



Published online: 6-18-2014

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IJPBL is Published in Open Access Format through the Generous Support of the [Teaching Academy at Purdue University](#), the [School of Education at Indiana University](#), and the [Jeannine Rainbolt College of Education at the University of Oklahoma](#).
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Recommended Citation

Lajoie, S. P. , Hmelo-Silver, C. E. , Wiseman, J. G. , Chan, L. , Lu, J. , Khurana, C. , Cruz-Panesso, I. , Poitras, E. , & Kazemitabar, M. (2014). Using Online Digital Tools and Video to Support International Problem-Based Learning. *Interdisciplinary Journal of Problem-Based Learning*, 8(2).

Available at: <https://doi.org/10.7771/1541-5015.1412>

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Cover Page Footnote

This research is supported by the Social Humanities and Research Council of Canada.

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THE INTERDISCIPLINARY JOURNAL OF PROBLEM-BASED LEARNING

ARTICLE

Using Online Digital Tools and Video to Support International Problem-Based Learning

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The goal of this study is to examine how to facilitate cross-cultural groups in problem-based learning (PBL) using online digital tools and videos. The PBL consisted of two video-based cases used to trigger student-learning issues about giving bad news to HIV-positive patients. Mixed groups of medical students from Canada and Hong Kong worked with facilitators from each country along with an expert facilitator. The study used AdobeConnect to support the international model through synchronous video interaction and shared applications. This study examines strategies and challenges in facilitating PBL across distance and cultures. Discourse was analyzed using both an inductive and deductive approach where the later used the Community of Inquiry coding scheme. The international context provides a way to facilitate multiple perspectives about how to communicate bad news to patients from different cultural backgrounds. In addition, we present the results of an exploratory analysis of pre and post tests using a standardized patient that demonstrate that the students' pattern of communication showed qualitative change. Several conjectures were developed for future research.

Keywords: technology enhanced learning, communities of inquiry, culture, emotion, medical education

A critical review of cultural characteristics and local community needs can lead to improved design of educational experiences (Conway, Little, & McMillan, 2002). Culturally competent communication is an important physician attribute in increasingly multicultural societies (Betancourt, Green, Carrillo, & Ananeh-Firepong, 2003). Cultural competence requires an understanding of affective responses in different contexts. Affective responses, be they appraisals or behavioral or physiological changes, differ across cultures (Mesquita, Frijda, & Scherer, 1997) as does the frequency and type of affect (Blanchard, Roy, Lajoie, & Frasson, 2009). Culture plays a role in how we interpret events and thus culture influences the way medical communication is presented and received (Girgis & Sanson-Fisher, 1998). Some researchers have examined how cultural norms determine what we express as well as how we reveal sympathy or grief (see Ekman & Friesen, 1975; Matsumoto, 1990) as well as how we learn (Volet, 1999). The issue of culture in instructional design and technology is becoming more important and researchers point

out that designers are not exempt from their own cultural bias (Rogers, Graham, & Mayes, 2007). Consequently international E-learning educational efforts may not be as positive as they can be (Massy, 2005).

Medical communication often involves giving bad news to patients and cultural differences may play a role in how much information a physician gives a patient. Extreme cultural differences were found between western and eastern cultures in the amount of information given to cancer patients by physicians (Tse, Chong, & Fok, 2003). Tse et al. (2003) found that western medical communities tend toward full disclosure of the diagnoses whereas eastern cultures may see this as undesirable and may tell family members rather than patients themselves. Using direct statements, such as "you have widespread cancer" or "this cancer is incurable" may be seen as insensitive, rude, or uncaring in some cultures but normative in others (Barclay, Blackhall, & Tulsy, 2007).

Giving bad news to patients, in any culture, is a difficult task and even seasoned physicians struggle in their confidence

about their ability to communicate such news effectively (Sise, Sise, Sack, & Goerhing, 2006). Bad news can be construed as any information that seriously affects an individual's view of his or her future (Buckman, 2005). Cultural differences between physician/student and patient complicate the experience (Barclay et al., 2007). For example, a male physician who comes from a non-diverse largely Christian population may not understand the cultural expectations of a Muslim female patient who wears a Hijab. This physician may try to shake his new patient's hand on the initial medical interview without being aware that such an act would be culturally inappropriate for the patient. Something as simple as a handshake can complicate the physician-patient experience, making the patient anxious. The SPIKES Protocol (Baile et al., 2000) is a North American medical consensus-based algorithm describing the six steps a physician should take in giving a patient bad news. Although widely quoted as effective both for medical practice and teaching there is little published evidence of its effectiveness in North American contexts and no evidence of effectiveness in other cultural contexts. For the purpose of this article we were interested in the role that culture plays in interpreting events and in particular how an inter-cultural group of medical students from western and eastern cultures would interpret and learn about the SPIKES tool for communicating bad news to patients. Our research explores how technology can foster medical student learning and practice at communicating bad news to patients in multicultural societies.

In this context, we designed an online problem-based learning (PBL) environment to bring learners together across cultures (Lien, 2009). PBL supports collaborative knowledge construction and in the process learners develop skills of critical analysis, problem solving, and content knowledge (Hmelo-Silver, 2004). We describe how this approach was used to foster an international community of students and physicians. Students from two different continents worked together synchronously as a PBL team using AdobeConnect video conferencing, chat, and shared whiteboards to support effective online collaboration. This research focuses on the affordances of technology for facilitating cross-cultural engagement in an online PBL.

Technology can create communities of learners across international boundaries (Ertmer et al., 2011; Lai & Law, 2006; Lajoie et al., 2006; Peters & Slotta, 2010) but working in non-western cultures can pose challenges (e.g., Hmelo-Silver, 2012; see Hung & Loyens, 2012). We examine the manner in which online communities evolve by using the Community of Inquiry (COI) framework that describes learning from a social-constructivist approach (Garrison, Anderson & Archer, 2000). The COI describes how online learning is interdependent and can be examined by looking at the degree of

social, teaching and cognitive presence (Arbaugh, Bangert, & Cleveland-Innes, 2010; Garrison, 2011; Garrison et al., 2000). This COI framework guides our discourse analysis of the international PBL case study.

Facilitating PBL across countries is a novel pedagogical method for learning about issues and practices in relation to different cultural contexts. However, “[l]ess is known about the use of PBL in the electronic-based distance-education “virtual classroom,” due to the relative novelty of electronic-based distance education” (Cheaney & Ingebritsen, 2005, para 5). This research will provide insight into practices for facilitating and guiding PBL in culturally and geographically diverse groups. Additionally, this research can highlight the affordances and constraints of the virtual classrooms that use video conferencing tools to support collaborative engagement across cultures. Facilitating PBL is a demanding practice that requires a repertoire of strategies to guide the learning process (Hmelo-Silver & Barrows, 2006, 2008). This practice is even more difficult when introducing new technology, working with students who have just met, and working with new content problems that have high face validity and high emotional content for the students in this study. Despite such challenges technology can afford additional support mechanisms for real-time coaching that are not available when PBL is conducted in a face-to-face setting. Our research examines how medical students' knowledge and communication skills are influenced by this online PBL.

The Instructional Model

The instructional framework is a PBL approach where patient cases serve as the instructional context for the international community of learners. Technology is used to support this community at different stages of the interaction. Our approach included opportunities for both individual and group learning. Individuals practiced giving bad news to online standardized patients (actors who played a scripted part as a patient) before and after a PBL intervention. Standardized Patients (SPs) are people trained to accurately and consistently recreate the parameters set-up in a scenario of an actual patient at a specific point in time. The SPs portray the patient as accurately as possible, following a scripted scenario (as defined by the Arnold and Blema Steinberg Medical Simulations Centre <http://www.mcgill.ca/medsimcentre/resources/standardized-patients>). The SP case (developed by a physician/coauthor) required the medical student to communicate the test results to the SP, confirming Hodgkin's Lymphoma, a type of cancer. The SP was instructed to show emotional reactions when the medical student gave the unfavorable diagnosis.

The PBL consisted of two online video-based cases used to trigger student-learning issues about giving bad news to

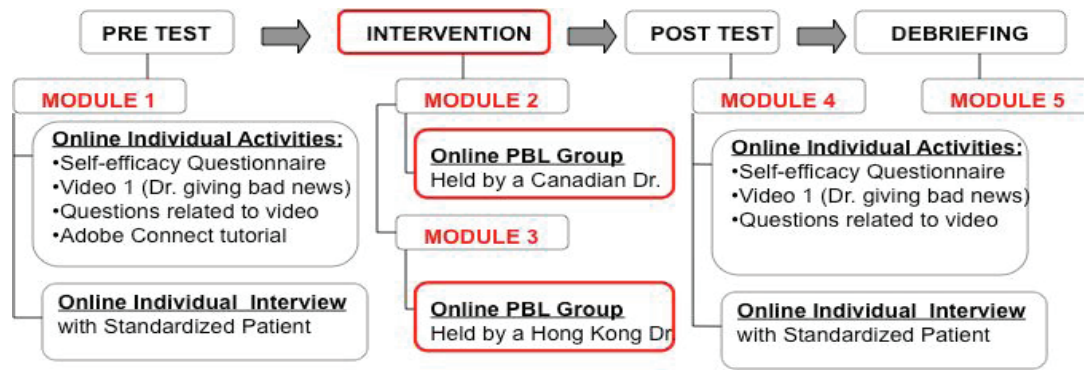


Figure 1. Instructional modules.

HIV patients. The PBL consisted of mixed groups of medical students from Canada and Hong Kong working in turn with medical facilitators from each country. Web conferencing software supported the international model through synchronous video interaction and shared applications.

To explore the cross-cultural PBL's effects on student learning, we ask three main research questions:

1. How does the technology-rich cross-cultural setting affect the PBL tutorial process?
2. To what extent can technology be used to create a PBL community of inquiry using video cases?
3. Can this technology-rich learning environment affect student learning?

We address these questions through a range of qualitative and quantitative methods.

Methods

Participants

There were seven participants in this study: four medical students, two from Canada (C1 and C2) and two from Hong Kong (HK1 and HK2), an experienced physician educator from each country (CPE, HKPE), and an expert in PBL facilitation (EF) from the USA. The students were volunteers, three males and one female student, average age 25 years old, with approximately 2.5 years of medical school. The physician educators were male and the expert PBL facilitator female. Data were collected on individuals as well as the PBL groups.

Materials and Procedure

The instructional modules constructed for this study are described followed by a description of the technology platform. The instructional environment consisted of five online modules. Data were collected over five consecutive days (see Figure 1). The pre- and post-tests were administered online individually before and after the PBL intervention respectively. The structure of the pre and post-test phases were identical (Modules 1 and 4), and students received training on how to

use technology in Module 1. Students accessed instructions and materials via a research blog in the following order: (a) completed the motivational questionnaire, (b) watched video of a physician breaking bad news to a patient and completed a questionnaire about their perceptions about the strengths and weaknesses of the physician's strategies, (c) practiced giving bad news to an SP, and finally (d) reflected on their practice by reviewing their own practice sessions. The PBL sessions (modules 2 and 3) are the focus of this paper along with individual pre and post performance measures, and hence we do not detail the questionnaire data. Module 5 consisted of a focus group discussion between the two medical instructors and the four medical students.

The Technology

AdobeConnect 9 video conferencing software was selected for its cross-platform capabilities, simple interface, easy navigation, features, stability, and ease of recording meeting actions. Adobe Connect supported collaborative engagement through audio, video, and text (see Figure 2) and data collection.

Design of PBL Sessions

The underlying curriculum model for delivering bad news is taken from the medical community's SPIKES protocol shown in Table 1 (Buckman, 2005). SPIKES is an algorithm that describes a method for communicating bad news based on establishing the appropriate *setting*, assessing the patient's *perception* of the problem, *invitation* for patient to ask questions,

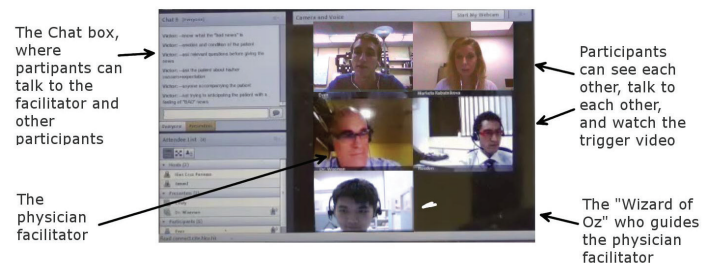


Figure 2. Adobe Connect session screenshot.

knowledge provided to patient, *empathy* for patient, *summary/strategies* for follow-up when communicating bad news. The PBL context involved two video-based medical scenarios, one from North America and the other from Asia that served to trigger discussions in the two online PBL sessions that focused on educating medical students about communicating bad news. Videos provide both contexts and communication spaces that could support collaborative engagement, which we define as students taking responsibility for generating, supporting, and building understanding in small group activities. Previous research suggests that videos have the potential to foster the development of a COI (Archibald, 2010).

The PBL group was facilitated for one session by a tutor from North American (Figure 2) and for a second separate session by a tutor from Asia, both of whom had extensive prior training and experience in facilitating PBL-type groups. The physician-educator who represented the country from which the video case was drawn facilitated each session. An expert PBL facilitator (EF) guided these physician-educators during these activities so that both PBL groups were run in a similar manner by using the integrated chat windows supported in the software. This chat window was only visible by the physician educators. EF synchronously supported the two instructors during the PBL sessions through a private chat window. Students worked in groups synchronously, reviewed two video cases on communicating bad news, one from a Canadian context and one from a Hong Kong context. Both PBL sessions were conducted in English. The video of a Canadian physi-

cian and patient was in English; the video from Hong Kong was in Cantonese with English subtitles.

PBL prompts were designed in collaboration with an expert in PBL and were used similarly by both instructors. The video case vignettes served as the context to trigger specific learning objectives in the PBL sessions, where medical instructors facilitated the session to help students to: (1) identify difficulties in communicating bad news to a patient with strategies for addressing these issues; (2) provide an approach to giving bad news; (3) use the SPIKES model to analyze a video of a bad news communication session; and (4) discuss and reflect on how the use of the SPIKES model may have to be changed in response to context, culture, and language barriers.

Individual Pre-Post Test Interviews with Standardized Patients

Each participant engaged in a pre-post test interview with the standardized patient where they practiced giving the patient the news that they had lymphoma, a cancer of the lymph nodes that forms part of the immune system (Parham, 2005). The student practice activity occurred before and after the PBL intervention.

Research Design and Analysis

An exploratory mixed methods approach was conducted. For research questions 1 and 2 we use a single case study design that examines a PBL group over two days. As Yin (2009) reports a single case study can be used as a revelatory case whereby the problems studied may be common across set-

Table 1. SPIKES coding protocol.

Code	Observable Behavior	Example
Setting	The physician plans for telling the patient the bad news by securing a space with privacy, involving the appropriate family members, and preparing for difficult questions and dealing with patient's emotional reactions	"If you want to bring a family member in, like your husband . . ."
Perception	The physician evaluates patient's perception about medical situation. For example, illness denial, unrealistic expectations of treatment, psychosomatic causes . . .	"Are you familiar with this virus? What do you know about it?"
Invitation	The physician assesses the patient's desire for information	"Would you like me to give you all the information about the test results?"
Knowledge	The physician gives comprehensive and appropriate information based on individual's patient needs to neither restrict nor overload	"There are two important things to remember. First . . . Second . . ."
Empathy	The physician acknowledges and respects the patient's emotional reaction	"I know this must be difficult . . . don't give up hope"
Strategy/ Summary	The physician summarizes and strategizes about what will happen next	"Do you have any questions?" "There are several things we can try here . . . First . . . Second."

tings but the research site provides for an in-depth study that may not have been possible before. In this research, we use the case to describe an online international PBL in depth. The case is unique since it uses technology to support an international PBL where the mainstream culture is a medical group of students and medical facilitators. However, the international context brings together the Hong Kong and North American culture to review culturally diverse medical cases on giving bad news.

Similar procedures and analyses were used to describe and interpret the discourse of the PBL group on both days. First, an inductive analysis of the PBL sessions was performed to address our first research question, which examines how the technology-rich cross-cultural setting affects the PBL tutorial process. The inductive approach was used to identify emergent patterns in the data that pointed to cultural differences in communicating bad news to patients. The second research question used a deductive analysis to examine the extent to which a COI evolved in this online PBL. The data were coded using the COI framework and then quantified to look for patterns in the evolution of the group over the two days.

Data sources for qualitative analysis included transcripts of PBL sessions between the students and the instructor, chat logs between students and instructor and between instructor and EF, and focus group transcripts between instructors and students. All data were uploaded into a qualitative data analysis program. The data were analyzed inductively and deductively for significant themes and patterns. In the inductive analysis, we looked for themes related to culture, facilitation, and affordances and constraints of the technology. In the deductive analysis the COI framework guided the analysis of interactions between the facilitators and medical students where utterances were coded based on teaching, social, and cognitive presence. The unit of analysis was a conversational turn and not more than three codes were given to a single turn. Few turns were long enough to have more than three codes; if so, they were parsed into two turns. The descriptive information on number of turns and frequencies of each indicator under all three presences is presented through this analysis. Two researchers worked together on the codes to achieve consensus on coding in this exploratory analysis (because this was an exploratory analysis, no inter-rater reliability was computed).

For research question 3 the individual was the unit of analysis rather than the group performance. A mixed methods approach was used. We analysed each participant's communication with SPs before and after the PBL sessions. The discourse was coded using the SPIKES model and changes in frequency data from pre to post were examined to determine which elements of the SPIKES model changed from pre to post test assessment.

Results

How did the Technology-Rich Cross Cultural Setting Affect the PBL Tutorial Process?

The purpose of this analysis was to examine whether the technology enhanced learning environment effectively supports PBL. Our premise was that technology-supported PBLs would be similar to face-to-face PBLs but would perhaps add new affordances. We examined facilitation and knowledge building across cultures and found that students were highly engaged in the PBL activities. On PBL day 1, there were 231 turns of talk and 432 turns on day 2. We review each PBL session below and describe the community of learners.

Technology Adaptation and Limitations

At the beginning of Day 1, the first 47 speech turns pertained to getting acquainted with the technology and its technical limitations. For example, there were some issues with getting the whiteboard to work properly and the CPE and HK1 worked together to figure out that they could use the chat tool in place of the whiteboard. The facilitator asked students to volunteer to take the role of the "student leader" or "scribe" and stated that these roles would be rotated among students from both countries over the two days. These are standard roles used in small group learning situations and follows Barrows and Tamblyn's (1986) PBL model. Participants discussed being aware of time delays in using the system, where they would need to wait to hear what someone was saying. After these technology issues were discussed in Day 1 participants moved on to a relatively seamless discussion that was supported by the technology. By Day 2 only seven segments pertained to technology use indicating an accommodation to the online platform as the discourse was predominately on-task pertaining to the PBL goals.

Cultural Awareness and Facilitation on Day 1

From the outset, students sometimes raised issues about practices in the other country as in this example:

HK1: I am just wondering, the video I guess is taking [place] in Canada, what are the procedures like about testing like for HIV. Is . . . throughout the video, my thoughts . . . 'cause in Hong Kong what happens is we have to get consents from the patient when we test for HIV viruses. And so in that sense um so, so that the patient would already given consent for HIV to be tested, that means they would have some sort of expectation already, so I am not sure ah is this the case in Canada?

This comment suggested that HK1 was trying to understand and bridge the practices in the two different cultural contexts.

The CPE helped keep the group on track in terms of the PBL process and clarifications. An affordance of the technology was that the EF could (and did) provide occasional suggestions to the CPE in the chat window that generally focused on PBL process and group dynamics. As in this next example when the EF suggested “How will you organize facts, ideas, learning issues. Might you want to use a shared word document?” and “You might want to get HK1 talking as well as writing so as to keep the scribe involved.” CPE judged the second of these suggestions to be more important and a few turns later said “I know, HK2, why don’t we look at what HK1 has written, HK1 could you, um . . . Could you show us what you’ve written, go through what you’ve already embedded, and tell us what you might get out of that?” EF reminded CPE that students were confusing facts from the case with their ideas about how to give bad news and this time CPE took up this suggestion and asked the students about that. The use of technology in this context served to facilitate the tutorial process. The medical tutors were scaffolding the group discussion by listening to the discussion, and monitoring whether every student’s input was getting answered, and whether or not the goals of the learning objectives were being met. The expert PBL facilitator was akin to a Wizard of Oz, who lived in the background monitoring the tutorial process and scaffolded the facilitator to make sure that he was aware of the next best step in the facilitation process. The EF facilitated the CPE eight times. The EF helped CPE by monitoring and evaluating the quality of the tutorial process and PBL outcomes.

Cultural Awareness and Facilitation on Day 2

The HKPE facilitated the students and EF monitored the tutorial process. Again, all students were involved in the discussion and there was substantial cross talk among students from the two countries. There were 438 turns in this session, an increase in dialogue from day 1. As on the first day, there were discussions of cultural differences, but these were easier to facilitate because the students each had points of reference from both cultural contexts (after having watched both the Canadian and Hong Kong videos):

HKPE: . . . What did you think was the perception of the patient in the video, um do you think the patient is very shock by the way that the doctor deliver that news to him? Or do you think that was completely normal in his mind. . . . Let me put it that way, if that doctor um was transplant into say to Canada, is that doctor gave same bad news to a patient to a Canadian patient in the same manner. Do you think the patient would react differently?

C2: Very likely I’ll say.

HKPE: um well obviously, I don’t think we can say ok that this is a typical patient ah . . . what a patient would typically react in Hong Kong but . . . supposed we are just making an assumption that this is a typical patient ah, how, how they would react to that kind of bad news to Hong Kong, and you was thinking that um are in a different country the patient would react in a different way. Right?

C2: Very likely but . . . I would just say that, there ah yes in Canada probably because of the history with . . . people coming from a lot of different places. We can end up with a lot of different variability in terms of the type of responses you might get from the patient because of their background and so it’ll be a little bit harder to make to say what a typical response might be.

HKPE: Well . . . same in Hong Kong I suppose. . . . Basically you are saying the, ah, the Hong Kong patient we saw on the video was reacting in a very calm way. . . . What do you think HK2 . . . and HK1 as well seems you were more familiar with the situation, the cultural situation, context in Hong Kong. Would you say that is probably way, a lot of people in Hong Kong, Asian cultural would react in that kind of situation?

HK2: . . . It is quite typical, because as you know in Hong Kong the consultation time would be less than 10 minutes for each patient . . . most case it would not expecting any sort of patient physician communication.

Up until this point in time there is a question and discussion of what might be typical in each culture, with HKPE noting that the mode of interaction in the Hong Kong case may be due to the limited interaction time. C1 goes on to discuss how she thinks SPIKES might help but when HKPE asks HK1 what he thinks, presumably about C1’s comment about SPIKES, he jumps back into the discussion of culture as they continue:

C1: I think for me, it is very useful to have um an acronym like “SPIKE” . . . because . . . I . . . think that it allows us to focus more on the patient as opposed to . . . it actually allow to actually to spend more time on the patient in reading the expression which is something important you know, so in a true sense it helps to focus more on the patient . . . so I find it very useful.

HKPE: What about HK1? . . . You have experienced Hong Kong culture versus Australian culture.

HK1: I think I could be the bridge between . . . Canada and Hong Kong for this, ‘cause . . . I have seen both versions, so . . . I agree with HK2 that I mean in the consultation video that we’ve just watched would be very typical of a Hong Kong hospital or even worse, I mean some doctor just go in and say Hey you are HIV positive, so I mean the reaction of the patient I think it’s

... acceptable and predictable from the general hospital environment we have ... and in the Chinese culture we also tended to be ... less expressive in facial emotions. ... It probably won't expect us be jumping around and expressing ... happiness or sadness anyways, so whatever that the patient had seen in that video was quite acceptable in the Chinese culture, but ... my experiences in Australian ... hospital is ... You can say that the issues that patients were worrying about is common across all races, there has been stereotypes and stuff, but it is just like ... for those in the western countries you would expect to see a bit more ... maybe in as a depression as a surprise or shock ...

HKPE: ... I think um perhaps it is kinda difficult ... to have a discussion on ... western culture or Asian culture because these are all ... changing dynamic and you know, but there are all different cultures, ... ways of doing things, react to things, thinking about things ... in different countries. I mean it is even different in one family then in a different family, let alone different countries with different history, different society you know, ... what I am trying to think about is ... the patient and the doctor in today's video seems to be ... not very emotional, both the patient and the doctor are right, just now we are thinking about the patient is very calm and you know, 10 to 15 minutes ago we were also saying the doctor was very ... flat, in terms of tone and facial expression, so they are both ... unemotional, you know, in that kind of emotional situation, so I was just trying to understand that um in terms of any cultural differences, but I don't know.

HK1: ... You need a different scale of sensitivity when you are um assessing for emotion of patient of from different races. I mean for the Chinese video that we've seen today ... I personally applied a higher level of sensitivity. I was observing for every single facial expression. ... Here as for the video yesterday, was quite easy. ... I don't have to look actively for physical changes, 'cause I mean from the whole posture of the patient I was able to walk away with enough information so I mean ... that's just me adding back, um, sensitivity definitely as to adjust when you are facing different culture, background.

In this extended discussion, the group spent considerable time discussing the differences across cultures. The students brought in their own experiences from their own culture, and made comparisons with the video that they saw on Day 1. C1 also related the discussion to the SPIKES protocol that the students had been given as one way to deliver bad news. Moreover, students also realized that it was hard to generalize the cultural differences because personality comes into

play. Additionally, the students felt that they would need more experiences to make any conclusions about whether there were cultural norms.

Similar to day one, EF provided advice on the PBL process and group dynamics, and supported HKPE 10 times. EF provided some suggestions on how to organize the chat screen being used as a whiteboard:

EF: Perhaps ask students to go over the whiteboard and remind them that they need to get ideas down. Maybe get suggestions for how to organize ideas—what they learned from SPIKES framework ...

Shortly after this intervention HKPE followed up with the students.

HKPE: Looking at the ... white board, so we have um quite a number of facts directly from the video. Okay, can we also start to think about ... the ideas that we have about the uh performance of the doctor in the video how he should or should not have, in our opinion ... communicating the bad news to the patient. Can we ... also you know jot down some of these ... great ideas, um start organizing our ... thoughts about what's gone really well in the video or not to mention too many uh, and what are the improvements we would suggest, or ... you would do if you were the doctor ... ?

We can see that small prompts from the EF led to powerful changes in the tutorial process. Once again, the technology afforded the private chat between the EF and facilitators in both countries helping the overall tutorial process and experience. Another data gathering activity that provided information on culture was the focus group, described in the next section.

The Focus Group

The focus group following the PBL sessions involved the medical students and the two instructors. The issue of culture remained salient. CPE noted that despite the cultural differences that divided them, there was also a common medical culture, which they shared:

What really surprised me about these sessions this week, I was thinking was that everybody comes to any session with their own culture. HK1 and HK2 with your own cultures, having been brought up in Australia and/or HK. C2 and C1 having lived at least a good part of their lives in Montreal. ... So each of us bring our own culture to our medical work. But there is another culture that we all have and which I thought was very well demonstrated during this entire week: Medical culture ... that physicians share that seems to me to be universal. What I was surprised was the smoothness with which

C1, C2, HK1, HK2 just went into discussing the patient. . . . And the ease with which myself and HKPE. . . . Here I would argue, that we were using our culture as physicians and so what was really interesting C1, HK2, C2, and HK1 you come from completely different cultural backgrounds and you have rather different backgrounds in terms of medical education and each of you are not even perfectly matched in terms of where you are in respective medical schools. Yet, when we got together around these patients there was an understanding that we had of what was important and what wasn't. I found that actually surprising and I thought we'd had much more difficulty but I am surprised at the ease with which we were able to do this.

Both physician educators noted that despite issues with the technology, it allowed them to bring this group together. During post problem reflection, HK1 noted that the technology-forced delay actually required students to listen to what each other said and not interrupt each other. After HKPE asked HK1 about why they were less polite in their normal HK groups, HK1 responded:

Well, well judging from everybody is waiting for others to speak . . . I think that's a good, I think that's a good, rarity, you don't get that a lot in PBL groups, some are really aggressive from what I've seen, but today there is a lot of mutual respect and we also understood that there is, ah, technical delays so. I mean there was heaps of silence, because we have nothing to say, we just waiting for someone to speak up, so I mean, um, we are definitely polite in that sense.

A few turns later, C2 jumped in, concurring with HK1's assessment, partly also due to the time delay:

As . . . we are giving some other people the, ah, the opportunity to speak we're . . . waiting I guess, there would be a longer time delay and, ah, sometimes we end up stepping on each other's toes a bit. But ah, we don't, at least we don't end up having two people continuing on, ah, you know, disrespect of each other.

In the focus group, the students agreed that although this was hard, it was also unique and rewarding. HK1's last focus group comment summed things up well:

I think the whole international theme . . . PBL really reminded me of being in Australia. Where you get a group of Caucasian people sitting with Asian people in the rooms chatting about the patients and trying to critique on how things can be improved. What I am trying get here is that different colors, different cultures, different language experience, or even knowledge experi-

ence I think it really just really shows that we are living in a global village where we could acknowledge common themes, acknowledge common facts, and ideas that are very much comparable.

This last comment made it clear that the students themselves were cognizant of the opportunities and importance of interacting across distances. In particular, sharing multiple perspectives on the same content can expand understanding of better communication practices.

Can this Technology-Rich Learning Environment Support a Community of Inquiry?

The COI framework was created to document inquiry-based learning in online environments (Garrison et al., 2000; Stein et al., 2007). This framework guided our deductive analysis of the PBL sessions. The three categories teaching, social and cognitive presence, describe the learning experience in the online environment. Social presence defines the ability of the students to present themselves in an online environment as "real people" (Rourke, Anderson, Garrison, & Archer, 1999). Cognitive presence is associated with critical thinking and is described by the phases of inquiry, namely a triggering event, exploration, integration, and resolution. Teaching presence describes the role of an online facilitator. For example, establishing the curriculum, rules of engagement, providing timely information and feedback, and monitoring student activities. The long-term goal of teaching presence is to enhance social and cognitive presence, with the intent of promoting student learning (Lowenthal & Parscal, 2008).

In the first PBL session, a total of 234 turns were coded (see Table 2) with teaching presence (130) being highest, followed by social (59) and cognitive presence (45) respectively. The most frequent discourse pertained to direct instruction (63), group cohesion (37), and exploration (34). Although direct instruction and instructional design accounted for a lot of teacher presence, students did help facilitate the discourse as the session progressed. Social cohesion was strong whereby the teacher helped form group cohesion and the majority of the students' codes were related to open communication. The majority of the cognitive presence turns in day one were dedicated to exploration of ideas (34) and very little to the resolution phase (2). The resolution phase is defined as the highest level of cognitive presence where students test the applicability of their ideas. The majority of the comments were exploratory in nature; hence, the progression to resolution phase was limited. Low level higher-order learning results are replicated in earlier research (Gunawardena & Zittle, 1997). There are a few reasons that might explain low levels of resolution such as a shortage of time, nature of the problem being discussed, and the instructional design of the PBL session. The content of the

Table 2. Frequency of codes in PBL sessions.

Category	Codes	Day 1	Day 2
Teaching Presence	Facilitating Discourse	33	31
	Direct Instructions	63	80
	Instructional Design	34	10
Total		130	121
Social Presence	Open Communication	13	17
	Personal Projection	9	5
	Group Cohesion	37	56
Total		59	78
Cognitive Presence	Triggering Event	1	2
	Exploration	34	43
	Integration	8	19
	Resolution	2	3
Total		45	67
Grand Total		234	266

PBL, communicating bad news, is a particularly difficult task that takes time to master. However, the data do show that the technology supports the PBL discussions.

The second session had a total of 266 coded messages, with the same pattern of frequency with teacher presence (121) being highest, followed by social (78) and cognitive presence (67) respectively. However, there was a slight decrease in teaching presence from Day 1 and an increase in the other two categories. By Day 2 students were familiar with the tasks, process, and technology as indicated by the reduced count of instructional design codes. The COI framework operationalizes instructional design as activities and messages associated with setting targets, timelines, and designing methods. This session had only 10 instructional design codes as compared to 34 in the previous one. Additionally, due to the nature of instructional design activities, it is largely the facilitator's responsibility to provide for instructional design, however, in PBL we expect students to take responsibility for learning. Only 91 messages in this session were from the facilitator as compared to 125 from the previous session, indicating that students were taking greater responsibility for the discourse. Once again, direct instruction (80), group cohesion (56), and exploration (43) were most frequent. There was an increase in integration codes, which may suggest that the community of learners was beginning to increase their understanding the materials over time.

Understanding the Tutorial Process within the COI

Good facilitation of PBL is a requirement for success of this process (Kamin, O'Sullivan, Deterding, Younger, & Wade,

2006). Our findings suggest that both sessions were well facilitated, though there was more direct instruction than anticipated. We define "well facilitated" based on the quality and quantity of discourse where all students were involved. Facilitation may have occurred in part because of the need to orient the students in this short time span, which may account for the higher presence of direct instruction. However, there was a great deal of social presence indicated by open communication by students. Such open communication or risk free expression occurs in a climate of trust and is an indicator of stronger group cohesion (Garrison, 2011). A decline in personal projection may be due to the cultural difference and different facilitating styles of the two physician educators.

To conclude, both physician-educators were able to develop a high level of social presence in a very short time. This may be attributed to physician's expert facilitation, the assistance of the EF, and the synchronous environment. The synchronous environment gave students an opportunity to hear and see each other live, get immediate feedback, and finish the tasks within a short time. The technology supported a meta-layer of communication between the facilitator and the EF that helped facilitate the overall tutorial process.

Student Learning as a Consequence of PBL

The COI model above provides some indication of the social and cognitive elements of the discourse during the PBL. Although teaching presence was higher than social or cognitive presence we still saw evidence that the PBL supported cognitive exploration and integration. We were interested in how students incorporated the content of the PBL in practice. For this reason, we examined individual student performance before (pre) and after (post) the PBL intervention to see whether they changed strategies for communicating bad news to standardized patients. These data are only indicators of how one might look at performance given that this is a case study with a small number of students. The work presented here is a pilot study and generalizations cannot be made. Nonetheless we coded the content of the discourse between students and SPs using the SPIKES protocol described in Table 1. The coding was done with the Canadian physician and the Canadian coauthors that met to construct and verify the codes prior to analysis of the corpus of data. The content analysis of student performance reflects both cognitive (knowledge of the disease) and affective dimensions (empathy). Our goal in this analysis was to examine changes in how individuals communicated bad news to patients before and after the PBL. Given the PBL addressed the SPIKES model (establishing the appropriate *setting* for the medical interview, assessing the patient's *perception* of the medical problem, *invitation* for patient to ask questions, *knowledge* provided to patient, *empathy* for patient, *summary/strategies*

for follow-up) we examined changes on each element of the SPIKES model from pre to post.

Differences were found in the total frequencies of skill usage of the SPIKES model $\chi^2(7, N = 550) = 258.44, p < .05$. The standardized residuals suggest that medical students spent most of the interview providing the patient with knowledge ($f = 150$) and showing empathy ($f = 137$) (see Table 3). It is noteworthy that this pattern is similar to the one that was observed in an experienced clinician while performing the same task (Lajoie et al., 2011). Although there were no changes in overall skill use from pre to post, $\chi^2(7, N = 550) = 6.35, p > .05$, the SPIKES skills were used differently across the different stages of delivering bad news. At the earliest stage of the interview, students first established the setting by spending time to interact with the patient ($f_{\text{pretest}} = 30, f_{\text{posttest}} = 26$). When gathering information before delivering the bad news, students most often assessed the patient's perceptions of his or her own condition ($f_{\text{pretest}} = 21, f_{\text{posttest}} = 35$). Students then explained the disease by providing knowledge ($f_{\text{pretest}} = 55, f_{\text{posttest}} = 87$) and showing empathy ($f_{\text{pretest}} = 7, f_{\text{posttest}} = 26$). However, students showed even more instances of empathy when closing the session ($f_{\text{pretest}} = 43, f_{\text{posttest}} = 25$), while also engaging in summaries ($f_{\text{pretest}} = 5, f_{\text{posttest}} = 8$) and strategies ($f_{\text{pretest}} = 17, f_{\text{posttest}} = 18$). It is likely that the patient would not be not fully aware of the repercussions of the diagnosis until the end of the interview and it would be at this time when empathy is most needed in order to engage the patient in considering treatments.

We concentrate the rest of our analysis on looking at pre- to post-test use of SPIKES skills, in particular, frequencies of cognition (knowledge) and affect (empathy) across different students. Students provided knowledge while delivering bad news by giving comprehensive and appropriate information based on the patient's needs. The results indicate that there is a significant difference across pre- to post-tests in how different students used this particular skill, $\chi^2(3, N = 150) = 18.73, p < .05$. Based on the examination of the standardized residuals for each case, there were individual differences from pre to post-test. For example, C2 provided knowledge to the patient more often than HK4 from pre to post-test. In regards to students who showed empathy, this particular skill involved efforts to acknowledge and respect the patient's emotional reactions. The results show significant differences in the use of empathy from pre- to post-test across the different students, $\chi^2(3, N = 137) = 15.58, p < .05$. The examination of the standardized residuals suggests that C2 and HK3 experienced an increase in the use of empathy while communicating bad news from pre to post-test. HK4 showed empathy less often from pre to post-test; however, that same participant used this skill more often overall than any of the other participants.

In an effort to make relative comparisons between participants who had different frequencies of utterances, we converted the frequencies to proportion of utterances pre and post for knowledge and empathy (see figure 3 and 4). Proportions were calculated by dividing the frequencies of

Table 3. Pre- and post-test frequencies in SPIKES skills used across stages in delivering bad news.

Stages	SPIKES Skills								Sum
	Setting	Perception	Invitation	Knowledge	Empathy	Summary	Strategies	No Code	
Pre-Test									
Initiating	30	0	1	1	1	0	0	0	33
Gathering	3	21	3	2	3	1	1	0	34
Explanation	3	0	1	55	7	1	3	3	73
Closing	1	2	2	2	43	5	17	2	74
No Code	0	0	0	0	16	0	0	17	33
Sum	37	23	7	60	70	7	21	22	247
Post-Test									
Initiating	26	0	0	0	0	0	0	0	26
Gathering	9	35	4	2	2	0	0	0	52
Explanation	1	0	1	87	26	4	9	0	128
Closing	0	0	1	1	25	8	18	2	55
No Code	1	2	0	0	14	0	0	25	42
Sum	37	37	6	90	67	12	27	27	303
Total	74	60	13	150	137	19	48	49	550

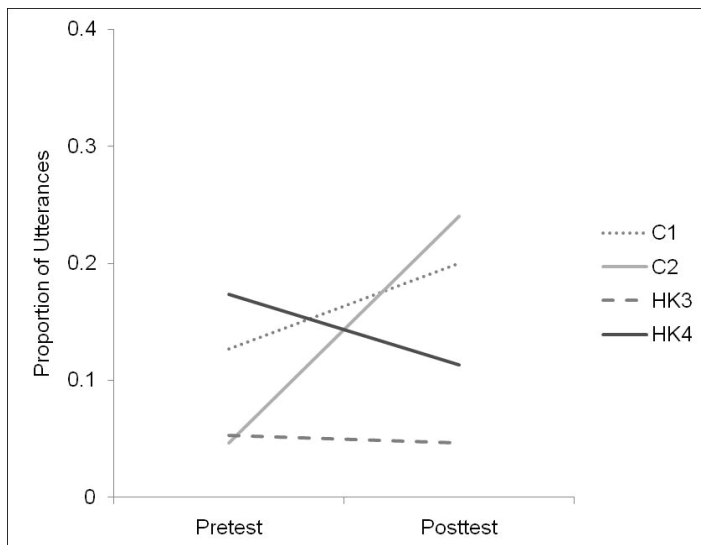


Figure 3. Knowledge use.

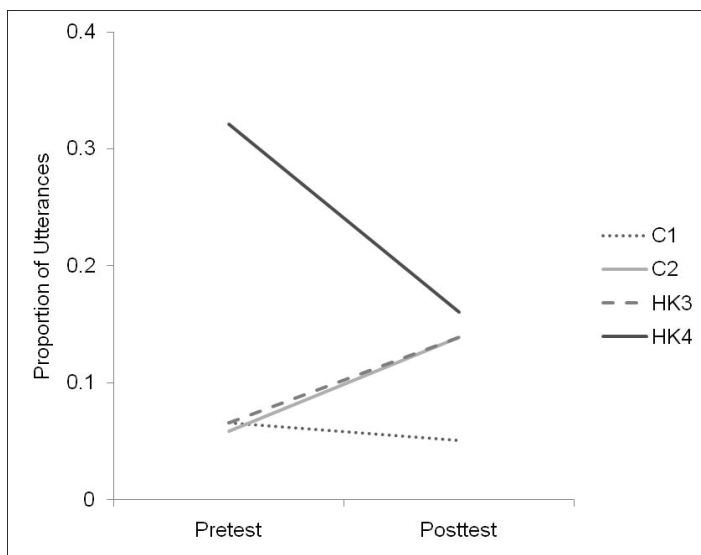


Figure 4. Empathy use.

strategy used by a student by the total amount of strategies used by students for both before and after the intervention. In doing so, we compare knowledge and empathy use across times (i.e., before and after intervention) and participants.

The data indicate that each participant had a specific trajectory for how they used the SPIKES model. The proportion of discourse attributed to knowledge and empathy varied for each individual, as did their paths for using the SPIKES model from pre to post. These differing trajectories are not unexpected given the variation in students' prior knowledge and/or practice in giving bad news to patients. Prior knowledge is an important construct when interpreting learning gains in all domains (Shapiro, 2004). The following excerpts demonstrate changes from pre to post-test in knowledge by the Canadian student and changes in empathy by the Hong Kong student.

Canadian Participant

Note at pretest that the student provided fairly straightforward unelaborated knowledge with little indication that there are other aspects of medical communication that are applied:

C1: We saw some uh cells a typical presentation of Hodgkin's Lymphoma, uh so that's [translating to Farsi] a disease that affects the blood.

Translator: [translating from Farsi]: Can you explain more?

C1: Yeah. So the Hodgkin's Lymphoma its, uh, it's a cancer, it's a type of tumour that is in the blood.

The post-test example shows a qualitative change in how the participant provided information to the patient:

C1: Yes, it is a cancer, it is a cancer, what I'm referring to and uh, technically it means that there is an abnormal growth that cells are growing uncontrollably; it's just that the cells have changed their properties and now they're there; because they're changing the body is not able to control them anymore and they're expanding, they're growing, and that's why there is a bump on her neck.

Here the participant provided more elaborated knowledge with an attempt to explain mechanisms compared with the pre-test. This participant also connected the mechanisms to the patient's observable signs (the bump on the neck).

Hong Kong Participant

The next example, from one of the Hong Kong participants illustrates change in use of empathy from pre to post test. The first example is from the pre-test.

Translator: [Translating from Farsi] She said she's confused, how can this happen?

HK 1: Alright, is there a tissue box over on your side which you can give to her?

Translator: Ok, I just passed her a tissue.

HK1: Thank you, please tell Miss Alavi that she doesn't need to be worried, that everything is fine, we have it under control, we understand what she's going through, it might be confusing, it is definitely scary, but we will treat her and she will get better.

In this example, the student paid some attention to the patient's emotional state. At this point however, the student is clearly steering the empathy through the translator rather than directly towards the patient. Again, there was a qualitative difference at post-test.

Translator: [Translating from Farsi] I can't believe it, I can't . . .

HK 1: I wish the news were better. And it is ok to feel what you are feeling now. Is there a tissue box around the room that you can give to Miss Alavi?

At post-test, the student's empathy is geared directly towards the patient rather than to the translator, which was the case in the pre-test. In post-test the focus of communication was shifted towards the patient, as illustrated by the shift from "tell the patient she does not need to worry" to "please don't worry." This is another indicator of empathizing where the patient is being acknowledged directly rather than being treated as a third person.

Discussion

As a proof of concept, this exploratory pilot study provides insights with regard to the use of technology to promote student engagement from different cultures in a PBL experience. Given the exploratory nature of this work and small sample size generalizations cannot be made but recommendations based on our findings can reveal important considerations for follow-up work in this area. We will discuss the affordances and limitations of the technology, followed by a discussion of how the PBL supported a cultural experience and helped create a community of inquiry. We also describe whether what was learned during the PBL could possibly transfer to individual performance.

The Technology

The greatest affordance of the technology is that it provided a synchronous environment for engaging in an international exchange of perspectives on how to provide bad news to patients without having to travel across the globe. The technology also supported individual practice for students learning to give bad news to standardized patients remotely. Technology use for physician-patient interviews may become more routine for patients that do not have services in their locale, and for specialists that are asked to consult remotely about specific patient cases. This research may help us understand the future possibilities in these areas.

There are similarities between technology-supported PBL and face-to-face PBL but there are also differences. The technology provided tools for synchronous face-to-face communication between instructors and students. The discourse of the PBL was analyzed and revealed that the discussions were as rich as they would be in a face-to-face context. However, the technology slowed down the discourse interactions slightly since hand-raising tools in the Adobe platform had to be recognized to give the speaker a turn so that people could be acknowledged and listened to. Furthermore, the time delay in speaking and being heard made participants

more respectful of turn taking. These slight delays could account for smoother interactions in which people did not talk over one another.

Another affordance of the technology is that it provided opportunities for just-in-time professional development by supporting the facilitators through a chat window with an expert PBL facilitator. Although instructors were experienced, there was a high cognitive load of monitoring the students using the technology tools. The expert PBL facilitator added an extra pair of eyes helping to monitor the discussions and keep an eye on the PBL process. The use of multiple collaboration spaces in the videoconferencing software made supporting the facilitators tractable in a manner that is not feasible in face-to-face-PBL sessions. Technology provided a means to externally support the facilitators through a chat window with an expert. This feature provides us with possible innovation strategies for professional development in future studies.

The use of technology did have its hurdles. First, there was the time factor of communicating synchronously across the globe, where students in Canada were working at 7:00 a.m. with students in Hong Kong at 7:00 p.m. Second, there was a learning curve with respect to using the technology to communicate since there were sometimes time delays or lags and students needed to work together by respecting each others' "talk time" and not interrupting each other. However, the time lag necessitated a degree of politeness and time for reflection. The students and facilitators did learn to use the tools, overlooked technical difficulties, and were connected in real time across the globe. However, in the practice environment technology does remove the physician-student from the patient and even though online conferencing allows one to see and hear nuances in patients' voices and see changes in posture, it does still impose a distance between participants. Future research is needed to research the differences in effectiveness of face-to-face vs. technology-supported learning.

The Cultural Experience

The analysis of the PBL discourse revealed that culture was an explicit item that the group spontaneously brought into discussion. Students appreciated that there were cultural differences that they needed to understand in the context of communicating bad news to patients. They also noted that the culture of medicine itself helped support this international collaborative PBL experience.

A review by Perry and Southwell (2011) described the complexities in defining intercultural competence. Cultural understanding occurs on two levels, a cognitive one where individuals are aware of similarities and differences between cultures and an affective one where respect, empathy and respect for other cultures is needed (Hill, 2006). This online/digital PBL

had an experiential element to it in that students from Asia and North America worked together to understand how best to communicate the bad news of a positive HIV test to a patient. The context required students to experience the context rather than just read about it. Video triggers were used to contextualize the PBL and this helped students experience their own cognitions and affect prior to and during their PBL sessions where they discussed the video vignettes. Furthermore, each student practiced giving bad news to a standardized patient from a culture that was different from his or her own. Experiential learning about culture has been demonstrated to be more effective than learning that is confined within a classroom (Byram & Feng 2004). Online digital technology, as it was used in this study, may provide opportunities for developing intercultural competence that one cannot learn through lectures. Providing individuals with authentic intercultural experiences in which working with other cultures in meaningful contexts such as patient care is relevant and important may lead to better appreciation of differences by listening to the multiple perspectives shared online. This was particularly relevant to these participants as they were all working towards their shared goal of becoming physicians.

At the same time, the goal of this research was not to train intercultural competence but to describe how culture may influence understanding and communication about emotionally sensitive issues. Some researchers might want to use this prototype and add a training component to it that focuses more deeply on intercultural pedagogy (Trede, Bowles, & Bridges, 2013) so that reflecting upon becoming interculturally competent would become a formal part of the international experience. Such an intercultural learning pedagogy, as described by Giroux (2005), could help students understand cultural differences and diversity supporting them to better understand the new perspectives provided through an international experience. This kind of multicultural curriculum transformation (Clark, 2002) can be accomplished with motivated faculty. Authentic learning activities such as the PBL model described in this paper can be used to explore shared cultural expectations and humanize cultural contact and perhaps lead to a more culturally-sensitive community of practice (Gunawardena & LaPointe, 2007).

The Community of Inquiry

The COI model (Garrison et al., 2000) provided a framework for analyzing the relationship between the teacher/facilitators and student interactions from a teacher presence perspective as well as cognitive and social presence perspective. The data reveal that the technology-enhanced PBL provided a rich environment for learning about how to communicate bad news to patients. Both facilitators provided appropriate amounts of direct instruction that were moderated by an ex-

pert PBL facilitator. Student discourse demonstrated social presence as well as cognitive presence that tended to increase over the two case presentations. Given the short duration of the PBL intervention, two hours, the amount of social cohesion among the group is impressive, as is the meaning making that was coded in the cognitive presence category. Garrison (2011) has stated that it takes times for social bonds to form and for a culture of sharing to evolve. Finding social cohesion and cognitive presence in a short PBL that is shared cross-culturally using technology tools is an important result. The social-emotional aspects of learning are important and further research is needed in this area to see how mutual trust and multiple perspective-taking can be fast-tracked, leading to shared understanding more efficiently.

Does the PBL Experience Transfer to Practice?

Individual learning trajectories were plotted for each student, as a way of describing how well they incorporated the SPIKES model learned during the PBL to practice sessions communicating bad news to standardized patients. This pilot data revealed individual differences were more prevalent than cultural differences and that prior medical knowledge and experience with empathy prior to the PBL had an effect on the amount of PBL learning and integration that might be reflected in practice. These findings are to be expected given the small sample for this pilot. However, the mixed methods approach does give us a solid framework for replicating this study with more participants in the future.

Future Directions

Based on this exploratory study, we identify several conjectures that will be important for scaling this to a larger trial. First, technology-rich PBL environments that situate learning with rich video cases can serve to address both cognitive and emotional issues that serve as effective boundary objects for bringing medical students together to collaborate across cultures. Second, given the complexity of this type of intervention, an expert facilitator can provide just-in-time coaching. It may be important to determine the extent to which such coaching can continue with a larger number of groups. Third, the technology, context and human facilitation appear to support the teaching, social, and cognitive presences needed for intersubjective meaning making (Suthers, 2006). These conjectures will all need to be tested in a larger study with multiple groups over extended time periods. These tests will be important both theoretically and pragmatically. As part of this, we need to develop models that scale up to more learners and PBL group facilitators. That requires exploring alternative participation structures that might blend synchronous and asynchronous modalities productively. Research in distance education also suggests the importance of considering

emotional as well as cognitive content (Gunawardena & LaPointe, 2007). The research presented here has followed those recommendations, but we also see a need to better understand how that might foster emotional and social regulation within PBL groups and what, if any, additional supports might be needed to support these kinds of regulation.

To conclude, this has been a fruitful demonstration, but putting this together across time and space was challenging. Organizing time, technology, and bandwidths required a great deal of coordination and consequently scaling this pilot project may necessitate a blended approach to PBL where there are both synchronous and asynchronous tools for collaboration in larger online spaces. Selecting topics that would be of interest and that would promote extensive discussion among students who came from different cultural contexts was another key factor in the success of this PBL. The results are consistent with Volet's argument that "In the long term, active participation in authentic learning activities and mindful, shared regulation of learning may help students decontextualize their knowledge about learning and develop metacognitive strategies to read culturally and educationally different learning situations" (p. 640). Technology-rich PBL afforded this kind of active participation in authentic learning activities. We close with the observation that it was the students themselves who noted the importance of understanding that they live in a global village and that they needed to understand what they had in common along with what was different.

Acknowledgments

This research was supported by grants from the Social Science Humanities and Research Council of Canada.

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