# The role of problematizing moves in online knowledge building activities

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**Abstract:** This paper employed the method of problematizing moves (Koschmann et al., 2005) to study the online discussion of two groups of fifth grade students with one group more experienced in knowledge building (Bereiter, 2002; Scardamalia, 2002) than the other. Productive discussions could be resulted even without the assistance of teachers, through the problematizing moves made by the students themselves. Students having more experience in knowledge building seemed to be better at initiating the problematizing moves. However, the initiation also requires the uptakes of other learners so that the inquiry could be sustained. There was evidence that the novice group learned to ask more questions in the discussions, but their questions could still not be qualified as problematizing moves, suggesting further guidance might be needed. Relevant issues such as culture, gender, and the concept of "group" in a CSCL context were also discussed in this paper.

## Introduction

In the paper that put forward a thematic agenda for the next decade of computer-supported collaborative learning (CSCL), Suthers (2005) argued that what makes this field unique is the computer support for "intersubjective meaning making", which implies learning is not only accomplished through interactions but also composed of those interactions (Koschmann, Zemel, Conlee-Stevens, Young, Robbs, & Barnhart, 2005, cited in Suthers, 2005). As CSCL environments can turn communication into substance (Dillenbourg, 2005: p.260), the joint meaning making process among participants is made visible and could be studied. Although there are studies that examined social interactions through "coding and counting", the study of joint meaning making is still not prominent in the field of CSCL (Stahl, Koschmann, & Suthers, 2006). Aligned with this new research focus, Stahl (2006) proposed small groups as the primary unit that mediates between individual learning and community learning. Within small groups, through the discourse displayed by the members, their meaning making process could be observed. Koschmann et al. (2005) proposed the method of "problematizing moves" to investigate how groups of learners identify a situation as problematic and requiring further inquiry. This type of research is at the beginning stage (Suthers, 2005). This paper attempts to use the method of problematizing moves to look at the online discussion of two groups of fifth grade students with one group having much more experience in CSCL activities combined with the knowledge building approach (Bereiter, 2002; Scardamalia, 2002) than the other. Two episodes are selected to see what factors might contribute to the successfulness or unsuccessfulness of problematizing moves. The relationship of knowledge building and problematizing will also be explored.

### Knowledge building as a learning goal for CSCL

According to Bereiter (2002) and Scardamalia (2002), knowledge building is the process through which knowledge advances in human societies, and that learning can also take place as a process of knowledge building. The theory of knowledge building can become a theoretical rationale and pedagogical basis for CSCL. In a shared network space provided in a CSCL setting, students could make their ideas explicit and share with others with a goal to advance the knowledge of the collective to become a knowledge building community. The knowledge building approach emphasizes the importance of collective cognitive responsibility and communal efforts to improve ideas and to advance the knowledge of the collective (Scardamalia, 2002). A total of 12 knowledge building principles were elaborated by Scardamalia (2002) to distinguish a knowledge building classroom from even the best of traditional and modern classrooms. These 12 principles include "idea diversity", "democratizing knowledge", "community knowledge, collective responsibility", "improvable ideas", "epistemic agency", "knowledge building discourse", "real ideas, authentic problems", "rise above", "symmetric knowledge advancement", "pervasive knowledge building", "constructive uses of authority sources", and "embedded and transformative assessment" (Scardamalia, 2002). Based on these 12 knowledge building principles, Law & Wong (2003) studied a number of CSCL groups and found consistent patterns of development across groups in that characteristics described by some of the principles were exhibited before the others, while the characteristics of some of the principles were much more difficult to be observed. They reported on their findings in the form of a developmental trajectory in knowledge building. This developmental trajectory broadly paralleled Gunawardena, Lowe, & Anderson (1997)'s five phases of knowledge construction (see Law, 2005): (1) sharing/comparing of information, (2) discovery and exploration of dissonance or disagreement, (3) negotiation of meaning or knowledge co-construction, (4) testing tentative

constructions, and (5) application of newly constructed knowledge. In other words, for students to become more advanced in knowledge building, they need to move from sharing or comparing information to the discovery of disagreement, negotiation of meaning and beyond. Other researchers employed the depth of explanation, that is, whether the discourse is fact-oriented or explanation-oriented, to differentiate students' levels of knowledge building (e.g., Lipponen, 2000; Hakkarainen, Lipponen & Jarvela, 2002). However, the method of problematizing moves has not yet been applied in the context of knowledge building.

## Problematizing and knowledge building

To better understand how learning takes place in interactional contexts, Koschmann et al. (2005) proposed the concept of "problematizing moves", which is "a form of social action that has the effect of calling something previously held to be so into doubt" (p. 265). The concept of problematizing moves draws on Dewey (1938/1991)'s idea of inquiry that "a problem is not a task to be performed which a person puts upon himself or that is placed upon him by others" (p. 111). To problematize learners have to discover something which is potentially problematic. In Koschmann et al. (2005)'s terminology, a problematizing move serves the functions of directing attention to some potentially problematic matter, as well as projecting some form of collective action with regard to that matter. Koschmann et al. (2005) illustrated with two examples, one face-to-face and the other online, that the strategy of problematizing moves could be applied to analyze how learning takes place in interactional settings. In both examples, the analysis began with a prelude to problematizing, followed by the problematizing moves initiated by the learners, and the uptakes of other members. Koschmann et al. (2005) concluded that even there might be communication constraints in online settings, the methods employed by learners to problematize a problem are similar to those in face-to-face contexts.

As one characteristic of knowledge building is the focus on problems that learners really care about (Scardamalia, 2002), it could be seen that the concepts of knowledge building and problematizing are closely related. Knowledge building emphasizes on learners' "epistemic agency"; problematizing also requires the moves to be initiated by learners themselves. Calling something previously held to be so into doubt requires putting forward ideas that are different from those shared by the majority and moving beyond current levels of community knowledge; these could be represented by the knowledge building principles of "idea diversity", "democratizing knowledge" and "rise above". The collective action towards the problematic matters and the uptakes of other members are closely related to the principles of "community knowledge, collective responsibility", "improvable ideas", and "knowledge building discourse". In the literature of knowledge building, teachers are found to be a critical factor to engage students in deeper levels of knowledge building. In Koschmann et al. (2005)'s paper, although the authors did not make it clear whether the presence of a facilitating tutor is necessary in problematizing moves, the tutor played a significant role in helping the learners to direct their attention towards the potentially problematic matter in both the face-to-face and online examples. This paper does not attempt to address the issues related to teachers or tutors, but focus on the interaction between two groups of same-grade students with one group having much more experience in knowledge building than the other.

## Peer scaffolding in a CSCL environment

Generally speaking, in a CSCL environment, scaffolding could be provided by human agents such as teachers and peers or by the artifacts embedded in software designs (e.g., Brush & Saye, 2002; Lajoie, 2005). In a recent overview, Reiser (2004) summarized two major and complementary mechanisms that educational software tools could provide scaffolding. Firstly, software tools could help structure the task to guide students through key components as well as support their planning and performance. Secondly, the tools could problematize important contents so that students would devote resources to issues they might not otherwise attend to. It should be noted that both Reiser (2004) and Koschmann et al. (2005) used the term "problematizing" and their meanings are in fact quite similar; the focus of the former is on how software tools could provide this function while the latter on how people actually do it in social settings, including both online and face-to-face contexts. However, Reiser (2004) also mentioned that "the social context of collaborative problem solving is often integral to the problematizing nature of the tool" (p. 289), suggesting that for the problematizing function to be effective, human involvements such as peer collaboration have to be included. The concept of peer scaffolding founded on the theories of Vygotsky and Piaget. With his notion of zone of proximal development, Vygotsky (1978) mentioned the benefits of interacting with a more capable peer. Piaget did not consider inequality in competence to be necessary (see e.g. Tudge & Rogoff, 1989) and focused more on peer interactions through which children with differing perspectives could create socio-cognitive conflicts that result in construction of new conceptual structures and understanding (see also Doise & Mugny, 1984). From the perspective of knowledge building, the focus is not on how individual learners could be benefited from the interactions or how the cognitive process of an individual operates, but on extending the

knowledge and understanding of the whole community beyond the initial state of knowledge of the collective community through intentional social interactions. The concept of problematizing moves is considered in this paper as a key to understand how the community knowledge could be advanced.

### Issues of methodology in CSCL

In the field of CSCL, there are basically three major methodological approaches: experimental, descriptive, and iterative design, as summarized in Suthers (2005)'s paper. The experimental approach usually involves the comparison of an intervention to a control condition and the data are analyzed through the method of "coding and counting". The descriptive or ethnomethodological approach is usually microanalytic and involves the examination of some episodes in greater detail; the method proposed by Koschmann et al. (2005) is an example of this approach. The iterative design approach involves the continuous improvement of software and pedagogical designs which is driven by the dialectic between theory and implementation. Suthers (2005) did not argue the importance of one approach over the others, but rather called for a methodological fusion that combines the strengths of different approaches. In the area of research design, "triangulation" is often used to refer to the condition that multiple or mixed methods are being employed. Triangulation is a metaphor borrowed from land surveying, which states that if we know the exact positions of two points, we can locate an unknown third point by projecting an angle from each of the two known points. When this metaphor is applied to the setting of research design, it is not clear what exactly each of the points mean and what different methods or combinations of methods should be employed in a study (for more on triangulation, see e.g., Erzberger & Kelle, 2003; Gorard & Taylor, 2004). In Chinese characters, there are three words constructed with the same component *mu*. As shown in figure 1, the single-component word *mu* means a tree; while the combinations of this component will become the words *lin* and *sen*, both meaning a forest. Interestingly, the word *sen* has the shape of a triangle, with its upper part meaning a tree and lower part a forest. This triangular-shaped word might provide a new metaphor for triangulation, which implies "seeing the tree as well as the forest". In other words, in choosing those multiple analytic methods, there should be some focusing on the detail, that is seeing the tree, while others focusing on the overall picture, that is seeing the forest. To triangulate is to supplement a detailed analysis with a whole-picture one, or a whole-picture analysis with a detailed one. The method of problematizing moves attempts to study human interacting episodes in great detail, in order to look at the whole picture, especially on the changes in discourse patterns over different stages of collaboration between the two groups of students, the detailed analysis in this paper is "triangulated" with a "coding and counting" method based on the five phases in knowledge construction proposed by Gunawardena et al. (1997). The coding scheme of Gunawardena et al. (1997) was chosen because it is one of the methods that can reflect the levels of knowledge building (Law, 2005); and compared to other coding methods, such as those distinguishing between fact-oriented and explanation-oriented discourse (e.g., Lipponen, 2000), Gunawardena et al. (1997)'s coding scheme included the category of "discovery of dissonance or disagreement", which is closely related to the concept of problematizing, as they both require the learners to discover something to be potentially problematic.


Figure 1. The three Chinese words with the meanings of tree and forest.

## Research Design and Methods

This current study was based on the collaboration between two primary school teachers, one in Hong Kong and the other in Toronto, Canada. The Canadian teacher is teaching at a laboratory school of the University of Toronto and has more than four years of experience in facilitating students to engage in online knowledge building activities while the Hong Kong teacher and his students were new to this novel approach. The international collaboration was set up when the two teachers met at an international conference. The Hong Kong teacher was interested in trying out this new pedagogical approach and the Canadian teacher wanted to scaffold the Hong Kong collaborators, both the teacher and his students, through online collaborative knowledge building of the two classrooms. As a result, the two teachers agreed that their students, 22 from Hong Kong and 22 from Toronto, all at grade five, would collaborate through the online platform Knowledge Forum® during the school year 2004-2005.

### The online platform

Knowledge Forum® (KF), the online discussion platform used in this study, was developed by Marlene Scardamalia and Carl Bereiter's team at the University of Toronto to support asynchronous collaborative knowledge building activities (Scardamalia & Bereiter, 1992). KF creates a shared network space for students to write new notes, read other's notes and respond by writing build-on notes. Notes related to the same topic could be arranged in the same view. KF has a number of specific features to support knowledge building activities. First of all, its graphical display helps users to visualize their interactions with one another as each build-on note is linked to the note it responds to. KF also provides the function of "scaffolds" in the form of word cues such as "New information", "New idea", "I need to understand", and "My theory" so that students could better organize their note contents.

### Participants' backgrounds

All the 22 Canadian students were from the same grade-five class in the laboratory school described above. These students had used KF as a learning environment fully integrated into their school learning experience since grade one. In fact, teachers in this school adopted not only the technology platform, but also the knowledge building approach in their pedagogical practices. While the Canadian students were experienced in knowledge building and the use of the technology platform KF, the 22 Hong Kong students were totally new to this online environment or the knowledge building approach. Although they were familiar with face-to-face discussions in class, they have never engaged in online knowledge building activities approach which emphasizes the continual improvement of ideas through intentional interactions with one another.

### The collaboration process

Stage one: The current study began in the autumn term of 2004. As the Hong Kong (HK) students had no experience in online knowledge building activities, the two teachers agreed to start their collaboration only after the HK students had a chance to familiarize with working in KF. In Nov 2004, the 22 HK students formed five groups among themselves to work collaboratively on the online platform KF for two months to work on topics of bacteria, computer, dress-up, electric boat, and electricity. This two month period could be considered as stage one of this study in which HK students discussed among themselves on KF. At the same time, the Canadian (CA) students used KF to work on topics related to ancient civilizations which was one of their curriculum themes for the school year. No interaction of the two classes occurred during this stage.

Stage two: Beginning at the end of Jan 2005, HK and CA students started their online collaboration. During the first week, an "Introduction" view was set up for the two classes of students to introduce themselves to each other and to articulate which topics they were interested in. Since the HK students and their teacher were also interested in ancient civilizations, the CA students extended their exploration by one and a half months to collaborate with their peers in HK on eight topics related to ancient civilizations that were found to be of interest to both classes of students. The topics included building, clothing, Egypt, food, language, life style, religion, and weapon. During this period of international collaboration, HK students formed eight groups each responsible for one of the topics, although they were encouraged to join in the discussions of other topics. While on the CA side, students were allowed to freely join in the discussions of any topic they were interested. This period of time could be regarded as the stage two of this study.

Stage three: The joint-collaboration ended when the CA school closed for their term-break. When school resumed in the spring term, the CA class moved on to other topics and no longer appeared on the online collaboration space with the HK students. On the other hand, the latter class of students did not have a term-break at the same time and they continued to work on the eight ancient civilization topics till June. Thus although it was not planned intentionally, the end of joint-collaboration signified the start of stage three, which could be regarded as a "fading" stage (Collins, Brown, & Newman, 1989), as the more experienced group had withdrawn from the collaboration, leaving the novice group to continue the discussions by themselves.

## Results and Discussion

To apply the method of problematizing moves proposed by Koschmann et al. (2005), two episodes each within a discussion thread were selected and analyzed. They were both created within stage two, in which the CA and HK students participated jointly in the discussion. The analysis was then "triangulated" with the findings based on Gunawardena et al. (1997)'s coding scheme. The results of two focus group interviews with the HK students after the collaboration were also presented and the corresponding issues were discussed.

## Episode 1: Did most civilizations hunt?

The first episode was related to the topic of "food". Before the problematizing move, students were discussing when ancient people changed from hunting to trading for food. Thus an assumption beneath the discussion is that ancient civilizations usually hunted. A CA student posed the first problematizing move, questioning whether all ancient civilizations hunted for food. The following excerpts were extracted from the online discourse triggered by this problematizing move. The text inside brackets at the beginning of each entry denotes the scaffold selected by the student in that note.

CA student #1: [My theory]: Is that most civilizations hunted for food? It would be interesting if a civilization did not hunt.

HK student #1: [I need to understand]: Unless you count the tribes in Africa or India, I'm not really sure that people nowadays hunt for food. But people long time ago either hunted or farmed or even fished. But I don't know whether the people hunted more or farmed or fished more.

CA student #2: [Further explanation]: Most civilizations found that hunting was much harder to use to get food and most civilizations were agricultural societies (farmers) and hunted only a tiny bit.

HK student #2: I think Chinese hunted for food .Then they fished for food. Lastly they planted.

HK student #1: [New information]: The Chinese mainly farmed for food. They think that wheat is the most important food, that's why they had so many farms in a village. The season for them to plant is spring and they harvest the food in autumn, they do not work in winter. And when sometimes they can't grow any wheat, they hunt instead.

The first problematizing move received the uptakes of other students to further inquire on other means of getting food in ancient times. As the HK students are all Chinese, they quickly associated the discussion with their knowledge that ancient China was a farming society. When the students came to a shared understanding that ancient civilizations could also farm for food, the CA student posed another problematizing move, questioning how ancient people who farmed could have meat to eat. The second problematizing move again drew the attention of other students and they came to a new shared understanding that agricultural civilizations could raise animals to get meat, as indicated by the following excerpts that followed the above ones.

CA student #1: [I need to understand]: How did they get their needed meat?

CA student #2: [New idea]: The civilizations would probably only hunt when they needed the meat and be farmers for more of the time. Maybe they even just raised their own animals like chickens and cattle.

HK student #1: Yes, that's a good suggestion, I think it's right. I once read a book and the people usually slaughtered their own animals, they rarely hunted. That's why some people have to take care of the animals and the other are doing the farming.

With the two problematizing moves, the understanding of students became more and more complete, from recognizing that most ancient civilizations hunted, to some of them farmed, to those farming civilizations could also raise animals to get meet. From the perspective of knowledge building, it could be said that the collective knowledge has been advanced. Both problematizing moves were generated by the same CA student, while HK and other CA students participated in the discourse through their uptakes of the problematic matters. It should also be noted that the teachers did not involve in the discussions, the problematizing moves were initiated and up-taken by the students themselves.

## Episode 2: Why some civilizations were more peaceful than others?

The first episode demonstrated how problematizing moves could lead to the sustained inquiry over the problematic matters so that the collective knowledge could be advanced; in the second episode, however, the initiation of a problematizing move did not result in sustained uptakes of other students. The episode is related to the topic of "weapon". A group of three HK boys was responsible for this topic. Before the problematizing move, they were gathering the information on weapons used in the past, such as the darts used by Japanese ninjas, and the swords used by ancient Romans. Then a CA student posed a problematizing move, questioning why some civilizations were more peaceful than the others.

CA student #3: [I need to understand]: I wonder why some civilizations were more peaceful than others? For instance the Mayans barely fought at all compared to the Romans who fought a lot.

CA student #4: May be the civilizations fought a lot depended on where they lived.

CA student #3: [Further explanation]: I think this might be true because the Mayans lived in a pretty remote part of the world (ancient Mexico).

HK student #3: [Further explanation]: It's the problem of the ruler or leader of the place. If the ruler likes to fight, then the place and all its people aren't peaceful at all.

The discussion thread ended with the note posted by HK student #3, who is not one of the three boys. Although there was a small degree of uptakes in this episode and ideas like whether the civilization lived in a remote place or whether the ruler loved to fight came out, the problematizing move did not trigger the sustained inquiry over the matter of why some civilizations were more peaceful than the others, which might turn out to be a productive discussion. The three HK boys did not participated in the discussion at all; they were still more interested in finding information about weapons and how ancient people fought and killed. One of the knowledge building principles, "symmetric knowledge advancement" (Scardamalia, 2002), articulates the importance of balancing the inquiries on different knowledge aspects. The three boys seemed to be too focused on their knowledge advancement in "weapons", while the discussion about peaceful matters was beyond their agenda.

## Triangulation with Gunawardena et al. (1997)'s coding scheme

With the concept of problematizing moves, students' discussions could be studied in great detail. The two episodes seemed to suggest that CA students, who were more experienced in knowledge building activities, were better at initiating problematizing moves than their HK counterparts. However, to draw a more concrete conclusion, the results have to be "triangulated" with an analytic method that could look at the whole picture. In another study, Lai & Law (in press) coded the same set of data with Gunawardena et al. (1997)'s model of five phases in knowledge construction. Each discussion note was classified into one of the five phases based on the coding scheme proposed by Gunawardena et al. (1997). Phase 1 is called "sharing/comparing of information", including the statement of observation, opinion, or agreement. Phase 2 is called "discovery and exploration of dissonance or disagreement among ideas, concepts, or statements", including the identification of areas of disagreement, or clarification of the source and extent of disagreement; this phase could be regarded as closely related to problematizing as they both require the learners to discover some matters that are potentially problematic. Phase 3 is called "negotiation of meaning/co-construction of knowledge", including the negotiation or clarification of the meaning of terms, identification of areas of agreement or overlap among conflicting concepts, or proposal and negotiation of new statements embodying compromise and co-construction; this phase is closely related to the uptakes of other learners, as after the problematizing move, learners will devote their efforts in further inquiring on the problematic matters. Phase 4 is called "testing tentative constructions", including testing the proposed synthesis against received fact, or testing against contradictory testimony in the literature. Finally, phase 5 is called "application of newly-constructed knowledge", including the application of new knowledge. The first phase of sharing or comparing information could be considered as the lowest level in terms of a knowledge building discourse, while the second to fifth phases denote more advanced levels (Law, 2005). As the current study did not require students to come up with some knowledge constructions for testing or applying, Lai & Law (in press) did not find any note belonging to either phase 4 or phase 5. Table 1 summarized the coding results over the three stages of collaboration between the two groups of students; only the findings within the first three phases were presented.

Table 1: Classification of the students' note contents in each of the three stages using Gunawardena et al. 's (1997) coding scheme on phases of knowledge construction.

| | Stage 1 | Stage 2 | | Stage 3 |
|---|---|---|---|---|
| | HK | HK | CA | HK |
| Phase 1: Sharing/comparing information | 91% | 67% | 60% | 81% |
| Phase 2: Discovery of dissonance | 6% | 13% | 18% | 5% |
| Phase 3: Negotiation of meaning | 3% | 21% | 22% | 14% |

It could be seen that over the three stages, the majority of notes belonged to the first phase of "sharing information", especially during stage one when HK students discussed among themselves. With the joining in of CA students in stage two, more notes related to the "discovery of dissonance" were added by CA students, which in turns triggered the discourse of HK students towards "negotiation of meaning". When CA students no longer appeared in the discussion, HK students continued to discuss on the topics of ancient civilization, but their discourse was not characterized by the "discovery of dissonance". A possible reason could be that the discovery of dissonance, or the initiation of problematizing moves is more likely to appear in the earlier stage of inquiry. However, it is also likely

that the CA students, at least some of them, with more experience in participating in knowledge building activities, were better at discovering dissonances, or problematizing the discourse than HK students.

## Are students equally good at problematizing?

Although the results suggested that CA students were better at initiating the problematizing moves or discovering dissonances than HK students, it does not mean that all CA students were equally good at problematizing. Of the 22 CA students, only ten of them created notes which belonged to the second phase of Gunawardena et al. (1997)'s coding scheme, while the others only brought in discussion notes that were related to information sharing. Among the ten CA students, one created three second-phase notes, the other two each produced two second-phase notes, while the remaining seven each created only one second-phase note. The results suggested that those problematizing moves were initiated by a few students, though it is likely that owing to the limit of time for the stage of joint-discussion, other CA students did not have the opportunities to initiate problematizing moves. The CA student who question "why some civilizations were more peaceful than the others" also created a similar note in the topic of language, asking "why some languages are still around and others are not". It could be seen that the wording pattern used by this student was, "why some…and others…" The tactic used by the student who initiated the problematizing move in "food" was to question whether hunting as the major means of getting food could be applied to all ancient civilizations. It was also found that the CA students usually initiated a problematizing move with the scaffold of "I need to understand" or "My theory".

## Did HK students notice any differences?

After HK students had finished the online discussions, two focus group interviews were conducted with six HK girls and seven HK boys respectively. They were asked with the question whether they noticed any differences between the notes written by them and by CA students. Both boys and girls mentioned the English of CA students was more fluent, but the girls also noticed that CA students asked more questions in their notes. To triangulate the interview results with the whole picture, the types of scaffolds used by students throughout the three stages were counted. As shown in table 2, the patterns of scaffold usage by HK students were quite consistent in stages one and two: about half of them were "New information", about 30% were "New idea", and about 10% were "I need to understand". The corresponding pattern for CA students was somewhat different: although half of the scaffolds used were also "New information", they tended to use more "I need to understand" (27%) and less "New idea" (13%). The results might reflect why the problematizing moves were mainly produced in stage two by CA students as the question-asking scaffold, "I need to understand", is more related to problematizing than other types of scaffold. It is noteworthy that in stage three, when the CA students withdrew, the HK students increased their usage of the scaffold "I need to understand" to 22%, suggesting that they might model their CA counterparts to ask more questions in their notes in the final stage. However, a closer look at the note contents will discover the questions asked by some HK students tended to be more information-oriented, suggesting that they might not fully grasp the meaning of "understand" in the scaffold, "I need to understand". For example, some HK students used this scaffold to ask questions such as "do you agree?" or in conjunction with the statement of "please tell me more what you mean". They might simply use it as "I need to know" instead of focusing on deepening their understanding. It should also be noted that HK students increased their usage of "New information" to 61% in stage three; this might be due to the fact that at the end of stage three, each group had to conduct a presentation on the topic of ancient civilization one was responsible for, so the HK students might try to look for information that were presentable; the results were in fact consistent with the analysis using Gunawardena et al. (1997)'s coding scheme as shown in table 1.

Table 2: Kinds of scaffold used in Hong Kong and Canadian students' notes during the three stages

| | Stage 1 | Stage 2 | | Stage 3 |
|---|---|---|---|---|
| Scaffolds used | HK | HK | CA | HK |
| New information | 49% | 48% | 49% | 61% |
| New idea | 27% | 32% | 13% | 15% |
| I need to understand | 13% | 12% | 27% | 22% |
| Others | 11% | 8% | 11% | 2% |

## Issues related to grouping

During the international collaboration, CA students were free to join in the discussion of any topics they were interested, while groups were formed among HK students with each group responsible for one topic related to ancient civilization, though they were encouraged to join in the discussions of other topics as well. The participation

statistics suggested that CA and HK students did not vary much on the numbers of topics they worked onto. In stage two, averagely speaking, each CA student participated in the discussion of 2.36 topics, while HK students worked onto 2.05 topics. In the focus group interviews, HK students were asked whether they preferred to participate in the discussion as group members or as individuals. The boys mentioned it was important to belong to a group so as to indicate one's devotedness to the topic, and it was not possible to have a deeper level of discussion if one belonged to many different groups. While for the girls, some preferred to work in groups while others said it was not important whether one belonged to a group, the concept of group identity could be flexible in the current context, as indicated by the following interview excerpt:

> When you are building on the notes in other topics, you will feel that you belong to a large group. If you simply look for the information of one topic, you will feel that you are a member of that group. So the membership changes in different times. (Interview transcript of a Hong Kong girl)

Recently, Stahl (2006) put forward the notion of "group cognition" to understand the importance of discourse in small groups in a CSCL context. Stahl (2006) spent several chapters to clarify concepts such as mediation by small groups, and whether collaborative groups could think. The concept of "group", however, seemed to be treated as unproblematic and not much words were spent on it in the book; it was used to contrast with individual learning (p. 5) and its size could vary from three to five (p. 19). In a face-to-face project-work setting, the concept of "group" or "group boundary" is more concrete. In a CSCL context, group boundaries are more blurred. Students can still form groups to carry out the discussion or inquiry, but their discourse is visible to other students who can join in the discussion at any time. The results of this study suggested that problematizing moves might not be easily initiated by all learners, so the flexibility of crossing group boundaries is important, or otherwise some groups may end up with only information-sharing discourse without any problematizing movements. The flexibility requires both the willingness to join in others' discussion and the welcome-ness of others to join in one's discussion. It is related to the knowledge building principle of "symmetric knowledge advancement" and further studies are needed on this issue.

### Issues related to culture and gender

The two groups of students were from two different cultures, one Eastern and the other Western. There have been findings that people from Eastern cultures, which are more collectivist, tend to conform and agree more while people from Western cultures, which are more individualistic, tend to deviate and disagree more (see e.g., Nisbett, 2003). However, it should be noted that to disagree is not equivalent to problematizing or discovering disagreements or dissonances. In this study, the factor of culture is confounded with the experience in knowledge building. In future studies, they should be separated to see whether culture alone could make any significant difference on the discourse patterns.

The focus group interviews of HK students suggested that girls might be more flexible in crossing the group boundaries than boys. The participation statistics also indicated in stage two, HK girls tended to work onto more topics (2.64) than boys (1.45) and the difference was significant ($F(1,20)=6.86$, $p<.05$); though there was no significant gender difference on the number of notes created or number of notes read. Gender is thus a factor that worth further inquiry. If boys are really less likely to cross the group or topic boundary, intervention might be needed to help them appreciate the importance of the knowledge building principle of "symmetric knowledge advancement".

## Conclusion

This paper demonstrates that problematizing moves could lead to productive discussions among fifth-grade students in a CSCL context. It was also found that students having more experience in knowledge building are better at initiating the problematizing moves. However, the initiation also requires the uptakes of other learners so that the inquiry could be sustained; it involves the issues of how to cross the group or topic boundaries, and more fundamentally how "group" should be conceptualized in the setting of CSCL. Although there was evidence that after the collaboration, the novice group tended to ask more questions, which might be the result of modeling from the more experienced group, the questions they asked could still not be counted as problematizing moves. It suggests that some more guidance might be needed; for example, the teacher could clarify with them the difference between "I need to know" and "I need to understand". This paper presents an international collaboration between two groups of fifth-grade students through an online discussion forum. As the whole world is increasingly connected, this type of international collaborative offers a promising way for future pedagogical designs in which productive discussions

could be resulted even without the assistance of teachers, through the problematizing moves made by the students themselves.

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