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Participation, interaction and social presence: an exploratory study of collaboration in online peer review groups

Abstract

A key reason for using asynchronous computer conferencing in instruction is its potential for supporting collaborative learning. However, few studies have examined collaboration in computer conferencing. This study examined collaboration in six peer review groups within an asynchronous computer conferencing. Eighteen tertiary students participated in the study. Content analyses of discussion protocols were performed in terms of participation, interaction, and social presence.

The results indicate that collaboration does not occur automatically in asynchronous computer conferences. Collaboration requires participation because no collaboration occurred in the two groups with low student participation; however, participation does not lead to collaboration, evidenced by student postings receiving no peer responses. Collaboration requires interaction but does not end with interaction, substantiated by different levels of collaboration across different interactional patterns. Social presence helps to realise collaboration through establishing a warm and collegial learning community to encourage participate and interaction, exemplified by the contrast of the group with the highest level of social presence and the group with the lowest level of social presence. A model of understanding and assessing collaboration in online learning is recommended, consisting of participation, interaction and social presence.

Introduction

The use of computer conferencing in higher education has triggered discussion about its potential for encouraging collaborative learning. However, Garrison (1997) argues that "while the technological characteristics of computer assisted learning are congruent with collaborative and constructivist approaches to learning, this does not happen by simply making the technology available or using it as an adjunct to didactic approaches to learning (p. 5)". Further Henri (1995) reports that many participants in asynchronous computer conferencing are

engaged in monologues to present their own views without reference to the solutions offered by their peers. Murphy (2004) reports that 68 of the 103 messages in her study were articulations of personal opinions or beliefs without making reference to peer perspectives; accordingly, she argues that identification and measurement of the presence of collaboration are required to reach an understanding of how collaboration manifests itself in an online context. However, the number of such studies is limited and more studies are needed to provide evidence-based proposals as to how best promote collaborative learning in computer conferencing contexts.

Background

Henri (1992) suggested an interactivity framework to scrutinise the level of collaboration in computer conferencing using three dimensions: participative, interactive and social. The participative dimension provides quantitative evidence for the level of collaboration. The interactive dimension examines the exchange of messages. The social dimension identifies the occurrences of social factors in messages unrelated to formal content. This dimension indicates the level of learners' focus on the task, the level of social cohesiveness established in the group, and the amount of affective support in the learning context.

Unlike Henri (1992) who examined the social dimension in learning-unrelated messages, the Community of Inquiry (CoI) framework (Garrison & Anderson, 2003; Garrison, Anderson, & Archer, 1999, 2001) examines social presence in messages related and unrelated to learning and categorises message as affective, interactive and cohesive(Garrison & Anderson, 2003; Rourke, Anderson, Garrison, & Archer, 1999). In the framework, social presence is essential for a collaborative learning community. When a significant degree of social presence is established, cognitive development is more easily sustained because social presence develops learners' awareness of each other's existence and contributions (Arnold & Ducate, 2006; Garrison & Anderson, 2003; Garrison, et al., 1999). This echoes Jelfs and Whitelock's (2000) finding that learning performances in a virtual learning environment were improved where a strong sense of social presence was reported because social presence maintained a strong sense of physical presence, promoted a feeling of team work and led to effective collaboration. In addition,

interactivity as an indicator of social presence stipulated in the CoI framework aligns with Zimmer's (2008) interpersonal action/learning cycle (IALC) which indicates interactivity as the necessary condition for collaboration because it encourages interlocutors to attend to others' perspectives, acknowledge comprehension and express own perspectives.

Social presence in the CoI framework is an element of Murphy's (2004) six-process model of collaboration in an online asynchronous discussion. Her six processes are (1) social presence, (2) articulating individual perspectives, (3) accommodating or reflecting the perspectives of others, (4) co-constructing shared perspectives and meanings, (5) building shared goals and purposes, and (6) producing shared artefacts. The early processes are prerequisites for the later ones but participation at the lower levels does not guarantee the occurrence of the higher levels (p. 423). Compared with social presence in the CoI framework (Rourke, et al., 1999), Murphy's definition of social presence is narrow.

It is apparent that participation, interaction, and social presence are commonly seen as key factors for achieving collaboration in computer conferencing but no detailed schemes have been developed so far to examine the intertwined relationships between three factors.

The current study contributes to the evidence base for learning in asynchronous computer conferencing in four ways. One, unlike most existing studies focusing on social presence alone, this study focuses on participation, interaction, social presence, and their interwoven relationships. Two, this study adds interaction patterns and turn-taking behaviours to examine the level of collaboration. Three, unlike most studies involving full-time students with similar backgrounds, this study was conducted in a part-time class with a heterogeneous group of students of different ages, education, cultural and professional backgrounds. Four, unlike most studies on online peer review, this study investigates online peer review in a class that is not an academic writing class.

Two research questions were asked:

RQ1. To what extent was the level of collaboration realised by the six online peer review groups in terms of participation, interaction, and social presence?

RQ2. How did these dimensions contribute to collaboration in the online peer review groups?

The current study

A part-time distance forensic linguistics course taught at a Swedish university was studied. As an integral part of the course, students were required to participate in online peer review before submitting the final versions of their task reports. The study reported in this paper is based on one task that required the students to review two other students' task reports.

Participants

Eighteen students completed the online peer review task. Sixteen of these were Swedish, together with one Irish and one German. All students were fluent Swedish and English speakers, and worked as police officers, insurance agents, medics, translators, and lawyers. At the start of the course, the students filled in a self-evaluation questionnaire that showed that all participants had previously studied distance courses, but only eight had experiences of online peer review.

Design of online peer review

The students were randomly divided into six groups. Table 1 summarises student background of peer review groups in terms of gender, age, and previous experiences of peer review.

(Insert Table 1 about here)

Two deadlines were set to ensure that the students completed the online peer review within three weeks: one was the date by which the students had to upload their draft assignments and the other was the date by which the students had to upload feedback on their peers' reports. The online peer review process was conducted in a local version of SAKAI CLE (Collaborative and Learning Environment). Students were required to upload and discuss their assignments in the online forum provided in the learning environment.

Each student reviewed two peer papers either directly as messages in the forum or as an attachment to a forum message. After receiving peer feedback on writing, writers and reviewers were encouraged to discuss peer feedback in the online forum to seek clarification of feedback and to negotiate revision strategies. Thus, although some argue that peer review should be anonymous (eg. DiGiovanni & Nagaswami, 2001; Liu & Sadler, 2003; Sullivan & Pratt, 1996), we followed Guardado and Shi (2007) who observed that anonymity can discourage online peer negotiation of feedback because authors did not know who they should ask for clarifications of received feedback.

Data analysis

Content and discourse analysis was conducted to examine the degree of collaboration in six online peer review groups. A number was assigned to each message according to its chronological order in the forum. To support the analysis, the message actions were visualised in interaction maps using Microsoft Visio 2007 using the following scheme: squares for messages containing feedback and social presence, circles for messages without social presence, diamonds for messages containing only social presence, different colours for different message contributors, and rectangles for instructor messages.

Analytic framework

Student participation was examined quantitatively by counting the number of participants in each group, the number of messages, and the distribution of messages among group members. The interactive dimension was examined quantitatively in terms of the number and distribution of responses and qualitatively in terms of the pattern of interaction and the turn-taking structure. The pattern of interaction indicates how each group achieves collaboration, and the turn-taking structure helps substantiate whether and how learners collaboratively improve each other's writing. The pattern of interaction was examined using interaction maps. The turn taking structure was analysed by following the four steps shown in Figure 1.

(Insert Figure 1 about here)

The Initiation step examines the turn that raises a new topic in terms of who made the turn (a writer or a reviewer) and whether the turn was task-related or not. The response was examined in terms of who made the response and whether the turn was task-related or not. The follow-up step examines the turn following a response in terms of who made the turn and whether the turn was task-related or not. The topic transition step acts as a message thread separator. It is not necessarily that every message thread contains all the four steps. For example, there could be no response to an initiating turn or no follow-up to a response.

Social presence was investigated by examining how the moves unrelated to the formal content of the task functioned to collaboratively establish and maintain online learning community. Rourke et al.'s (1999) template for assessment of social presence was used as the basis for the analytic framework in this study (see Table 2). Table 3 summarises the categories, indicators, and definitions.

(Insert Table 2 about here)

Rourke's category of interactive responses was developed by adding four new indicators to the category: inviting peers to provide feedback, informing peers of plans to review their writing, expressing appreciation for peer providing feedback, and stating action on peer feedback. Two indictors were removed from interactive responses: quoting other's messages and continuing a thread removing because "the presence of replies and quoted messages may be a superficial artefact of conferencing communication rather than a defining indicator of social presence (Rourke, et al., 1999, p. 63) ". Two further elements were excluded: the use of humour was excluded from affective responses since it was not observed in the data and phatics and salutations were excluded from indicators of cohesive responses since every forum message started with "Hej/hi" and ended with signatures.

(Insert Table 3 about here)

Results

The interaction maps (Figure 2) were the starting point for interpretation of the results.

(Insert Figure 2 about here)

Participation

Table 4 shows that with the exception of Group F, all the students in the peer review groups were involved in peer review process but the level of participation was varied between groups. Group D contained the highest level of participation, followed by Group A. Groups C and F posted a much fewer messages than the four other groups, suggesting a lower level of participation than the four other groups.

(Insert Table 4 about here)

Interaction

Group D made the largest number of responses (*n*=21), followed by Group A (*n*=13). Groups C and F were the least active groups with Group F making one response to peer messages.

The pattern of interaction differed between the online peer review groups (see Figure 2). Messages in Groups A and B were scattered into three clusters, with each cluster discussing one student's writing. Discussions in Group C were scattered into two clusters about two students' reports. Messages in Groups D and E showed a synergistic pattern and formed one big cluster due to the cross-thread connection.

Different turn taking structures were observed across groups. Using the interaction map (Figure 2) and content analysis of interaction protocols, Table 5 shows the characteristics of turn-taking behaviours in each group.

(Insert Table 5 about here)

The following two extracts exemplify the different turn taking structures.

Extract 1 writer initiating → peer responses (IR)

Correct decision? - Andrea (Nov 5, 2:09 PM)

Correct decision. docx

Here is my first draft to the task. I have answered task A.

Re: Correct decision? - Jonas (Nov 13, 9:46 PM)
Task_4_Andrea.doc

Hi.

I enclose my comments in the attachment.

Regards, Jonas

Extract 1 is taken from Group B's discussions in which peer feedback provided by Jonas received no follow-up response from the writer, Andrea and thereby suggests one-way interaction that provides no indication of whether the writer would act on peer feedback or not.

Extract 2 Interaction containing more than one peer response

Was the court correct? - Monika (Nov 1, 12:20 PM)
AATASK4PaulMalonemww.doc

I attach my first draft for Task 4.
I wonder if I should remove the last sentence…
I look forward to hearing from you.
Monika

Re: Was the court correct? - Helga (Nov 15, 4:45 PM)

Hello Monika,
I have read your paper, that I found interesting… Some minor remarks. I would suggest that you write "a statement of a **female** eyewitness" on page 2, to make it easier to cope with the "She" a few lines below…
However, your task was to argue along the B-line and as far as I understand you have succeeded in doing so!! Well done!

Re: Was the court correct? - Monika (Nov 15, 5:54 PM)

Thank you Helga!
You raised very good points. I take your points aboard and revise my draft.
Monika

Re: Was the court correct? - Saga (Nov 18, 5:01 PM)

Hi Monika! First of all well done on your draft for this assignment. I found it to be a solid piece of work and thoroughly enjoyed reading it. There are a few points I would like to bring to you're attention that I thought could be altered... I agree that possibly you should omit the highlighted sentence "it would be surprising… " as it is unnecessary and can be seen as more of a personal opinion than fact. I have read the other review and also agree with many of Helga's suggestions [underlined by researchers]... Again, well done and good luck!

Re: Was the court correct? - Monika (Nov 19, 9:19 PM)

Thank you Saga!
I have revised this sentence
"prove that Malone's conviction was not safe" .
…
I did remove my "speculative" sentences about the motives.
Monika

Extract 2 is taken from Group E's discussions and is a good example of multiple peer interaction where peer feedback provided by Helga received responses from the writer, Monika and another peer reviewer, Saga.

Summarising the interaction in the six groups, we find that writer initiating → peer response → writer follow-up (IRF) is the most predominant structure in Groups A, D and E whereas discussions in Groups B and C were one-way interaction. Although there was one case with writer follow-up in Group B, further analysis showed that the case was off-task discussions. In contrast to Groups B and C, all discussions in Groups D and E were two or multiple direction communication: Feedback was provided to peer reports to which a writer and/or a peer then followed up on.

The findings of patterns of interaction and turn taking behaviours indicate that the synergistic pattern involves a higher level of collaboration than the scattered pattern and different levels of collaboration occurred to the scattered pattern. Groups D and E contained a higher level of interactivity than Groups A, B and C. Group A contained a higher level of interactivity than Group B on account of writer follow up to peer feedback although Groups A and B were characterised by the same scattered pattern.

Social presence

Content analysis of the interaction transcript was performed in terms of the indicators of social presence, taking a move as the unit of analysis. It was found that Group D made the largest number of social moves (*n*=35) with Group B making the smallest number (*n*=3). The larger number of social moves made by Groups D and E suggest that they made more effort than the other four groups to maintain peer discussion and establish a social collaborative environment.

The groups commonly used the complimenting of peers' writing or of peer feedback to promote interaction (Table 3: 2d) and five of the six groups (except Group F) used addressing peers by name to sustain a sense of group commitment (Table 3: 3a). Group D employed expression of emotion (Table 3: 1a) and expression of appreciation for peer feedback (Table 3: 2h) as the main types of social presence to create a warm and collegial group learning community.

Discussion

This study showed the different levels of collaboration achieved by six online peer review groups in terms of participation, interaction and social presence and how the three dimensions contributed to collaboration in online peer review (See Figure 3).

(Insert Figure 3 about here)

First, participation was found to be a prerequisite for interaction and collaboration; however, participation does not make interaction and collaboration automatically occur. Although a similar level of participation was achieved by Groups B and E in terms of a similar number of messages and responses, Group B was a scattered pattern of one-way interaction whereas Group E was characterised by a synergistic pattern permeated with two- or multiple-way interaction.

Second, interaction was found to be a prerequisite to collaboration, echoing the central role of interaction in studies on computer-supported collaborative learning (Kahrimanis, Avouris, & Komis, 2011; Rummel, Deiglmayr, Spada, Kahrimanis, & Avouris, 2011); yet, interaction does

not guarantee the occurrence of collaboration, echoing Murphy's (2004) argument that collaboration begins with interaction but interaction does not end up with collaboration. On one hand, the higher level of interaction in Groups D and E than the other four groups brought about a higher level of collaboration, echoing Schrire's (2004, 2006) argument that the synergistic pattern reflects a larger component of peer collaboration than other patterns of interaction. On the other hand, interaction could end up with one-way communication, evidenced by Group B where all interaction threads were one-way interaction short of writer follow-up.

Third, social presence was found to evolve from interaction and an optimal level of social presence encouraged participation and positively shaped the dynamics of interaction, and thereby promoted collaboration. This is best seen in Groups D and E that contained a higher level of interaction than the other four groups and employed more social presence than the other four groups. This aligns with Whitelock, Romano, Jelfs and Brna's (2000) finding based on interviews that interactivity enhanced sense of social presence. In turn, social presence encourages participation and interaction and promotes collaboration, evidenced by the findings of how social presence helped Group D establish a warm and supportive learning community. Garrison and Arbaugh (2007) argue that social presence evolves from open communication (interaction), to purposeful academic exchanges (discourse), and finally, to achieving a feeling of camaraderie (p.160). Social presence in Group D exemplified these three phases. Learners in Group D created a separate discussion space within the forum for open interaction before starting peer review, which fostered group cohesion and encouraged interaction. Almost all responses with peer feedback contained compliments for peers' work and writers' thankfulness for peer providing feedback: compliments and appreciations created a warm and supportive community and helped learners realise the phase, camaraderie, where they shared their technical difficulties and personal life in the end. The findings confirm Murphy's assertion that social presence creates group cohesion, which enriches interaction (Murphy, 2004). Social presence could also promote trust among group members, an important precondition for computer-supported collaborative learning (Gerdes, 2010). In contrast, Group B produced no

follow-up to peer feedback with the online forum. The forum was simply a place where writing and feedback was exchanged without a collaborative online learning community. The contrast between Group B and Group D corroborates Rourke et al.'s (1999) viewpoint that low frequencies of social presence indicate a cold and impersonal social environment where participants use the online space for information exchange; high frequencies of social presence indicate a warm and collegial environment where participants feel a sense of affiliation and solidarity within the group.

The interwoven relationships among the three dimensions corroborate Garrison's (1997) argument that collaboration does not happen automatically by simply using computer conferencing in didactic approaches to learning and Murphy's (2004) argument that collaboration is a continuum process with a lower level of processes making the higher level of process possible but not inevitable. The findings also imply that quantitative evidence in terms of participation alone and the interaction pattern without supporting evidence of turn-taking structures cannot sufficiently explain the level of online collaboration.

Last but not least, the different participation, interaction and collaboration patterns across groups alongside the different student backgrounds in Table 1 suggest possible impacts of student traits on collaboration such as gender. For instance, Groups D and E consisted of students of females and turned out to be more collaborative than the other four groups consisting of students of different genders. This corroborates the viewpoint that considers females to be better at online discussion than males as they are generally thought to be more social and collaborative (Herring, 2000; King, 2000; Ory, Bullock, & Burnasks, 1997).

Conclusions and future work

Although the sample size is small in this study and caution should be taken when interpreting and applying the findings in different instructional contexts, this study has provided a new direction for rethinking and assessing collaboration in online learning. It argues and substantiates that collaborative learning does not automatically occur due to the use of computer conferencing within a learning environment. Collaborative learning is established and

maintained by the intersection of participation, interaction, and social presence. Evidence based on one dimension alone cannot sufficiently assess the level of collaboration in an online learning context. These findings suggest strategies for online instructors to enable them to provide support and scaffold asynchronous online discussions to move them beyond participation and interaction to collaboration.

Future work can replicate the current study in a larger and longer scale to confirm and develop the findings in this study as understanding how collaboration is established in terms of participation, interaction and social presence. Future studies might also focus on the impact of student traits on collaboration and the impact of collaboration on the productivity of online learning.

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Figure 1: Analysis flowchart for turn-taking structure

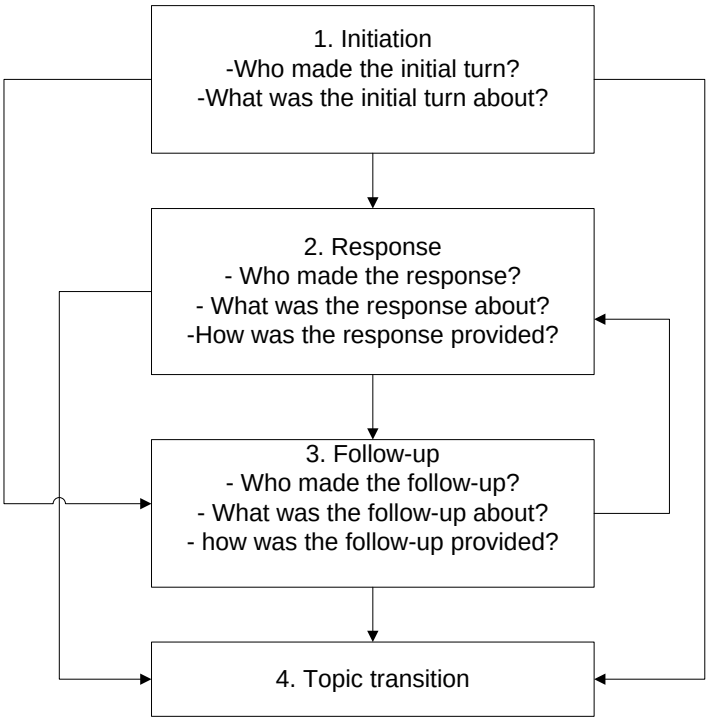

Figure 2: Participation and interaction in the six online peer review groups

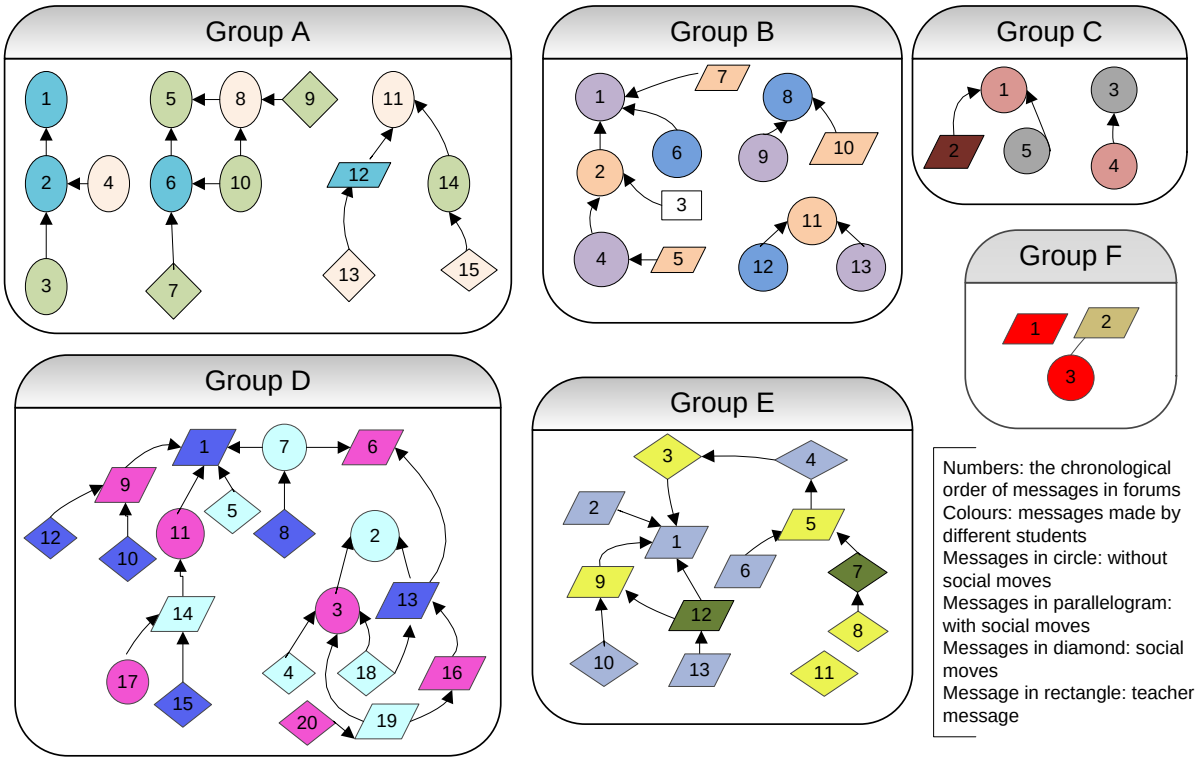

Figure 3: Participation, interaction, social presence and collaboration in online peer review

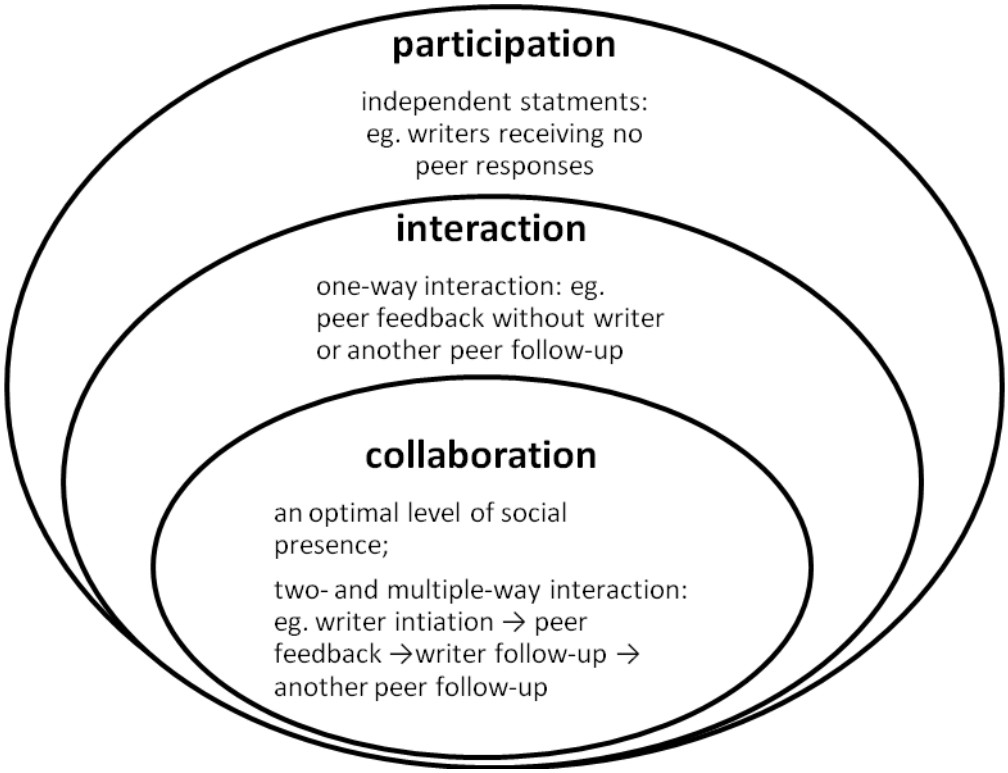

Table 1: Background information of peer review groups

Groups	**Gender**	**Age groups**	**Previous experiences of peer review**
Group A	Male: 1 Female: 2	30-35: 1 Above 50: 2	No: 3
Group B	Male: 1 Female: 2	30-35: 3	Yes: 1 No: 2
Group C	Male: 1 Female: 2	25-30: 1 40-45: 2	Yes: 2 No: 1
Group D	Female: 3	30-35: 3	Yes: 2 No: 1
Group E	Female: 3	25-30: 1 Above 50: 2	Yes: 2 No: 1
Group F	Male: 1 Female: 2	25-30:2 30-35: 1	Yes: 1 No: 2

Table 2: Rourke et al.(1999)'s model and template for the assessment of social presence

Category	*Indicators*	*Definition*	*Example*
Affective	Expression of emotions	Conventional expressions of emotion, or unconventional expressions of emotion, includes repetitious punctuation, conspicuous capitalization, emoticons.	"I just can't stand it when ...!!!!" "ANYBODY OUT THERE!"
	Use of humor	Teasing, cajoling, irony, understatements, sarcasm.	The banana crop in Edmonton is looking good this year)
	Self-disclosure	Presents details of life outside of class, or expresses vulnerability.	"Where I work, this is what we do ..." "I just don't understand this question"
Interactive	Continuing a thread	Using reply feature of software, rather than starting a new thread.	Software dependent, e.g., "Subject: Re" or "Branch from"
	Quoting from others' messages	Using software features to quote others entire message or cutting and pasting selections of others' messages.	Software dependent, e.g., "Martha writes:" or text prefaced by less-than symbol <.
	Referring explicitly to others' messages	Direct references to contents of others' posts.	"In your message, you talked about Moore's distinction between ..."
	Asking questions	Students ask questions of other students or the moderator.	"Anyone else had experience with WEBCT?"
	Complimenting, expressing appreciation	Complimenting others or contents of others' messages.	"I really like your interpretation of the reading"
	Expressing agreement	Expressing agreement with others or content of others' messages.	"I was thinking the same thing. You really hit the nail on the head."
Cohesive	Vocatives	Addressing or referring to participants by name.	"I think John made a good point." "John, what do you think?"
	Addresses or refers to the group using inclusive pronouns	Addresses the group as *we, us, our, group.*	"Our textbook refers to ..." "I think we veered off track ..."
	Phatics, salutations	Communication that serves a purely social function; greetings, closures.	"Hi all" "That's it for now" "We're having the most beautiful weather here"

Table 3: Analytic framework for assessment of social presence in online peer review groups

Categories	Indicators	Definitions	Examples
1.Affective: the expression of emotions, feelings and mood	a. expression of emotions	Conventional or unconventional expressions of modes such as repetitious punctuation, conspicuous capitalisation, emoticons	I hope this is constructive and helpful. It was solved ☺
	b. self-disclosure	Sharing personal life with group members	Have been in the famous flue and haven't done anything in the past week.
2.Interactive: evidence that the other is attending	a. inviting peers to provide feedback	Writers inviting peers to provide feedback on their drafts	I look forward to hearing from you.
	b. informing peers of plans to review their writing	Telling their peer collaborators about their plan to review their work	This is just to let you know that I have to postpone it until upcoming weekend.
	c. asking questions	Asking students where to find their assignment	Where can I find your essay Sarah?
	d. complimenting	Complimenting peers' writing or peer feedback	Well done! You raised very good points.
	e. agreement	Expressing agreement with peers' non task-related messages	Agree with you that CLE not directly user-friendly!
	f. expressing appreciation	Writers expressing appreciation for their peers' comments or peers' effort to create a group	Thanks for your constructive feedback.
	g. stating action on received feedback	Writers expressing the use of received feedback in revised drafts	I take your points aboard and revise my draft.
3.Cohesive: build and sustain a sense of group commitment	a. vocatives	Addressing or referring to participants by name	Thank you Sarah!
	b. create, addresses or refers to the group using inclusive pronouns	Addresses the group as we, us, our, group	We are in the same group I guess.

Table 4: The number and distribution of messages in the six online peer review groups

Groups	Student participants	Student messages	Message distribution
Group A	3	15	4:5:6
Group B	3	13	3:4:5
Group C	3	5	1:2:2
Group D	3	20	6:7:7
Group E	3	13	2:5:6
Group F	2	3	1: 2

Table 5: Turn-taking behaviours in the six online peer review groups

Group	Number of cases: turn-taking behaviours
Group A	6: writer initiating → peer response → writer follow-up
	2: writer initiating → writer follow-up→ peer response
Group B	6: writer initiating → peer responses
	1: writer initiating → peer response→ writer follow-up→ peer response
Group C	3: writer initiating → peer response
Group D	7: writer initiating→ peer response→ writer follow-up
	2: writer initiating → peer response → another peer follow-up → writer follow-up
	1: writer initiating → peer response → another peer follow-up → peer follow-up
Group E	4: writer initiating → peer response → writer follow-up
	1: peer initiating → writer response → peer fellow-up
	1: writer initiating → peer response → another peer follow-up
Group F	1: writer initiating → peer response