sets of social presence constructs. Tu (2001) identified three main variables: social context Computer-Mediated Communication (CMC) users’ characteristics and their perceptions of the CMC environment, online communication (language used online and attributes of CMC), and interactivity (active communication and learning activities used in CMC). In his later study, Tu (2002) expanded his previous idea on the construct of social presence and included system privacy, feelings of privacy, online paralinguistic, and emoticons. Garrison et al. (2001) divided social presence into three categories (affective, interactive, and cohesive) in the CoI model and suggested indicators for each category (see Appendix A).

Lambert and Fisher (2013) investigated the existence of the three elements of CoI by examining student perceptions of and preference for community in online learning, concluding that the elements were adequately addressed in the online courses. Akyol and Garrison (2011a) utilized CoI strategies to design an online course and then explored the development of cognitive presence in online and blended learning contexts. The authors found a strong correlation between cognitive presence and collaborative constructivism. In another study, Akyol and Garrison (2011b) analyzed metacognitive presence in online learning, also by using the CoI framework. In this study, they confirmed that CoI is a reliable tool to assess metacognition in an online community of inquiry.

Various research methods have been used to investigate online learning presences. Quantitative content analysis is the most popular method because it makes the systematic, objective and replicable examination of symbols of CMC possible (Rourke, Anderson, Garrison & Archer, 1999; Rourke & Anderson, 2002). Content analysis, “when conducted with an aim to understanding the learning process, provides information on the participants as learners, and on their ways of dealing with a given topic” (p.118, Henri, 1992). Akyol and Garrison (2011a), Boston et al. (2009), and Shea et al. (2010) also adopted quantitative content analysis in their studies. Other popular methods in this area include questionnaires and surveys. Garrison and Cleveland-Innes (2005) administered the Study Process Questionnaire to assess the nature and depth of online interactions by graduate students in four treatment groups. Garrison, Cleveland-Innes, and Fung (2010) conducted the CoI survey and structural equation modeling to examine the causal relationships among teaching, cognitive, and social presences. Shea and Bidjerano (2009a) used data from a large-scale survey to investigate whether one of the presences might be a predictor of the others by using chi-square automatic interaction detection (CHAID) model.

There are, however, discrepancies in the findings among studies. According to Shea and Bidjerano (2009b), social presence served only small or ancillary functions in learning. They further reported that social presence could not be a predictor of learner satisfaction, as claimed in other studies. Ke (2010), in his study on the relationships among cognitive, social, and teaching presences, also argued that social presence was perceived merely as a superficial and overemphasized bonus. Diaz, Swan, Ice, and Kupczynski (2010) similarly found that social presence functioned as the least important of the three presences after examining students’ perceptions of the presences.

In addition to discrepancies in results, other problems also arise in the existing studies of social presence. Researchers have questioned the reliability of social presence constructs. Shea et al. (2010) intended to define constructs of social presence through a quantitative content analysis of online interactions and concluded that “social presence construct is somewhat problematic and requires further articulation and clarification if it is to be of use to future researchers seeking to inform our understanding of online teaching and learning” (p. 17). Annand (2011) also addressed the

problem of the validity and function of the social presence construct and claimed that the value of social presence has been overstated.

Another problem resides in social presence measuring instruments. Kreijns, Kirschner, and Jochems (2011) tested six different social presence scales developed by diverse researchers: Social Space Scale (Kreijns, Kirschner, Jochems, & Buuren, 2004), Sociability Scale (Kreijns, Kirschner, Jochems, & Buuren, 2007), Social Presence Indicators (Gunawardena, 1995), Social Presence Scale (Gunawardena & Zittle, 1997), Work-Group Cohesiveness Index (Price & Mueller, 1986), and Group Atmosphere Scale (Fiedler, 1962, 1967); and determined that the existing instruments for measuring social presence are not adequate. Studies have also noted that the distinction between social presence and teaching presence is not clear. For instance, Shea and Bidjerano (2009a,b) emphasized the importance of teaching presence over social presence based on their study in which the students' experienced high teaching presence but low social presence. Annand (2011) doubted whether the positive results found in the studies by Akyol and Garrison (2008) and by Diaz et al. (2010) were attributed to social presence or teaching presence because both studies highlighted the instructors' purposeful interventions. Annand (2011) argued that social presence "does not impact cognitive presence in a meaningful way" and previous studies, Col in particular, "inappropriately magnified the effect of social presence on cognitive presence" (p. 53). Based on these conflicting findings and theories, more research is needed to determine the relationships between cognitive and social presences and to determine the reliability of Col as an analytical framework for online learning.

3. Methods

The data were collected from two graduate courses in the English Education department in a Korean University, Multimedia-Assisted Language Learning (MALL, Group A) and Communicative Language Teaching (CLT, Group B), during one 15-week semester in 2011. The same instructor taught both courses, maintaining least interventions in both courses. CLT included 13 students (8 females and 5 males) and MALL included 10 students (6 females and 4 males). CLT consisted of 10 Korean students and 3 foreign students, and MALL was comprised of half Korean and half foreign students. Both courses blended face-to-face (primary) and online (supplementary) learning. The courses utilized online discussion boards embedded in MOODLE across the semester to expand the discussions and promote students' higher-order thinking skills. English was used in both online and offline classes.

Over the semester, 303 messages from CLT and 369 messages from MALL were collected. Quantitative content analysis was employed to analyze the messages. Quantitative content analysis, by utilizing statistical methods, establishes valid measurement rules and assigns numeric values accordingly. Thus, it is useful to "describe communication, draw inferences about its meaning, or infer from the communication to its context, both of production and consumption" (Riffe, Lacy, & Fico, 1998, p. 22). Content analysis, in addition, allows the researchers to visualize how students engage in the cognitive process, share information among participants, and develop a learning community. Rourke and Anderson (2002) emphasized the systematicness, objectiveness, and reliability of quantitative content analysis. Systematicness requires a theoretical set of categories in which content is classified. When classification is rule-based, objectiveness can be accomplished. Lastly, for reliability, data should be analyzed by multiple coders. In accordance with these principles of quantitative content analysis, two coders utilized the Col framework as a theoretical framework and classified the messages based on the rules adopted from the Col framework.

Prior to the final analysis, the researchers conducted a pilot analysis to determine the unit of analysis and share their understanding of coding. Garrison et al. (2000) utilized two heuristics of coding down (to the earlier phase) and coding up (to the later phase), when a lengthy message contained multiple phases. For the current study, however, the two researchers independently reviewed the messages from the perspective of

the Col model and decided to use the meaning unit as a unit of analysis. For example, when a message contained more than two phases of cognitive presence, the message was broken into two units of meaning. Longer messages (about one page long with two or three paragraphs) tended to contain more than one phase of cognitive presence. Because, unlike with cognitive presence, the categories of social presence were not hierarchical, social presence was calculated based frequencies of each indicator of the category. The researchers also compared results and checked the discrepancies between them. Through discussions, they reached a consensus for coding and minimized the gap between their individual results.

Daradoumis et al. (2006) affirmed that it is crucial to develop a "principled framework for evaluating collaborative behavior and success of online learning at several levels" (p. 623). Accordingly, the researchers coded the messages into the categories at several levels. The researchers first divided the messages into on- and off-task, and then, using the Col model, coded them into cognitive or social presence. In the cognitive and social presence matrix, the researchers also classified the messages into the categories in each presence with notes of the indicator for each message. The researchers followed the categorization of the Col model. However, two indicators, "continuing threads" and "quoting from others' messages," were removed from social presence. These two indicators refer to the technical reply functions, automatically generated by the online discussion board, which do not necessarily indicate meaningful interactions between the participants. (For the examples for each indicator and category see Appendix B.) The inter-rater reliability for the final analysis was 0.81.

Each number for the categories in cognitive and social presence for each group was converted to a percentage to compare the results between the groups. In addition, cognitive and social presence densities were calculated by dividing the number of times an indicator occurred by the total number of words, and multiplying by 1000 (Garrison et al., 2000). This method has been frequently adopted in studies on online learning presences because, as Rourke, Anderson, Archer, and Garrison (2001) note, "the raw number of instances of [cognitive and] social presence, or the number of instances per message are both skewed by differences in the number of words per message or per conference" (p. 61). Therefore, to compare presences on the multiple discussion boards, cognitive and social presence density figures were calculated for each category, as described by Rourke et al. (2001). This calculation offers a more precise way of examining what portion of the overall contribution was coded as one of the responses in the discussion boards.

Quantitative content analysis was supplemented with semi-structured interviews. At the end of the semester, all participants were interviewed individually. In the interviews, the students were asked about their learning experiences on the discussion board, including whether the online discussions contributed to their learning and whether they felt comfortable using the discussion board. The interviews were recorded and later transcribed.

4. Results

4.1. Overview

The results showed a large discrepancy between the groups. Despite the fact that Group B had more students, Group A exceeded Group B in every category, including total word counts, number of threads, and number of messages (Table 1). In particular, the total number of words of Group A was almost as twice that of Group B. Despite the large difference in the word counts, the difference between the groups was not as large in the numbers of messages, and this resulted in greater average words per message and per student in Group A. This indicated that the students in Group A produced more and longer messages than those in Group B. Additionally, the results indicated that Group A generated more student-centered discussions. Of 41 threads, 26 were initiated by students, whereas all the threads in Group B were initiated by the teacher. The students of Group A were far more interactive in responding to others' messages (see Figs. 1 and 3).

As Table 2 shows, a large discrepancy appeared between the groups in the distribution of messages for each presence. In Group A, the majority of messages simultaneously contained cognitive and social presences, whereas in Group B, messages containing both presences were infrequent. Group B exhibited a high ratio of the cognitive-presence-only category, with none in the social-presence-only category. Because all the messages contained cognitive presence in Group B, it is not surprising that there were no off-task messages. The numbers of meaning units of each group reveal that Group A produced more complicated messages combining different phases of cognitive presence.

4.2. Cognitive presence

Overall, as described in Table 3, the results showed that cognitive presence in Group B was much denser than that in Group A; however, a closer examination displayed a quite different picture. Despite the high density of cognitive presence in Group B, most of the messages remained in the first two phases. The messages of Group A categorized as integration and resolution accounted for 32.3% of the total messages, whereas the messages of Group B in those categories accounted for only 8.3% of the total.

The threads always started with triggering questions, such as “Why do you want to use technology in your English classrooms?” Although the frequencies of triggering were almost identical between the groups, the patterns were distinctive. Whereas triggering always appeared in the first message of a thread in Group B, Group A frequently posted triggering questions in the middle of the discussion as well as in the beginning, as shown in the following example:

Trade-off, of course. Those western holidays are now celebrated in this country and!!! becoming commercialized (as they are in their countries. e.g., Easter, Valentine's day, Halloween...). Kids are rather victimized by adults who are trying to make money out of them (and their parents).

Another serious (potential) problem is that some kids take those western holidays more seriously than Korean traditional ones. They may think those are “cooler.”

How would you, as an English teacher, draw a line? How can we teach the target culture to students and promote their language skills but at the same time, not to lose their own cultural identity? (Group A)

This pattern of triggering questions within existing discussions did not often appear in Group B. As mentioned earlier, all the threads of Group B were teacher-initiated; the students merely responded to the teacher-initiated topic, rarely triggering a new question. Even when students triggered a problem, they mostly employed a statement form rather than a question, which did not induce further discussion or a response.

Exploration was the most frequently appearing phase in both groups. Exploration consisted of exchange and divergence of ideas. Exchange of ideas often created a serial monolog, particularly in Group B, as shown in Fig. 2. Moreover, most of Group B's messages involved exchanging ideas without much divergence of ideas. As shown in Table 4, in Group A, divergence of ideas was more frequent than the exchange of ideas. Jeong (2005) argued that divergence usually entails more responses and arguments divergence of ideas. Similarly in this study, divergence of ideas, usually marked by disagreement with the previous message, is more interactive than exchanging ideas, as shown in the following example:

I would disagree with your opinion that Korea is a ‘developing country’. South Korea is 15th in the list of Developed countries. Also, America isn't a country, it's a continent. (Group B)

Interestingly, divergence of ideas also occurred without interaction with others in Group B. In some longer messages, exchange and divergence of ideas occurred, usually in that order, within a single message, such as in the following:

Thus, NNS students feel the power relationships and still feel inferior and reluctant to speak out. In short, this situation does not guarantee any egalitarian community where the participants can take an equal part and do an equal contribution.

On the other hand, asynchronous communication allows more benefits because it does not have any time constraints. So the students can have more time to reflect before posting. In this case, both parties, NS and NNS, can share their ideas on a more equal ground and learn from each other. (Group A, bold original)

Integration included the convergence of ideas among group members, synthesis of ideas with other resources, and creation of solutions. The convergence of ideas was usually marked with the sentence, “I agree with (a person's name),” clearly indicating the interaction with one or more other group members:

Michelle mentioned that synchronous online class is like a cocktail party. I totally agree with that metaphor ... (Group A)

The student in the above example reached integration based on someone else's integration. Unlike convergence, synthesis occurred within a single message, as in the following examples:

In particular, however, the proliferation of networked computers has re-mapped the surface of literacy and communication, enabling unparalleled opportunities to connect people across time and space. In addition, modern technologies have arrayed a space where a variety of different media intersect and oral speech and written language converge. All of these changes are reshaping the map of education – transforming what we learn, how we learn, how we teach, and how our schools function. (Group A)

In summary, **first**, I think now we have a **better understanding** through the real experience. **Second**, as Michelle noted, **asynchronous communication** is more beneficial, because it allows students to have more active role and equal participation, and motivate to develop multiple viewpoints regarding ongoing topics. **Third**, students writing should be ongoing process through the **in-class discussion (F2F) and discussion board (on-line)**. I thought, in Cummings' article, because we are shy and fear mistaking, if the author took the combination method both in class discussion and online discussion, she could get better results.

I just read an interesting article about postmodernism by James Gee but instead of making me think of my other class, what he said reminded me of our discussion on “Why learn English”. He said, “Industrial capitalism, with its attendant nationalism and colonialism, is being rapidly replaced by economic structures based on information rather than goods, services rather than manufacturing and the absence of borders rather than their presence.” (Group A, bold original)

In the first message, integration occurred without interaction with other group members. The idea evolved to integrate within the message itself. This type of integration is also possible because it occurred in the private reflective world of the student and was facilitated by the writing process (Arnold & Ducate, 2006). Like the second example above, several messages in Group A contained both convergence and synthesis within a message. The author of the message summarized what the

Table 1
Overview of the results.

Group	Students	Word count	Threads	Teacher-initiated threads	Total messages	Messages per person	Words per message
A	10	64058	41	15	369	36.9	173.6
B	13	36026	13	13	303	23.0	118.9

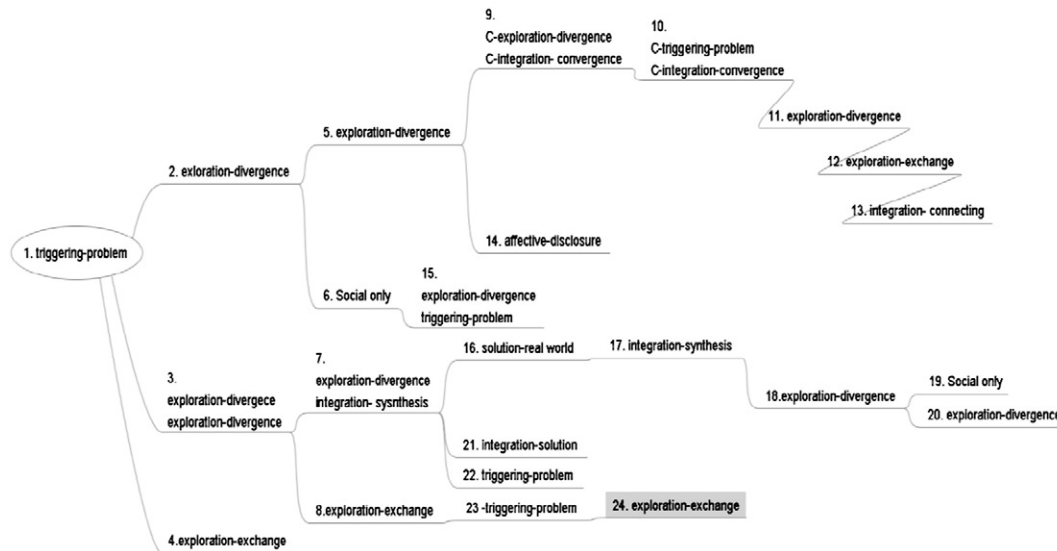


Fig. 1. Cognitive presence of Group A.

other members had discussed previously, and, at the same time, she connected the class reading with her ideas. This type of message was seldom found in Group B. Although the messages were sometimes tagged with “I agree with you,” they did not produce an in-depth discussion on the issue. Overall, integration was very low in Group B.

As was observed in prior research (Celentin, 2007; McKlin et al., 2002; Vaughan & Garrison, 2005), the last phase, also the highest cognitive order, in the CoI model was observed the least in the present study. This phase was reached by building upon previous messages and involved members’ suggestions about how to apply what they had discussed in the real world:

It’s absolutely a good and important idea to provide a guideline or designate sites for student research, particularly for young learners. (Group A)

The above example was excerpted from a discussion on the use of technology in education. The student, reacting to the potential dangers of using technology, provided a suggestion to prevent such risk in the classroom. In Group B, no discussions were found in this phase.

As shown in Figs. 1 and 2, sample threads from each group represent each group’s idiosyncratic patterns. The students of Group A were in general much more responsive and fluid. They also displayed more diverse indicators of each phase, and their messages were spread more evenly across the four phases. In contrast, the majority of messages in Group B were found to be indicative of the exploration phase.

4.3. Social presence

Overall, the social presence density of Group A was observed to be much higher than that of Group B, and also higher than its own cognitive density. As mentioned previously, a majority of the messages in Group A contained both cognitive and social presence, and, in addition, social-presence-only messages accounted for 8% of the total messages. In contrast, in Group B, there were no social-presence-only messages, and the number of messages containing both presences was very low.

Table 2
Number of messages in each category.

Group	Cognitive only	Social only	Cognitive + Social	Course management	Off-task	Uncategorized
A (%)	51(13.8)	31(8.0)	254(68.8)	22(6.0)	7(1.9)	4(1.0)
B (%)	231(76.2)	0(0)	53(17.5)	16(5.3)	0(0)	3(1.0)

The indicators of the affective category included expressions of emotions, self-disclosure, use of humor, and apology. Group A exhibited all of these and often added personal narratives to their discussions. The students frequently commented on their emotions and disclosed stories and thoughts about themselves and their experiences, as in the following examples:

I also have a son that has mental retardation and learning delays. So, for him we explore all of the ways to connect with his learning potential. Every sensory avenue humanly possible can help lead to understanding. (Group A)
 First of all, as I reflect upon myself, I felt dumped much stronger than ever when my question or any message has no reply from anyone. It’s maybe lots of text messages are uploaded so fast that other peers have no sufficient time to think and answer it. Even though I understand the reasonable excuse, still my emotion is humiliated. (Group A)

In contrast, Group B rarely displayed their emotions and shared personal information about themselves only on a few occasions. Even when disclosing personal information, messages were limited to the realm of their academic lives:

Even though I believed that teaching method of CMC is so effective and efficient that we easily take part in communication activity, the activity is difficult for me. Through this experience, I knew that there were several components I missed. (Group B)

Interactivity was another category that was often observed in Group A. The students frequently referred to others’ messages and tried to advance the discussion on the issue, as shown in this example:

Jason also said, “...the large number of students made it rather difficult to have a meaningful linear discussion, I think therefore that a possible approach might be, in the virtual classroom, that sub-groups of students are given certain topics to discuss; a summary is then compiled, then all the sub-groups can read the summaries at their leisure online.” The large number of students (were we 9?) seemed almost impossible to focus on topics. Several students posed

Table 3
Results based on four phases in cognitive presence.

Phase		Group A	Group B
Triggering	No.(%)	59(12.9)	43(12.5)
	Cognitive density	1.246	1.491
Exploration	No.(%)	253(54.8)	272(79.17)
	Cognitive density	5.293	9.401
Integration	No.(%)	112(24.2)	29(8.33)
	Cognitive density	2.335	0.99
Resolution	No.(%)	37(8.1)	0
	Cognitive density	0.778	0
Total	No.(%)	461(100.0)	344(100.0)
	Cognitive density	9.653	11.87

The numbers were calculated based on the numbers of meaning units, not the numbers of messages.

questions at the same time, and when someone answered one of them, we in general weren't sure that.... (Group A)

Explicitly quoting other members' statements became more prevalent in Group A as the discussions progressed, and more group members employed this practice. One of the members expressed appreciation to a student from whom he learned a valuable online communication technique, letting her know that she contributed to the creation of a learning community:

Wow, **Katie!** I've learned from you, a veteran teacher. That is you always mention others opinions first, and then share your idea. You may be the same attitude in your class. For example, last time student A mentioned this, this is admirable and my opinion is this. This kind of speech makes encouraging environment because students realize individual concern from the teacher. (Group A, bold original)

The students of Group A also asked questions, expressed agreement and disagreement, and showed appreciation to others. Asking questions

Table 4
Results based on indicators in each phrase.

Phase	Sub-category		Group A	Group B
Triggering	Recognizing the problem	No.(%)	59(12.8)	43(12.5)
	Divergence	No.(%)	132(28.6)	83(24.1)
Exploration	Exchanging ideas	No.(%)	109(23.6)	189(54.9)
	Suggestions	No.(%)	12(2.6)	0(0.0)
	Convergence	No.(%)	37(8.0)	12(3.5)
Integration	Synthesis	No.(%)	49(10.6)	17(4.9)
	Solutions	No.(%)	26(5.6)	0(0.0)
	Application	No.(%)	37(8.0)	0(0.0)

included asking for clarification on what previous messages meant, raising a problem related to the on-going discussion, and asking questions for class management. Additionally, as described in the cognitive presence section above, the students in Group A raised questions more actively than those in Group B. In addition, each group utilized different styles of questions:

- Well... I have a question to you guys. What is difference between mind and culture? (Group A)
- Hey, David, are there any particular reasons except for the fun factor? (Group A)
- Should we turn in the paper by next week? (Group B)

Such examples display a clear difference. Whereas the questions of Group B seemed impersonal and formal and were not directed to a specific target, those of Group A seemed more personal and informal, often targeting a specific person. The style employed by Group A tended to encourage responses more frequently and lead to further discussions, in contrast to Group B.

Expressing agreement and disagreement, as with cognitive presence, was indicated by "I agree (disagree) with ..." Agreement

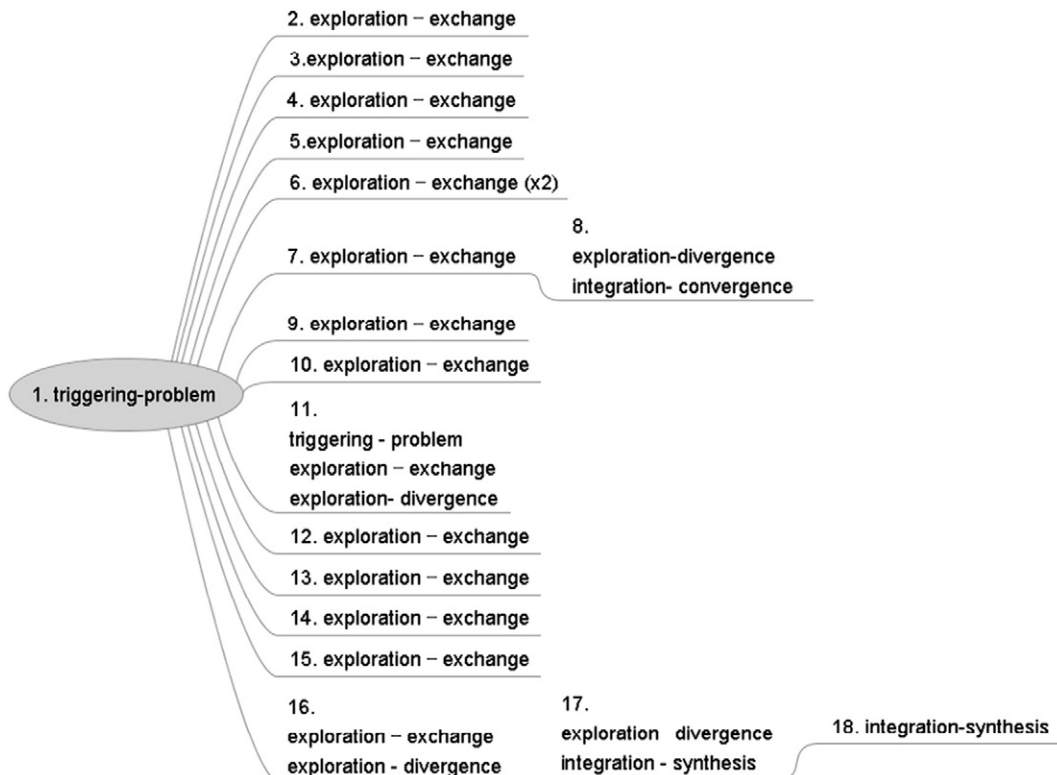


Fig. 2. Cognitive presence of Group B.

and disagreement appeared with similar frequency in Group A. In contrast, Group B often showed agreement, but rarely expressed disagreement. Even when Group B students indicated agreement, the content that followed did not fully explain why they agreed. On the other hand, the students of Group A generally included a lengthy explanation for agreement or disagreement, which advanced discussions and ultimately moved them to the next phase. The difference is shown in the following examples:

I agree that the www is difficult to manage but in addition to learning about access to www the student needs to learn about responsibility [sic] and discernment. Students of all ages can be taught to evaluate the truth, or look for multiple sources. It isn't just on the www that we find untruths. For my younger students... (Group A)
I agree with your idea. I also like learning a foreign language. (Group B)

The last category, cohesiveness, exhibited the most distinctive difference between the groups. Whereas Group A often expressed group cohesiveness through various means, Group B did not show any elements pertaining to cohesiveness. In Group A, the most frequently appearing sub-category was vocative. The students often addressed their peers' using their names to gain attention from that specific person ("Hey, Kim, did you...") or to use their messages as references ("As Jason wrote"). They also frequently addressed the group as "we" and "us," as in the following example:

But it was kind of fun. I am really sorry that Lara was dumped out many times and she must've been frustrated. But she took care of David, who was dumped out several times like her asking if he was alright... I thought that was really nice of her... And I was really glad to see that kind of social interactions (warm and caring) happened there and to see how we care for each other like a real member of a community. (Group A)

The example above clearly shows that the students in Group A had a strong sense of community and a rapport with the group members by explicit phrases such as "social interaction," "warm and caring," and "care for each other like real member of a community." In fact, the message was an excellent example of social presence, containing various sources of social interaction. In the message, the student disclosed his emotion about himself and about other members, complimented the peer's social behavior toward another peer, and appreciated the caring atmosphere of the group as a true community.

Although many of the social presence messages overlapped with cognitive presence, the last sub-category within the cohesive category was pure socialization. Unlike other messages that functioned as both cognitive and social presences, the messages of this sub-category, from the perspective of cognitive presence, were off-task. In the present study, only apologies in the affective category and greetings in the cohesive category served a purely social function, as shown in the following example:

Hey, Laura...
How have you been? It's been a while since I was here last time so that I didn't have chance to read your posting. -_-;; I just hope you feel alright. ^_^ I'm really sorry that we didn't to talk to each other for some time now... Yuin was really sick and I was tied up with that and other stuff. Hope everything goes well with all the members of the board..... ^_^ (Group A)

Figs. 3 and 4 representing each group's social presence showed a stark contrast. The thread from Group A demonstrated varied and multiple types of social presence. In contrast, Group B showed very few messages in this category. This led to a large gap in the social presence density between the groups. In total, Group A manifested a

social presence density approximately six times higher than Group B (Table 5). The results of each indicator are summarized in Table 6.

4.4. Interview results

The interviews with Group A and Group B confirmed the discrepancy between the groups. Overall, Group A generally developed positive feelings and attitudes toward the online discussion board, and Group B had negative feelings. The interviews showed that the members of Group B did not feel connected to other group members on the discussion board. They did not regard other members as learning partners or develop a sense of community.

I didn't care much about others' messages on the board. I sometimes read them, but didn't feel like replying back to them. I cared about mine though, because I knew they were going to read mine, too. I wrote whatever I had to, because it was a class assignment. (Interview with a student of Group B)

Even though the student showed awareness of audience, his awareness did not lead to further interaction with others. Instead, the awareness of audience made them feel uncomfortable about writing in English on the discussion board. They said that they were afraid of making mistakes, particularly grammatical errors, and that they felt others would notice mistakes. In short, the members of Group B did not feel secure, and thus it was taken for granted that they did not talk about personal matters.

In contrast to Group B, the interviews revealed that the members of Group A, including the non-native English-speaking students, did not have much language anxiety. Instead, they felt able to be more communicative than in the face-to-face class because they did not feel much shyness or anxiety on the online discussion board. Group A members also commented that using the online discussion board expanded their learning and social connection opportunities with members whose voices were not frequently heard in the face-to-face classroom. Korean students reported that they often felt shy talking when having native speaking peers as an audience during the in-person discussion; however, they did not worry much about this audience in the online discussion. The Korean and foreign members of Group A both agreed that the online discussion board was more effective in developing a sense of community and this, in turn, led to members' individual cognitive development and a learning community.

The online discussion board helped us understand others better and I think it made our relationships smoother and more natural. I believe this is because interactions became a lot higher in the online discussion board. Through the frequent interactions, I could develop my ideas based on the others' ideas, and have chances to reflect my previous ideas. This, I believe, contributed to my academic development.

The interview above clearly indicated social interaction's contribution to cognitive development. Additionally, the members commented that they felt more comfortable and competent due to the friendly atmosphere of the discussion board and the sense of belonging. However, not all the members had the same feeling toward the discussion board. Some members mentioned that longer messages discouraged them to read. A few members also complained that the social function of the online discussion board sometimes diminished the quality of discussions because some messages were off-topic or too informal. Although these messages served a social function, some members revealed their uneasiness toward off-topic messages, as in the following interview:

Some students seemed to go astray from the on-going topic on the board. It's like they didn't think whom they were talking to. These

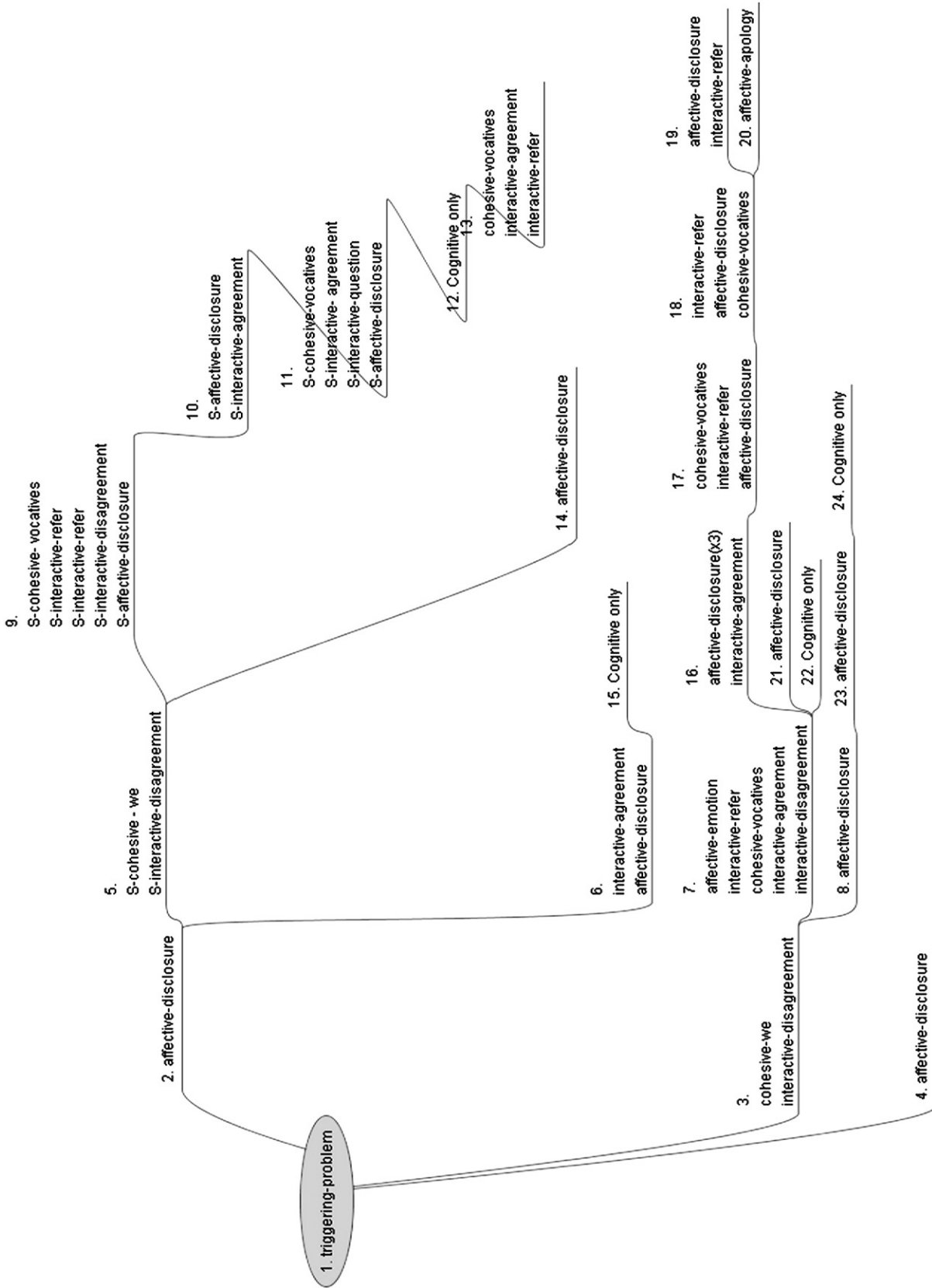


Fig. 3. Social presence of Group A.

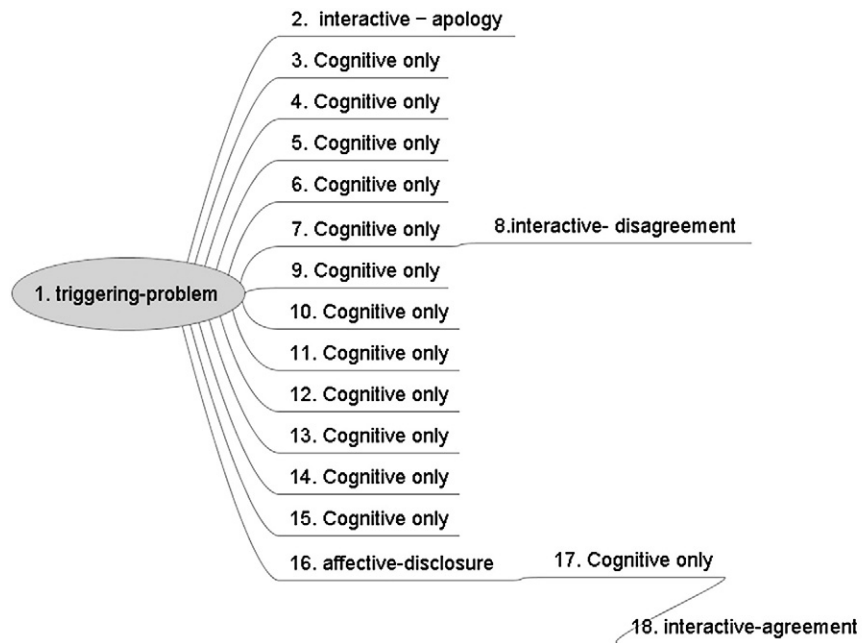


Fig. 4. Social presence of Group B.

messages sometimes annoyed me. I prefer the messages strictly on the topic.

Whether the message was on- or off-topic, the members preferred to be connected to and included in the discussion thread. The members articulated that when the discussion board did not graphically show the connections of their messages to others or when they found no reply to their messages, they “felt like outcasts.” Despite some negative comments toward the discussion board, most of the members of Group A concluded that the discussion board contributed both to social and cognitive developments that would not have been possible otherwise.

5. Discussion and implications

The current study revealed that high cognitive density was not necessarily related to the quality of learning or higher levels of Col. Although Group B was highly focused on cognitive functions on the discussion board, most of their messages were serial monologs, rather than promoting collaborative learning built upon previous messages. As a result, most of the messages remained in the exploration phase and could not move much beyond that phase. The students produced a considerable amount of messages, but they were mostly uni-directional, random exchanges rather than discussions generating meaningful interaction or discourse. However, reaching consensus and resolution and creating a common purpose in learning required collaborative effort among the members, and Group B failed to create a synergetic discourse.

Table 5 Results based on social presence.

Category	Group A		Group B	
	No.(%)	Social density	No.(%)	Social density
Affective	162(34.18)	4.204	29(50)	0.990
Interactive	162(34.18)	4.204	27(48.2)	0.910
Cohesive	150(31.64)	3.892	0(0.0)	0.000
Total	474(100.0)	12.299	57(100.0)	1.979

The numbers were calculated based on the numbers of meaning units, not the numbers of messages.

Conversely, Group A, despite the fact that its cognitive density was lower than that of Group B, much more frequently reached higher levels of Col. They produced messages of better quality, created a desirable learning process, constructed meaning, and reached a zone of proximal development on the discussion board (Vygotsky, 1978).

The apparent difference between the groups in cognitive presence was likely due to the different patterns of social presence between them. According to the results of the current study, the higher the social presence, the better the quality of cognitive presence. In other words, social presence was positively correlated with cognitive presence. Group A demonstrated much higher social presence density than Group B. Whereas Group B exhibited few interactions in the affective and interactive categories and none in the cohesive category, Group A showed high rates all in three categories. The affective category, including self-disclosure and apology, inevitably contributed to building trust among the group members, which naturally led to greater group cohesiveness. This brought a sense of belonging to the members and a feeling of security in the community. According to Palloff and Pratt (2007), the single most important element of successful distance learning is “the formation of a learning community through which knowledge is imparted and meaning is co-created” (p. 4). Except for a few instances, most of the messages generated by Group A were still on topic, in spite of the high social presence density. In fact, rather than straying from the topic, Group

Table 6 Results based on subcategories of social presence.

			Group A	Group B
Affective	Expressions of emotions	No.(%)	25(5.3)	7(12.5)
	Use of humor	No.(%)	2(0.4)	0(0.0)
	Self-disclosure	No.(%)	130(27.5)	22(39.3)
Interactive	Apology	No.(%)	0(0.0)	5(1.1)
	Referring	No.(%)	76(16.1)	4(7.1)
	Asking	No.(%)	5(1.1)	3(5.4)
	Appreciation	No.(%)	8(1.7)	0(0.0)
	Agreement	No.(%)	33(7.0)	8(14.3)
	Disagreement	No.(%)	29(6.1)	2(3.6)
	Suggesting	No.(%)	10(2.1)	0(0.0)
Cohesive	Vocatives	No.(%)	51(11.0)	0(0.0)
	Addressing the group as we	No.(%)	88(18.6)	0(0.0)
Social function	Social function	No.(%)	12(2.5)	0(0.0)
	Total	No.(%)	473(100.0)	56(100.0)

cognitive presence, which intensified the discussions. Consequently, the group members could share their ideas as well as their emotions more openly and frequently referred to others' messages to reach a common learning goal. A sense of belonging and trust among the members certainly helped lower anxiety (Arnold & Ducate, 2006). From the constructivist perspective, learning occurs through interactions within a community, thus, "social presence is necessary for the development of cognitive presence" (Garrison & Arbaugh, 2007, p. 160) or a precursor to reflective or critical thinking. This notion also resonates with Shea and Bidjerano (2009a), which revealed that students' perceptions of social presence were a valuable predictor of students' perceptions of cognitive presence.

Although Group A had higher frequencies of integration and resolution than Group B, as in other studies (Arnold & Ducate, 2006; Rourke & Anderson, 2002), the ratios were still low. This indicates that active participation, interactions, and a learning community may not be enough for promoting higher-order thinking skills. Rather, adequate and timely teacher intervention may be essential to foster higher levels of thinking. More directive and focused instruction will augment student learning outcomes. According to Shea and Bidjerano (2009a), both social and cognitive presences correlate with teaching presence, and "the establishment of social presence is contingent on the establishment of teaching presence" (p. 551). As Garrison et al. (2010) ascertained, it is a teacher's responsibility to create cognitive presence and mediate social presence to optimize the learning environment and sustain it.

In addition to enhancing teaching presence, there are a few suggestions to make online discussions more dynamic and synergetic. Assigning a role to students such as initiator, leader, facilitator, elaborator, evaluator, or wrapper can be an effective option, rather than solely depending on the teacher. Since prior studies indicate that students' gender, age, and personality influence the amount of messages and interaction levels (Wishart & Guy, 2009), the instructor should take these factors into consideration when assigning the role. Additionally, it is reported that there is a relationship between interaction levels and group size (Schellens, Keer, & Valcke, 2005) and that group size is a critical factor to the effectiveness of online learning (Dennis & Williams, 2005), hence, the instructor should decide the effective group size to promote higher levels of knowledge construction online. While students' control and self-regulation over learning is important, a certain degree of discipline, such as providing evaluation rubrics, can also guide student learning and improve the quality of an online discussion. The rubric can include recommendations for clear communication protocols and requirements for participation (Brannon & Essex, 2001), value or point of individual messages, and descriptions of levels of responses (Anderson & Krathwohl, 2001).

The study confirmed that the CoI frame was generally a relevant and effective instrument to evaluate online learning. However, there were still a few difficulties found while coding and applying the frame to the data. First, it was not easy to delineate the meaning unit in a straightforward way. Unlike many other previous studies that utilized a message as a unit of analysis, the current study used a meaning unit for analysis. Hence, one message often contained more than one unit of analysis. Moreover, as shown in this study, one unit of analysis often includes cognitive and social presences at the same time, due to an overlapping set of lenses among the elements of the CoI framework (Garrison et al., 2010; Shea & Bidjerano, 2009a). In content analysis, defining a unit of analysis becomes an important starting point, which determines the rest of the analytical process. Future CoI researchers need to clarify this issue. Second, calculating presence density was also more complicated than expected, as the proportion of presences can fluctuate depending on the unit of analysis. For instance, if a message was a unit of analysis, the presence density would be lower. However, in this study, because the unit of the analysis was a meaning unit, the presence densities of each group increased. Additionally, as in Group A, if members produce long messages with long explanations and examples, the current method to calibrate (by dividing the number of times

an indicator occurs by the total number of words and multiplying by 1000) may risk underestimating the results (i.e., the cognitive presence density will be lower than it should be) even if the messages are cognitively dense and greatly related to higher order thinking skills. Therefore, an alternative to the total number of words, such as a total number of units of analysis, should be considered in future analysis.

The present study did not examine teaching presence; thus, it is not clear how teaching presence influenced each group's cognitive presence. Apparently, social presence greatly affected or interacted with cognitive presence in both groups, but it is also possible that different degrees of teaching presence also influenced social and/or cognitive presence. However, Rourke and Anderson (2002) contended that students had a preference for interactions with peers over those with the instructor and that interactions with peers were more helpful to learning. Because the results of previous studies are still contradictory, the relationship of teaching presence to social and cognitive presence needs further investigation.

The reason underlying the difference in social presences between the groups found in the current study also needs to be further investigated. For the current results, there are a few possible explanations, such as possible differing degrees of teaching presence and different classroom cultures due to different compositions of students. Student characteristics that may be relevant include nationality, personality, and attitudes toward and previous experiences of computer-mediated communication of group members. These variables may have direct or indirect influences on the dynamics of the interactions.

In addition, high social presence density does not always engender cognitive benefits. On the contrary, as one of the students mentioned in the interview, it may detract from cognitive presence and hinder learning. Other research (Garrison et al., 2010) also suggests that social presence alone will not ensure critical discourse in online learning, but it is highly unlikely that such discourse will develop without a foundation of social presence. Future research needs to investigate the optimal point between cognitive and social presences to maximize student learning.

Appendix A. Cognitive presence coding scheme

Category	Indicators	Examples
Triggering	Recognizing the problem	Why do you want to use technology in your English classrooms? ... but when trying to apply the same method to language learning, we see its limitations.
Exploration	Divergence of ideas	However, the proliferation of networked computers has re-mapped the surface of literacy and communication... This way, children have better understanding of Halloween and they also become a part of that tradition.
	Exchanging ideas	Maybe we need to think about alternatives to F2F classrooms.
	Suggestions for consideration	I can't agree more with you. And in that sense... Therefore, I concluded at that time that not did they lack information to write, but lacked opportunities to write.
Integration	Convergence among group members Connecting ideas, inference, synthesis	So, they should be given many chances to apply their knowledge to writing.
	Creating solutions	It's absolutely a good and important idea to provide a guideline or designate sites for student research, particularly for young learners.
Resolution	Application to real world	

Appendix B. Social presence coding scheme

Category	Indicator	
Affective	Expressions of emotions	I was frustrated the other days during the chatting session.
	Use of humor	...too lazy to bring the cassette player in the rainy days...
	Self-disclosure	I am an auditory/visual learner myself.
	Apology	My apology for the disruption during the chat session...
Interactive	Referring explicitly to others' messages	Jason wrote...the more sensory organs that are utilized...
	Asking questions	Well.. I have a question. What is difference between mind and culture?
	Expressing appreciation	Thank you for sharing the info.
	Expressing agreement	I agree that the www is difficult to manage...
	Expressing disagreement	I would disagree with your opinion that Korea is a 'developing country'
	Inviting, suggesting	Wanna do it again?(suggesting to have another chat session)
Cohesive	(Vocatives) Addressing peers by name	As Jason mentioned...
	Addressing the group as we, us, our, group	We discussed the idea of desocialization ...
	Communicating solely for social function	Welcome back! I remembered your doctor appointment, too.

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