Towards a framework of interactions in a blended synchronous learning environment: what effects are there on students' social presence experience?

Elson Szeto & Annie Y. N. Cheng

To cite this article: Elson Szeto & Annie Y. N. Cheng (2016) Towards a framework of interactions in a blended synchronous learning environment: what effects are there on students' social presence experience?, Interactive Learning Environments, 24:3, 487-503, DOI: 10.1080/10494820.2014.881391

To link to this article: http://dx.doi.org/10.1080/10494820.2014.881391

Published online: 20 Feb 2014.

Submit your article to this journal

Article views: 247

View related articles

View Crossmark data

Citing articles: 3 View citing articles
Towards a framework of interactions in a blended synchronous learning environment: what effects are there on students’ social presence experience?

Elson Szeto* and Annie Y. N. Cheng

Department of Education Policy and Leadership, The Hong Kong Institute of Education, 10 Lo Ping Road, Tai Po, New Territories, Hong Kong SAR, People’s Republic of China

(Received 9 April 2013; final version received 5 January 2014)

A synchronous blend of online learning and “face-to-face” teaching is becoming a feasible instructional approach in higher education with the advent of technology. Although this learning mode is not new in higher education, little research has been done to contextualise social presence experiences in which effects of interactions were explored for enhancing learning. A qualitative approach was adopted using the case study method to examine the instructor and students’ pedagogic interactions in the social presence of a blended synchronous learning environment. This paper reports an exploration of the blended learning with an online group of students at a remote site attending a computer-aided engineering drawing course synchronously with a face-to-face group taught by an instructor in a laboratory. The process of interaction was visually and verbally mediated by videoconference as if in an online face-to-face learning community. The findings show that the online and face-to-face groups had different social presence experiences in which interaction emerged. Emotional adaptation and practice is needed for the students and the instructor in such a complex environment. Based on the interaction patterns, a framework of interactions in the blended synchronous learning environment is conceptualised to inform course development and instructional design. Implications for further study are also discussed.

Keywords: interactions; social presence; blended synchronous learning; online learning; face-to-face teaching; virtual environment

Introduction

As multi-learning sites are increasingly being set up in different locations, campus-based universities are exploring online teaching and learning with the aim of transforming education opportunities beyond conventional “face-to-face” teaching (Szeto, 2011). These institutions are searching for different instructional approaches to cater for diverse student learning needs, attract more non-campus-based students and internationalise their institutional profiles in the advent of technology. A synchronous blend of online learning and face-to-face teaching modes is one of the ubiquitous approaches gaining currency in higher education. This is termed as the blended synchronous learning mode (Hastie,
Hung, Chen, & Kinshuk, 2010). Although this is not new, little research has been done to reveal its social presence in which pedagogic interactions are facilitated.

Online interactions have been evidenced as a significant component of pedagogy attaining intended learning outcomes in online learning contexts (Ravenna, Foster, & Bishop, 2012). In particular, those interactions can facilitate peer rapport between online and face-to-face students in a blended synchronous learning mode. Furthermore, synchronous online interactions realise students’ immediate connections with each other for participation and cooperation in learning activities (Park & Bonk, 2007). Garrison and Cleveland-Innes (2005) argued that interaction alone is not enough for learning attainment, since new forms of interaction have emerged in the blended synchronous learning mode. Effects of blended synchronous interaction are yet to be fully explored to inform university course developers, faculty and instructional designers in different places.

This paper reports a qualitative case study of interactions that emerged in the social presence of a blended synchronous learning environment. In this environment, online and face-to-face students synchronously learned in a virtual space mediated by an internet/intranet-based videoconference as if the learning was situated in a virtual face-to-face environment (Yamada, 2009). Particular attention was paid to exploring the effects of interaction on student learning through learning activities designed for the blended synchronous learning mode. Three research questions were addressed:

1. What were the online students’ social presence experiences in contrast to those of the face-to-face students in the blended synchronous learning process?
2. What types of interactions emerged in the social presence experience?
3. What patterns of interactions were found in the blended synchronous learning environment?

Framing an approach to studying interactions in a blended synchronous learning environment

In higher education, different studies on understanding interactions for teaching and learning with technology have been conducted. In the implementation of various online learning modes, be it asynchronous, synchronous or blended, various types of interaction are identified. As early as the 1980s, interactions were classified into three types: “learner–content,” “learner–instructor” and “learner–learner” interactions (Moore, 1989), in the context of distance education. Cobb (2009) enquired these interaction types “… in relation to the quality of the online learning experience … [in terms of] social presence” (p. 241). Qualitative and quantitative understandings of the effects of social presence on learning have been developed with a focus on online interactions (Bianco & Carr-Chellman, 2007; Gunawardena & Zittle, 1997; Szeto, 2013a). However, Tu and McIsaac (2002) asserted that “social presence is much more complicated than previously imagined [with the advent of ICT]” (p. 146). Continuous enquiries of interactions in the online learning context are needed (Kreijns, Kirschner, & Jochems, 2011). In particular, interaction is regarded as a key component of social presence that contributes to attaining the intended learning outcomes in online learning (Swan, 2004).

A line of enquiry has been built on Short, Williams, and Christie’s (1976) social presence theory in telecommunications in which social presence is “a hypothetical construct” in “the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships” (p. 65). Studies (Gunawardena, 1995; Gunawardena &
Zittle, 1997; Kreijns et al., 2011) have focused on measuring online social presence and its impact on learning in text-based online discussions. The prime concern is how social presence affects online educational experiences through various types of interactions facilitated in different online learning modes.

Social presence has a positive correlation with communicative interactions as a means of constructing online learning with peers in connection with a social context mediated by communication media (Tu & McIsaac, 2002). Additional attributes were found in understanding interactions as part of online communication. For example, Woods and Baker’s (2004) immediacy (i.e. the psychological dimension) and intimacy (i.e. the physical dimension) are also emphasised, while closer online peer relationships through interactions contribute to peer intellectual and affective support for learning (Gunawardena, 1995). Likewise, higher degrees of immediacy and intimacy of online student experience in instructor–learner–content interactions have a significant effect on learning outcomes. In turn, social presence is enriched for quality online learning.

Parallel to the social presence theory, another line of enquiry added new dimensions to the study of social presence by incorporating the presence of instruction and cognitive attainment. This line of enquiry has taken a broader communal view of educational experience as the community of inquiry (CoI) framework (Garrison, Anderson, & Archer, 2000). The enquiry aims to examine educational experience in online learning and teaching at the intersection of teaching, social and cognitive presence. Akyol and Garrison (2011) indicated that “The philosophical premise of the framework is a collaborative constructivist approach to teaching and learning” (p. 235). The ideal experience is regarded as deeper approaches to meaningful learning in relation to constructivist learning through a community of critical enquiry (Akyol et al., 2009). Quality educational experience is at the centre of the CoI framework.

In the CoI framework, Garrison et al. (2000) define social presence as “the ability of participants in a CoI to project themselves socially and emotionally, as ‘real’ people through the medium of communication being used” (p. 94). Teaching presence is interpreted as an effective instructional leader in learning processes (Akyol & Garrison, 2011) towards constructivist orientation, while cognitive presence can be considered as “participants in any particular configuration of a community of inquiry [being] able to construct meaning through sustained communication” (Garrison et al., 2000, p. 89). Although teaching and cognitive presence play equal roles in shaping the educational experience, a positive sign of social presence influencing perceptions of learning tasks, cooperation and media was evidenced in an experimental study (Weinel, Bannert, Zumbach, Hoppe, & Malzahn, 2011). However, regarding the attainment of the intended learning outcomes, the effects of social presence in terms of interactions argue against its contribution to meaningful learning in the notion of CoI (Garrison & Cleveland-Innes, 2005).

By adopting the blended synchronous learning models proposed in recent studies (Chen, Ko, Kinshuk, & Lin, 2005; Hastie et al., 2010), social dimensions can be enriched to facilitate a sense of learning community. The term social dimension refers to “the ways in which learners interact and communicate with other learners and their tutors using electronic communication networks” (Nicol, Minty, & Sinclair, 2003). In a face-to-face context, Paakkari, Tynjälä, and Kannas (2010) argue that the learning mode is salient to “…[form] a community where there is a place for everyone [i.e. students and teacher] to learn, grow, develop and share” (p. 913) such that the flow of interactions can be enriched. Likewise, with the advent of internet/intranet-based videoconferencing technologies, a similar sense of online community (McInerney & Roberts, 2004) can also be
built in a virtual context. With respect to these, a blended synchronous community can be adopted to attain the intended learning outcomes, given that appearances, visual and audio expressions and non-verbal interactions can be mediated as if students are learning in a virtual face-to-face context. Following this line of technological and pedagogical adaptation, blended synchronous learning communities are likely to be extended to different levels of education (Lawson, Comber, Gage, & Cullem-Hanshaw, 2010). Given that a blended synchronous learning community is built for online and face-to-face students, the presence of enriched social dimensions is paramount to connect and engage students in attaining the learning outcomes (Gregori, Torras, & Guasch, 2012).

Despite the above lines of enquiry, the concept of social dimension or social presence emphasises its positive impacts on student learning through peer interactions in an online or blended learning environment. The terms social dimension and social presence seem to describe two sides of a coin. Regardless of the terminology, the enquiries by and large postulate peer interactions as a salient pedagogic element which could lead to meaningful learning attainment compatible with the theoretical stance of social constructivism (Woo & Reeves, 2007). A sense of learning community should not be overlooked as a form of social learning (Wenger, 1998) whereby learner–content, learner–instructor and learner–learner interactions facilitate social construction of knowledge in the environment.

The above review of relevant enquiries provides an integrated theoretical lens for studying the nature of interactions in a blended synchronous learning environment supported by videoconferencing. Table 1 summarises the enquiries stemming from the belief that social interactions are of paramount importance in facilitating student learning to attain the intended learning outcomes.

With a focus on interaction, this study explored the students’ online and face-to-face social presence experiences in a blended synchronous learning mode. The design of blended synchronous learning was contextualised in the notions of Chen et al.’s (2005) synchronous learning mode and Hastie et al.’s (2010) blended synchronous models. Little research has been done to understand students’ interaction experiences of social presence in such a context. In particular, internet/intranet-based videoconferencing was used to support a two-way real-time communication and real-object projection. Not only textual but also visual and verbal interactions were mediated. Relevant to the context of this study, this paper prefers to use the term student rather than learner unless directly citing from original sources, while the terms social dimension and social presence are used interchangeably. What follows is a report of the implementation of this blended synchronous learning design in the study.

The case study of blended synchronous learning

This paper draws from a larger study aiming to investigate blended synchronous learning involving 150 undergraduate students over a two-year period in a university. It reports the first phase of the project as a qualitative case study (Yin, 2003) of a blended synchronous learning mode with a focus on what pedagogic interactions emerged in the blended synchronous learning environment. The term pedagogic interactions refer to learning interactions which emerged during the teaching sessions (Park & Bonk, 2007; Swan, 2004). This case study also paid great attention to the effects of the interactions on the students’ and instructor’s experiences in the social presence of blended synchronous learning. The approach to studying the interactions was derived from the above review of the social presence enquiries into the effects of pedagogic interactions.
Table 1. A summary of the lines of enquiry into interactions in an online context.

<table>
<thead>
<tr>
<th>Line of enquiry</th>
<th>Framework</th>
<th>Focus</th>
<th>Key meaning</th>
<th>Enquiry method</th>
<th>Participant</th>
<th>Online context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short et al. (1976), Gunawardena (1995), Gunawardena and Zittle (1997), Tu and Mlsaac (2002) and Kreijns et al. (2011)</td>
<td>Social presence theory (technological versus social determinism)</td>
<td>Social presence; social construction of knowledge</td>
<td>Social presence is “a hypothetical construct” in “the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships” (Short et al., 1976, p. 65)</td>
<td>Validated surveys: social presence and privacy questionnaire; social presence indicators; The Gunawardena and Zittle Social Presence Scale; Perceived Social Presence Scale</td>
<td>Students/ instructors</td>
<td>CMC and LMS: synchronous text-based interactions of discussions</td>
</tr>
<tr>
<td>Garrison et al. (2000), Garrison and Anderson (2003), Swan (2004) and Akyol et al. (2009)</td>
<td>CoI</td>
<td>Educational experience in the intersection of teaching, social and cognitive presence</td>
<td>Social presence is defined “as the ability of participants in a community of inquiry to project themselves socially and emotionally, as ‘real’ people through the medium of communication being used” (Garrison et al., 2000, p. 94)</td>
<td>Validated CoI survey; CoI coding schemes, e.g. social presence coding: (1) emotional expression; (2) open communication and (3) group cohesion</td>
<td>Students/ instructors</td>
<td>CMC, VC and/or LMS: a/synchronous text-based interactions of discussions</td>
</tr>
<tr>
<td>Nicol et al. (2003), Chen et al. (2005), Yamada (2009), Hastie et al. (2010) and Smyth (2011)</td>
<td>A model of (blended) synchronous learning; five dimensions</td>
<td>Social dimensions; a set of roles for students and instructors; constructivist learning</td>
<td>A social dimension is referred to as “the ways in which learners interact and communicate with other learners and their tutors using electronic communication networks” (Nicol et al., 2003)</td>
<td>No specific instrument</td>
<td>Students/ instructors</td>
<td>VC and/or LMS: synchronous visual/audio/text-based exchange and interactions in learning activities</td>
</tr>
</tbody>
</table>

Note: CMC, computer-mediated communication; LMS, learning management systems and VC, videoconference.
**Technological infrastructure of the university**

The setting of the blended synchronous learning environment only involved existing technological infrastructure provided in general teaching venues of the university. Regular desktop and portable computers, video and real-object projectors and network facilities were available without particular technical reconfiguration. General desktop video cameras, microphones, speakers and a simple videoconferencing software package bundled with the camera were used for the study. The study kept the video and audio qualities to the minimum, but acceptable for watching and for communication between the online/face-to-face students and the instructor, to avoid technological problems. The reason was so that the study design can be repeated in university contexts of different locations.

The blended learning environment was affected by the network traffic. For example, high network traffic occasionally reduced the transmission speed and delivered poor visual and audio quality for the students and instructor during the teaching sessions. The greatest challenge was expected to be the need for participants to adapt to the synchronous online communication with the use of video projection, the microphones and speakers. This way of communication is different from that in a face-to-face situation. That is the reason why some studies of blended/online learning interactions still focus on text-based communication. Nonetheless, this study explored the participants’ verbal interactions with visual cues mediated by the videoconferencing.

**Blended synchronous learning**

The study was set in a blended learning mode that synchronously blended online learning and face-to-face teaching. There are many ways or modes to conduct the blending (Bonk & Graham, 2006; Garrison & Vaughan, 2008; Hastie et al., 2010; Picciano, Dziuban, & Alfred, 2007; Szeto, 2013b). Littlejohn (2007, p. 1) stated that “… this blending of e-learning with traditional methods is attracting the interest of many teachers in further and higher education.”

The blended synchronous learning design reported in this paper was based on Hastie et al.’s (2010) holistic mode (Mode 9). The mode was realised as an ideal blended synchronous pedagogy such that teachers and students “… are [simultaneously] participating both in physical classrooms and in cyber classrooms” (p. 17). This design was implemented in the course content involving not only the instructor who taught engineering theories and hands-on demonstrations but also the two groups of online and face-to-face students who practised computer-aided engineering drawing techniques. The two groups were simultaneously engaged in learning the drawing in a virtual face-to-face environment mediated by the desktop videoconferencing. This implementation set out to explore both the online and face-to-face groups’ interaction experiences in social presence in this learning environment.

**The participants**

As key players in the case, two faculty members from an engineering department of a university and the author from an education institution in Hong Kong formed a project team. The team members could provide both disciplinary and instructional expertise for the exploration. One of the two faculty members also acted as the course instructor for this study. Although having extensive face-to-face and online teaching experience, he had
not previously taught students in such a blended synchronous learning mode. The other team members supported him in redesigning the learning activities.

According to the regular course registration for all first-year engineering students, 28 students enrolled on a computer-aided engineering course in the university. They were then invited and agreed to participate in this phase of the study. All student participants were first-year engineering students and were equally divided into two groups, the face-to-face and the online group. As the other key players in the case, the face-to-face group \((n = 14)\) was taught face to face in an engineering laboratory, while the online group \((n = 14)\) simultaneously attended the same sessions of the drawing course at a remote site.

The course assessment requirements adopted a formative assessment scheme for the student learning. The course expected the students to attend 6 hours per day for 9 days (i.e. 9 sessions) with a total of 54 hours scheduled in a summer semester, during which they were required to submit 7 engineering drawings, and take an in-class test in the 5th session. As part of the assessment, learning activities were designed for the students.

The learning activity designs focused on student cooperation through group discussion, group problem-solving exercises and group projects. Starting from the fifth session, the students were randomly divided into seven sub-groups comprising two students from each of the two groups, forming a blended grouping of face-to-face and online members. Each group was engaged in a group project in the remaining sessions. Students’ blended synchronous interactions were expected to occur across the two groups in the blended learning environment.

**Data collection**

The case study adopted a qualitative approach to collecting data from multiple sources including class observations, interviews, focus group sharing and the instructor’s reflections. Ten class observations, 30 individual interviews, 1 focus group sharing session and 3 reflections of the instructor were conducted. In particular, class observations of 10 half-day sessions in the engineering laboratory in parallel to those at the remote site were conducted and captured on a digital storage device in a 4-in-1 format for further analysis. Figure 1 shows a screen capture of the recording.

The instructor’s live teaching, live demonstration of engineering drawings and the two groups of students’ learning process were displayed simultaneously on the video. Then, three students were immediately interviewed after each in-class/on-site observation. Finally, a group sharing session was conducted with the instructor, with five and four students from the online group and face-to-face group, respectively, to gain deeper understandings of their learning experiences in the interactions following the latest session.

**Data analysis**

Data analysis involved qualitative coding of the collected data based on the CoI coding scheme of social presence (Garrison & Anderson, 2003) and counting the frequencies of the interactions among all the participants. First, the coding process took several cycles until saturation. The richness of the social presence experiences which emerged from the data could deepen our understandings of the students’ interactions throughout the entire course. Table 2 shows sample quotes by the CoI social presence indicators. One of the
project team members coded the data first and the other members cross-checked the coding. The data were coded based on the CoI social presence coding scheme, to identify relevant incidents in relation to the characteristics of the students’ interactions in the social presence mediated by the videoconferencing.

Second, the number of interactions among the two groups of students and the instructor were counted throughout the 4-in-1 video recordings of the teaching sessions the project team observed. To gain an understanding of the interactions in the blended synchronous learning mode, the count was based on Moore’s (1989) notions of interaction types. The number of interactions provides an important dimension of illustrating the case through which the participants’ interactions could be understood. The objective was not for any statistical analysis to be undertaken.

Instead of measuring the type of interactions, the author expected to gain deeper understanding of the interactions beyond the researchers’ previous studies (Moore, 1989; Swan, 2004; Tu & McIsaac, 2002) due to the learning mode. The frequencies and directions of the interactions among the participants contributed to frame a pattern of interaction types. University management, course developers, faculty and instructional designers were informed about the complexity of pedagogic interactions in the social presence. Thus they can adjust, facilitate and extend the constructive effects of interactions on blended learning and teaching when developing courses for various blended learning modes.
A computer-aided qualitative data analysis package, NVivo 9, was used for the coding of relevant data extracts as incidents of the students’ experience. As human actions are based on social meanings, such as beliefs and intentions, what constitutes a real claim for one person may not be real to another, depending on their interpretation (Bassey, 1990). To enhance the internal validity, the final coding of the two researchers was compared within NVivo. The inter-rater reliability Cohen’s Kappa coefficient (Cohen, 1960) was calculated as 0.88 which indicates substantial agreement between the researchers. The disagreements were resolved through discussion until consensus was reached.

**Findings**

This case study presents the online and face-to-face groups of students and the instructors’ experiences in the blended synchronous learning through the CoI presence coding scheme. The frequencies and directions of the participants’ interactions characterise the social presence during the teaching and learning processes.

**Emotional expression: the students’ experiences of social presence**

In relation to the interview and observation data, the online and face-to-face groups’ experience had both positive and negative impacts on their learning in the blended context. Table 3 highlights the students’ expression of their social presence experiences in the blended synchronous learning.

This table shows that the online students appreciated the multi-screen projection of themselves which enhanced a “real” sense of face-to-face communication. However, they perceived that the interactions were indirect and that they were not physically present in the virtual face-to-face environment. Additional hand gestures and social cues were required. The online students found that meeting the face-to-face students virtually was interesting but felt that they were placed under a spotlight in many question-and-answer sessions. This was because the instructor paid too much attention to their responses.

<table>
<thead>
<tr>
<th>The online group</th>
<th>The face-to-face group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received too much attention as if they were <em>under the spotlight</em></td>
<td>Regarded that the instructor <em>spent longer</em> facilitating the online group in the question-and-answer sessions</td>
</tr>
<tr>
<td>Multi-screen projections of the instructor’s teaching and the face-to-face group created a “real” sense of attending “face-to-face” teaching</td>
<td>Seemed to <em>be neglected</em> by the instructor</td>
</tr>
<tr>
<td>Experienced short <em>transactional interactions</em> with the face-to-face group for cross-group activities</td>
<td><em>Interested in meeting other students located at the remote site</em></td>
</tr>
<tr>
<td>Cooperative learning activities with the face-to-face group were <em>indirect</em> but <em>effective</em> in the environment</td>
<td><em>Interaction</em> with the online group was <em>difficult</em> because the students were <em>not physically present</em></td>
</tr>
<tr>
<td>Transmission was occasionally interrupted and the system was restarted</td>
<td>Screen projection of the online students enhanced <em>a sense of connected</em> learning communities at large</td>
</tr>
<tr>
<td></td>
<td>Audio transmission was rough and unstable</td>
</tr>
</tbody>
</table>
In the beginning, both the tutor and students needed to psychologically adapt to the change of teaching mode. The tutor reflected that

We (the tutor and students) would feel the psychological barrier [which emerged in this online teaching] when facing change, because people always expect things to remain unchanged. When changes are made, it takes time to get used to it. (Extract from the instructor’s reflection)

The face-to-face students realised that participating in the cooperative activities was difficult in the virtual environment even though it seemed real and face to face. They regarded it as unnatural to discuss and collaborate through screen projection and a microphone.

We were not used to discussing or doing things with others through a screen and a microphone with a voice level louder than normal talking. (Focus Group Interview Extract/S3).

Nevertheless, both groups agreed that a sense of being connected simultaneously with another group enriched their learning experience. One online student further added a general evaluation of the learning experience:

I felt free and liked the feeling very much. The interactive methods [assignments and in-class activities] seemed interesting. I was eager to learn in such a learning atmosphere. (Focus Group Interview Extract/S1)

In contrast to his traditional way of teaching, the instructor seemed to realise transformation of his pedagogy in implementing the blended synchronous learning:

I taught in a traditional face-to-face classroom before this blended synchronous teaching. It was about passing information to the students with different teaching aids such as overhead projectors. However, the blended synchronous teaching seems to transform my teaching towards an interactive approach. (Extract of the tutor’s reflection)

Group cohesion: identification of interaction types

The interactions represent the participants’ group cohesion in the learning process. This cohesion refers to whether the interactions initiated from the same group (either the online or the face-to-face group) or cross group (between the online and face-to-face groups). Based on the 30 hours of video recordings of the observed sessions, the interactions were counted. The online group, the face-to-face group and the instructor interwove different types of interactions, be they one-to-one, one-to-group or group-to-group interactions, and the number of interactions by participant group.

In line with the notion of Moore’s (1989) three types of interaction, two more interaction types emerged from the data. The additional interaction types are (1) “instructor–content” interactions, referring to the interaction which emerged when the instructor delivered the learning materials and conducted skills demonstrations to the students; and (2) “instructor–student” interactions which are those interactions initiated by the instructor for the students. Table 4 shows the types of interaction by the participant group.

The interactions emerged in the content delivery and learning activities. For the content delivery, the instructor presenting the learning materials, demonstrating the engineering skills and questioning-and-answering about the content are regarded as the instructor–content-type interactions, while the students reading the materials, watching the demonstrations and questioning-and-answering about the content are the student–content-type interactions.
interactions. For the learning activities, interactions occurred between the online students and face-to-face students when they participated in individual/group exercises, group discussion and group projects, and when the instructor facilitated and engaged the students in the activities. These interactions were then classified as the student–student, student–instructor and instructor–student types.

The instructor–content, the face-to-face student–content and the online student–content interactions were counted as 142, 34 and 36 times, respectively. These findings show that the number of instructor–content interactions is much higher than that of student–content interactions. In the learning activities, the number of the instructor–student interactions was 129, while the face-to-face student–instructor and the online student–instructor interactions were 55 and 81, respectively. Thus, the instructor–student interaction type had the highest number of interactions, while the online students initiated more interactions with the instructor than the face-to-face students did.

Interaction patterns: directions and frequencies of intra/inter-group interaction

Interactions patterns were identified by interaction direction and interaction frequencies within/between groups. The interaction direction, which refers to the flow of communication initiated by one party (e.g. the online group, the face-to-face group or the instructor) to another in the learning activities, reflects a high/low level of initiation of interactions. There were eight directions of interaction associated with the frequencies of relevant interaction types grounded in the data. As the instructor taught the face-to-face group in the engineering laboratory, the interactions between them were regarded as a form of intra-group pattern, whereas the interactions between the instructor and the online students and between the online and face-to-face students were regarded as an inter-group pattern. Table 5 shows the interaction pattern by interaction direction and frequency of intra/inter-group interaction.

Intra-group interactions also include those which emerged within the individual groups. There were 24 and 222 intra-group interactions within the online and face-to-face groups, respectively. These frequencies indicate that the face-to-face students had a much higher level of intra-group interaction than those of the online group. Regarding the inter-group interactions between the online group and the face-to-face group, few interactions were found. From the online group to the face-to-face group, the number was 16 versus 17 in the reverse direction. For the instructor–student interactions, the instructor initiated slightly more interactions with the online group (frequency = 67) than with the face-to-face group (frequency = 62). Yet, the online group had a higher level of interactions with the instructor than the face-to-face group, with 81 versus 55 recorded. The findings suggest that the online

Table 4. Types of interaction by participant group.

<table>
<thead>
<tr>
<th>Participant group</th>
<th>Interaction type</th>
<th>Number of interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The online students</td>
<td>Student–student</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Student–instructor</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>Student–content</td>
<td>36</td>
</tr>
<tr>
<td>The face-to-face students</td>
<td>Student–student</td>
<td>239</td>
</tr>
<tr>
<td></td>
<td>Student–instructor</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Student–content</td>
<td>34</td>
</tr>
<tr>
<td>The instructor</td>
<td>Instructor–student</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td>Instructor–content</td>
<td>142</td>
</tr>
</tbody>
</table>
students would like to seek help from the instructor, while the face-to-face students were more likely to consult their peers within their group.

As a course requirement, the two groups of students attempted an individual quiz during the fifth session. The quiz results showed that the online and face-to-face groups achieved similar average scores, 58.9 and 65, respectively. The instructor’s final grading of individual students varied regardless of online or face-to-face students.

**Discussion and conclusions**

The above results have answered the three questions listed in the beginning of this paper. They help the students deepen their understanding of the social presence and interaction patterns experienced in the blended synchronous learning. The understanding is discussed in this section. To conclude this paper, a framework of interactions in the blended social presence is provided to inform the relevant parties for further implementation of various blended modes for student learning in higher education.

**Emergent blended social presence experience**

Both groups of students had experiences of juggling the social presence in the learning environment. They agreed that their learning was enriched within this environment. For the group projects, each sub-group was composed of members from the online and face-to-face groups who were conscious of the natural, face-to-face contact first and then the virtual interaction. This is natural that students in videoconferencing are more conscious of natural ways of interaction because it is similar to a direct, face-to-face situation (Yamada, 2009). However, the sub-group members reluctantly adapted to such social presence blended with face-to-face and online interactive situations. Such blended types of interactions which juggle between the two situations have not been reported in previous studies.

The number of all the interaction types constitutes a map of interaction density including the new interaction types, the instructor–content and instructor–student, in addition to

<table>
<thead>
<tr>
<th>Interaction type</th>
<th>Interaction direction</th>
<th>Intra-group interaction</th>
<th>Inter-group interaction</th>
<th>Total no. of interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student–student</td>
<td>Within the online group</td>
<td>24</td>
<td>–</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>From the online group to the face-to-face group</td>
<td>16</td>
<td>–</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Within the face-to-face group</td>
<td>–</td>
<td>222</td>
<td>239</td>
</tr>
<tr>
<td></td>
<td>From the face-to-face group to the online group</td>
<td>–</td>
<td>17</td>
<td>239</td>
</tr>
<tr>
<td>Student–instructor</td>
<td>From the online group to the instructor</td>
<td>–</td>
<td>81</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>From the face-to-face group to the instructor</td>
<td>55</td>
<td>–</td>
<td>136</td>
</tr>
<tr>
<td>Instructor–student</td>
<td>From the instructor to the online group</td>
<td>–</td>
<td>67</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td>From the instructor to the face-to-face group</td>
<td>62</td>
<td>–</td>
<td>129</td>
</tr>
</tbody>
</table>
Moore’s (1989) classification. The frequencies show that not only the online and face-to-face students but also the instructor actively participated in the learning processes. The highest frequency was the student–student type within the face-to-face group, followed by the instructor–content type.

However, there is a significant difference of the overall student–student interaction frequencies between the two groups of students (Table 4). To ensure the count of the interaction frequency, two researchers repeatedly checked the 4-in-1 video recordings of the teaching sessions. The difference was likely a result of the lack of face-to-face facilitation and moderation where the online group of students was located. In contrast, the instructor could provide timely moderation for the face-to-face group in the laboratory. The need for additional facilitation and support is of particular significance to online students who are at remote locations.

The interaction pattern is characterised by the interaction direction and frequency levels of intra/inter-group interaction. In contrast to Park and Bonk’s (2007) study, the pattern reflects the participants’ preferences and density of initiating interactions with other parties. One of the classroom observations noted that “[the online & face-to-face students in the sub-groups] seldom entered into discussion with others beyond their immediate vicinity” (observation notes-8). This suggests an explanation that the intra-group interactions show a higher level of interaction density than those of the inter-group.

The instructor’s directions of initiating interactions with the online and face-to-face students show an even distribution. In contrast to the online students who consulted with the instructor first, the face-to-face students’ interaction direction shows their preference for seeking help from their immediate neighbours within the same group (Table 5). It seems that the online students perceived a closer immediacy with the instructor, while the face-to-face students perceived a closer intimacy with their peers. In line with Paakkari et al’s (2010) suggestion, “The direction of interaction is closely intertwined with the roles of the teachers and the pupils” (p. 914). These interaction flows and between-group interactions illustrate the complexity of the interaction patterns among the online students, face-to-face students and the instructor in the blended learning environment.

Despite the interaction frequencies, interaction directions and intra/inter-group patterns, one cannot assume that the participants will automatically interact among themselves simply because of the learning environment (Kreijns, Kirschner, & Jochems, 2003). The influences of psychological attributes (Woods & Baker, 2004), such as rapport and different levels of intimacy (i.e. the physical dimension) and immediacy (i.e. the psychological dimension), on initiating interactions need to be taken into account.

Towards a framework of interactions in blended synchronous learning

Based on the above results, students and instructors should choose a mode that best suits their learning needs and teaching purposes. What is important is how students and instructors can cultivate quality interactions for enhanced learning and strengthen teaching in that technology-mediated learning environment. Hence, it is crucial to anticipate what kind of social presence for interaction types and patterns will be evolved in a mode of learning and teaching. An instructor, for example, can develop his/her instructional modalities with innovative pedagogy so that students can learn in different ways. Both the instructor and students can enjoy the process. In turn, universities need to formulate teaching and learning policy which facilitates informed choice.

To conclude, this study provides new insights for university management, course development, faculty design and students about interaction experiences in the blended social
presence of the learning environment. These insights can be further incorporated into the design of blended learning courses with a focus on enriching the social presence for quality interactions among online/face-to-face students and instructors. As a consequence, a community of learning can be built in the blended environment. Despite this insight, this study does not aim to generalise its findings due to its small sample size. For further research on enriching blended social presence, a framework of interactions in the blended synchronous learning environment is proposed, as shown in Figure 2.

Figure 2 summarises the insights of this study in the blended synchronous learning environment where the blended social presence is unveiled at the centre of fostering quality interactions for learning and teaching. It suggests how the blended social presence affects the interaction frequency, direction and pattern among different groups.

This framework can inform the complex interaction pattern in further implementation of blended learning by course developers, designers and instructors. Inter- and intra-group interactions should be taken into consideration when designing blended learning activities. For example, online students at remote locations may interact much less than those in face-to-face situations because an instructor teaches the face-to-face students who can perceive a prominent sense of intimacy and immediacy (Woods & Baker, 2004). Online students in groups or on their own need greater learning support to close the gap of intimacy and immediacy with their peers although their learning can be extended in a close to face-to-face synchronous situation. Thus, additional techniques are required to facilitate and moderate the intra-group interactions among the online students and their inter-group interactions with the face-to-face students. The framework is a first step to unlock the potential of pedagogic interactions in blended social presence. The social presence needs further investigation into
quality interactions among students and instructors towards attaining intended learning outcomes during the instructing process.

In summary, the instructional design for the blended synchronous learning needs to take into account online students’ and face-to-face students’ and instructors’ emotional adaptation in the blended environment. Although the overwhelming number of intra-group interactions indicates that students prefer to communicate face to face with their peers in the same location, many students support the use of this learning mode to break the limitations of either online or face-to-face teaching and learning in this study. Furthermore, they regard the effects of blended interactions as a way of enriching their learning. The instructor’s teaching performance was also transformed. Although the idea of blended synchronous learning is not new, the framework of interactions informs not only educators and course designers in Hong Kong but also those in other places with insights into the complex interactions in social presence of blended synchronous learning. Further detailed research into instructors’ assessment of student learning and students’ learning outcomes is needed.

Notes on contributors
Dr. Elson Szeto is an Assistant Professor at Department of Education Policy and Leadership of The Hong Kong Institute of Education. His research interests include pedagogy, ICT for education, educational leadership and teacher education.

Dr. Annie Yan Ni Cheng is an Assistant Professor at Department of Education Policy and Leadership of The Hong Kong Institute of Education. Her research interests include teacher education, educational leadership and education policy.

References
Bassey, M. (1990). On the nature of research in education (part 2). Research Intelligence, 37 (Summer), 39–44.


