Fostering Collaborative Knowledge Building Culture: Initial Experiences in the Context of Mobile Learning

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Abstract

In this paper, we present issues and challenges for fostering collaborative knowledge building culture in the context of teaching and learning integrated humanities. Specifically, we focus on the design and enactment of one mobile learning trail that aims to foster in situ small group collaboration leveraging on the affordances of mobile device and Web 2.0 technology – an initial step to create and cultivate the culture of collaborative knowledge building. The design of the first mobile learning trail serves as a platform to acquaint students with situated collaborative learning; generating, sharing and affirming findings and solutions in problem-solving and inquiry-oriented activities. Data from the online survey show that students appreciated the authentic learning experiences where they had opportunities to apply what they learn in classroom. Academic ability and gender were not significant factors affecting students' overall perceptions and attitudes. Further, in focus group interviews, a number of students expressed the necessity and enjoyment of working together as a group. In conclusion, we discuss some implication for fostering collaborative knowledge building culture in an initial stage and our plan for conducting future studies.

1. Introduction

This research paper discusses initial findings of the enculturation process toward collaborative knowledge building practices in the context of teaching and learning integrated humanities in one Singapore secondary school. In particular, this paper focuses on the issues and challenges that are likely to surface in the initial process of fostering knowledge building culture, such as: "how to introduce knowledge building pedagogy into classrooms" and "what are the students' initial perceptions toward collaborative knowledge building experiences that require explicit idea sharing and inquiry process". This paper is based on the research program in Singapore that aims to explore seamless knowledge building practices in situated learning, and also to introduce the affordances of mobile technology and in situ collaboration as significant instruments and channels for knowledge building.

Previous research on knowledge building has emphasized the importance of enculturation process (K. Bielaczyc & Ow, 2007; Kolodner et al., 2003; van Aalst & Truong, 2010). The enculturation process into knowledge building culture is a complex endeavor which necessitates a shift of both teachers and students' epistemologies on the nature of knowledge and knowing. So far, the introduction and adoption of knowledge building pedagogies have been mostly carried out by researchers and teacher practitioners who have some formal or informal exposure to knowledge building pedagogy through coursework or research projects. The principles of knowledge building (Scardamalia, 2002) have been a useful tool that conveys the essence of knowledge building pedagogies, but allows some flexibility for localization and adaptation. Knowledge building approaches have been examined in several Asia-Pacific countries (van Aalst & Chan, 2007; J. Oshima et al., 2006; So, Seah, & Toh-Heng, 2010) to shift culture of teaching and learning from teacher-centered to student-centered and from task-focused to understanding-focused pedagogies.

Teachers who attempt to introduce and promote knowledge building pedagogies often face challenges to transform classroom culture from knowledge telling to knowledge building practices. Moreover, teachers often question whether such pedagogical approaches that promote student agency and constructivistic thinking, can work for the so called academically lower achieving students. While one of our previous research studies found the compelling evidence that knowledge building pedagogies are beneficial to both high-achieving and low-achieving students (So et al., 2010), our interaction with Singapore teachers indicates that such concern regarding student abilities levels and constructivistic approaches are still prevalent.

Another important issue on fostering knowledge building culture is the need for an epistemological shift to view a classroom not as a mere collection of individual students, but as a collaborative knowledge creation community. The essence of knowledge building approaches is the continuous improvement of ideas with a belief that "what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts" (Scardamalia & Bereiter, 2003 p.1370). However, since much of school culture is based on individual performance and assessment, promoting such collective cognitive responsibility has been a challenging task which necessitates gradual long-term practices. Simply put, the culture of playing with ideas and messing around ideas is not readily accepted and assimilated into classroom culture. This issue becomes more problematic in Asia-Pacific contexts where individual performance and competition for preparing high-stake national examinations are highly prevalent. Previously, we found that the discourse patterns of Singapore primary classrooms, despite our effort to integrate knowledge building pedagogy, is still dominated by the teacher-initiated IRE (Initiate - Response - Evaluate) pattern, and student-initiated questioning and knowledge-centered questions rarely appear (Lossman & So, 2010).

Lastly, a more practical issue for promoting pervasive knowledge building practices is that the access and use of Knowledge Forum, which is a vital public space for community knowledge building, has been limited to desktop computer centered environments in school contexts. In Singapore, while the ratios of computer access has been improved to 6.5:1 in primary and 4:1 in secondary and junior college levels (Koh & Lee, 2008), teachers often express difficulties of booking computer labs to implement knowledge building integrated lessons.

2. The Present Study

The aforementioned issues and challenges that we have faced in our research trajectory of promoting knowledge building pedagogies in Singapore contexts have motivated us to look for ways to address such issues. One approach that we perceived to be promising was to introduce the affordances of mobile technology and web-based applications in order to help students engaged in pervasive knowledge building practices across physical contexts and time scales. In So, Seow, and Looi (2009), we have reported our first attempt to promote so called "knowledge building in situ". To explore the affordances of mobile devices and Web 2 technologies, we designed the Chinatown learning trail that includes six phases of knowledge building from idea generation to idea compare/contrast. Similar to geo-tagging systems, the Google Map space allows students to create locative content when they are situated in relevant contexts and plan or revisit their ideas whenever they are connected with mobile devices. We found some compelling evidence that being able to connect across contexts, coupled with students' sense of place helped students engaged in knowledge-building discourse and collaborative meaning-making practices.

The research program discussed in the remaining part of the present paper is our attempt to extend previous findings on promoting pervasive knowledge building culture and knowledge building in situ practices. Particularly, the current project examines how the affordances of 1:1 mobile technologies, coupled with pedagogical considerations on knowledge building can help students develop critical thinking skills and subject knowledge in integrated humanities curricula. In particular, we are interested in the affordances of mobile computing and social networking applications with the potential of creating seamless learning spaces that promotes continuity of collaborative learning experiences across contexts. In geography, students can engage in collaborative learning activities integrating classroom learning and field trips to develop deep understanding in both typological (i.e., language-based, categorical) and topological (i.e., space-based, continuous) representations (Lemke, 2000; Roschelle & Pea, 2002).

One of the questions examined in the research project is to examine what is the socio-technical infrastructure that supports and enables pervasive knowledge building with 1:1 mobile technologies. According to Bielaczyc (2006), designing a learning environment, that dramatically differs from traditional conceptions of teaching and learning, requires careful orchestration of multiple critical dimensions of classroom structures and learning culture, including a) the cultural belief dimension, b) the practices dimension, c) the socio-techno-spatial dimension, and the d) interaction with the outside world dimension. Specifically, this paper concerns with the first two dimension-cultural belief and practices in the initial phase of introducing knowledge building pedagogy into curriculum teaching.

Our primary data in this paper is drawn from a geography field trip study to the Sentosa Island that requires an explicit idea sharing and discussion for collaborative knowledge building. For the integrated humanities curricula, the school adopted the inquiry approach to learning as a key pedagogy. Students are guided to pose questions into an inquiry, probe using a variety of sources, process the information, create and communicate new understandings. Students are encouraged to reflect at every stage of the process so as to equip them with the skills for evaluating and analyzing information from the various disciplines to construct knowledge. Experiential Learning, evident in this particular field study on Sentosa Island, is a key feature in the teaching of integrated humanities. It provides students with the hands-on experience and a chance to construct their knowledge through investigation during visits to areas of study on the island. It helps students to make explicit connections between their classroom experiences and immediate environment. In geography, inquiry-based fieldwork is one of the pedagogical tools to encourage students to ask geographical questions and to carry out an investigation based on them. Through fieldwork, students acquire geographical concepts and knowledge in a challenging and authentic way. Some of these knowledge include navigation, photo interpretation, and identification of physical geographical features.

3. Methodology

Employing design-based research as a methodological framework where it allows “progressive refinement in design” (Collins, Joseph, & Katerine Bielaczyc, 2004 p.18) the mobile learning trail at Sentosa forms the first milestone of this research project. Two fundamental features of design research – “a design focus and assessment of critical design elements” serves as a guiding framework in the iterative process of implementation, reflection and refinement of educational practices (Collins et al., 2004 p.22).

The focus of the first learning trail was to foster in situ small group collaboration leveraging on the affordances of mobile device and Web 2.0 technology – an initial step to create and cultivate the culture of collaborative knowledge building. Premised upon Bereiter’s notion of Knowledge building – “the creation of knowledge” as “a social product” and Scardamalia’s proposition of nurturing “collective cognitive responsibility”, the design of the first mobile learning trail serves as a platform to acquaint students with situated collaborative learning; generating, sharing and affirming findings and solutions in problem-solving and inquiry-oriented activities. The works of Bereiter and Scardamalia have aptly pieced together the critical elements that shape the essence of knowledge building; i.e. that of a social construction and the need to cultivate an environment that supports such a collective and progressive learning journey.

There is more than sufficient literature to reiterate that collaborative learning does not take place by itself when students work in groups with or without technologies. For any meaningful collaborative learning to occur, it necessitates scaffolding of the learning journey to bring about the desired learning outcomes. Here, we speak in respect of the lesson design as the primary indicator. Next, of equal significance would be the appropriating of relevant technologies to materialize those lesson objectives. In the curriculum planning and design of in situ collaborative learning, the conceptualization of the on-site activities seeks to maximize the presence of a "real world" platform, engaging students in meaningful knowledge creation and production where "the process of learning is informed by sense of place" (Lim & Barton, 2006 p.107). And to enable students to best leverage on the benefits of in-situ learning, mediating technological tools is pivotal in helping students create, consolidate and modify data where the affordances of mobility fosters contextualized learning and collaborative learning. Brown and Adler (2008) call it "a culture of participatory learning 2.0 through enculturation into a practice as well as on collateral learning" (p.30).

3.1 Research Questions

The first in situ collaborative learning experience at Sentosa was an initial move to facilitate the enculturation of collaborative learning practices which promotes a knowledge building culture. In this study, we examine how the affordances of mobility and in situ collaboration impact collaborative knowledge building on an outdoor learning trail at Sentosa:

- To investigate the impact of mobile device-supported learning environments on collaborative knowledge building
- To examine how the social structure and the curriculum design of the activities foster location-based collaborative learning; moving students towards a Knowledge Building culture

3.2 Research Context

The School is one of the future schools of Singapore; forerunner in the use of emerging Interactive Digital Media-based (IDM) tools and mobile technologies for teaching and learning both in and out of the classroom. The school has invested extensively both in human resources, technological infrastructure, hard and software to prepare, engage and immerse her students in using IT for collaborative learning and critical thinking. All staff and students are equipped with MacBook and the campus is fully IT-enabled.

One of the hallmark desired student outcomes of the school is to nurture collaborative and independent problem solvers. Students will be motivated, curious and self-reliant and be able to work independently with confidence. At the same time, they will be good team players with strong inter-personal skills. To enrich and deepen the learning experiences of the students in achieving this particular outcome, technology is used to support the key components of learning. These include active engagement where teachers facilitate class and group discussions, leading to frequent interaction and feedback between teachers and students, or between students in their groups. Such interaction takes place across online platforms as well as during face-to-face interactions. Tools such as the internet, digital media, blogs and learning management systems add new dimensions to the inquiry process and allow students of the school to construct new knowledge.

3.3 Design Consideration

The lesson design was premised upon a constructivist approach on educational environments, where students are presented opportunities to think about the object and subject of study, construct meaning on their own and with others and to apply knowledge in real world context (Pena-Shaff & Nicholls, 2004). Two key considerations drive the design and execution of the learning activities. Firstly, the learning activities should provide students with an authentic platform to apply their geography knowledge in a "real world" setting. Secondly, the learning activities ought to set the stage for in-situ collaborative learning. Brown and Adler's (2008) posits the need to assimilate students into the process of "learning to be" where he likened this to Dewey's concept of "productive inquiry - process of seeking the knowledge when it is needed in order to carry out a particular situated task" (p.20).

The application of geography skills was identified as the curriculum of the mobile learning trail. The field trip primarily seeks to provide a real world platform for the students to apply geographical skills and knowledge acquired in the classroom and to foster in situ collaborative learning. Sentosa was a choice location in terms of its terrain and physical features for the application and transfer of geography skills and knowledge such as mapping and gradient of slopes and its geographical significance; contextualizing their learning experience. Measuring of gradient, identification of physical features in relation to the impact of physical forces of erosion and disposition, and the collection of qualitative data via face-to-face interviews with tourists form some of the key lesson objections for the learning trail. Table 1 presents an overview of the type of tasks designed for the mobile learning trail.

Table 1. Overview of Mobile Learning Trail Tasks

Tasks	Location
<u>Station Yellow</u>	
1a. Calculate gradient of slope at 3 different sections of the beach	Siloso Beach
1b. Rank the slope from the gentlest to the steepest	
2. Interview Tourists	
<u>Station Red</u>	
1. Capture and annotate five features of the beach	Palawan Beach Start of Suspension Bridge
2. Calculate tower height using trigonometry	
3. Identify, photo and annotate physical feature – the ridge	
4. Identify important industries near Sentosa and state their significance for the Sentosa establishment	Twin Observation Tower at the Southern-Most-Point of Asia
<u>Station Green</u>	Emerald Pavilion
Design thinking on the attractions, accessibility and amenities of Sentosa. It consists of four steps – brainstorm, share, categorise and suggest solutions to a problem issue identified.	

3.4 Participants

About 200 Secondary one students took part in the mobile learning trail. Students were put in groups of four; 24 groups were scheduled for the morning and 30 groups in the afternoon. The learning trail consisting of three stations took about two and a half hours to complete. Each group shared a MacBook as their mobile learning device on the event day. With wireless modem and MacBook, students were able to use the internet and Google applications, take pictures, collect data, key in information in their MacBook, and upload them onto the web-based platform, designed and developed for the mobile learning trail.

To understand the effectiveness of our design, our study focused on three experiment groups of four students. The school was particularly concerned about student ability levels and gender issues. So we grouped students as two mixed ability groups (one all-girls group and an all-boys group) and one high ability group (mixed gender). The ability grouping of the students was determined via a standard geography test.

3.5 Data Collection Method

Data were collected to study the impact of curriculum design on location-based collaborative learning. An online survey questionnaire was administered to all participants of the mobile learning trail, and a focus group interview was conducted with the 12 students from the three experiment groups to inquire on their mobile learning experience and collaboration efforts. Video and audio recordings of the three experiment groups on day of mobile learning trail were also obtained. The conversational discourse during group tasks at the activity stations also forms an important research data to examine the scope and intensity of their collaborative learning experience. In this paper, our data focus on findings from the online survey and focus-group interviews.

4. Findings

This section presents the major findings that address the inquiries of our research focus. The analysis of the survey questionnaire provides insights into participants' experience of mobile learning and collaborative learning. For a greater in-depth analysis of the impact of curriculum design on the nature and progress of in situ collaborative learning, we would also discuss the responses of the focus group interview to establish that location-based learning, coupled with the affordances of mobile technology promotes a culture towards collaborative knowledge building.

4.1 Students' Attitude and Perception

The online questionnaire consists of two sections: namely the effectiveness of mobile learning and collaborative learning. There are a total of 42 Likert scale and two open-ended questions. The constructs of each section are shown in Table 2. We received a total of 181 responses (N = 181) out of the 197 participants in the mobile learning trail. The reliability coefficients of each factor were obtained using the index of Cronbach’s Alpha. The results showed every factor had a high Cronbach’s Alpha value (> .80) as indicated in Table 2.

Table 2. Survey Constructs and Cronbach’s Alpha of Factors

Section	Constructs	No. of items	Cronbach’s Alpha
Effectiveness of mobile learning	Learning	8	0.80
	Satisfaction	3	0.83
	Open-ended	2	
Collaborative learning	Self-perception	4	0.81
	Perception of team members	5	0.90
	Team work	9	0.90
	Progress	5	0.82
	Satisfaction	8	0.88

The mean values (M) and standard deviation (SD) of different factors for all classes are shown in Table 3. ANOVA tests were also carried out to evaluate the mean differences of factors between genders and classes. The analysis on gender issue was conducted to establish if there is any correlation between gender and performance in a computer-assisted collaborative learning environment. The results show there is no significant difference between genders for each factor. However, the ANOVA test on the mean differences of factors between classes shows that there is significant difference for the factor "Satisfaction_ML" ($F(8, 172) = 2.80$, $p < .01$), and marginally significant difference for the factor "Learning" ($F(8, 172) = 1.96$, $p = .054$). The post hoc tests results show that the difference for "Satisfaction_ML" occurs mainly between Class 4 and Class 7, Class 4 and Class 8, and the difference for "Learning" is mainly between Class 04 and Class 07. This could be explained by further analysis conducted which shows a strong correlation between "Satisfaction_ML" and "Learning". Students who regarded the mobile learning trail an effective and useful experience tended to have higher satisfaction level of the mobile learning experience.

Table 3. Mean and Standard Deviation for all Classes (N=181)

Class		Learning	Satisfaction_ ML	Self-perception	Team-perception	Team work	Progress	Satisfaction_ CL
01 (n=19)	M	4.17	4.12	4.39	4.27	4.16	3.91	4.26
	SD	0.48	0.86	0.51	0.66	0.72	0.70	0.64
02 (n=23)	M	4.20	4.41	4.29	3.84	3.91	3.54	3.89
	SD	0.46	0.64	0.51	1.09	0.79	1.00	0.80
03 (n=20)	M	4.31	4.40	4.60	4.23	4.29	4.03	4.46
	SD	0.39	0.66	0.37	0.65	0.52	0.68	0.34
04 (n=19)	M	3.86	3.77	4.26	4.22	3.99	3.72	3.88
	SD	0.59	0.68	0.57	0.58	0.66	0.73	0.75
05 (n=19)	M	4.10	4.28	4.37	3.77	3.74	3.62	3.92
	SD	0.60	0.94	0.61	1.12	1.12	1.20	0.83
06 (n=20)	M	4.22	4.18	4.47	4.36	4.26	3.85	4.23
	SD	0.42	0.57	0.58	0.79	0.64	0.76	0.55
07 (n=19)	M	4.46	4.68	4.47	4.36	4.25	3.79	4.33
	SD	0.44	0.42	0.46	0.56	0.44	0.59	0.59
08 (n=20)	M	4.17	4.60	4.47	4.19	4.02	3.94	4.15
	SD	0.60	0.51	0.58	0.65	0.63	0.65	0.53
09 (n=22)	M	4.16	4.35	4.35	4.26	3.99	3.65	4.20
	SD	0.55	0.89	0.54	0.65	0.55	0.75	0.70

Note: Satisfaction_ML=satisfaction of mobile learning, Satisfaction_CL=satisfaction of collaborative learning

4.2 Open-Ended Items

The two open-ended questions in the questionnaire aimed to elicit the participants' comments on three aspects of the mobile learning that they liked or disliked. The responses were analysed by means of categorisation. Within each category, responses were reviewed for content and grouped according to related factors. Finally, frequency of occurrence of responses within each of the categories was tabulated and ranked from the highest to the lowest. For the purpose of this study on the significant implications of curriculum design and in situ collaborative learning towards a knowledge building culture, the tabulated responses of the four most important categories with high occurrences of responses are reflected in Tables 4 and 5.

Table 4. Summary of Responses on the Three Points They Liked Most about the Mobile Learning Trail

Category	Factors	Frequency
Activities	Engaging and interesting hands on activities	125
Location-based Learning	Applying geography skills learnt in school in real world setting; using map in real life situations understand how topics relate to real world; increase knowledge, more resourceful and flexible	96
Self-directed Learning	Independent learning without teachers; making decisions in small group to locate stations and complete tasks	60
Collaboration	Get to work and learn with our friends; boost team work and strengthen friendship	57

As indicated in Table 4, the mobile learning trail creates an enriching learning experience for majority of the participants with a frequency of 125 responses citing the activities as one of the three things they liked most about the learning trail and a frequency of 96 comments indicating their appreciation of situated learning where the acquired geography skills were able to be applied in real life situations; thereby increasing understanding of how the topics could be applied in the real world. Closely related to “Activities” and “Situated Learning” would be the high indication of preference for “Self-directed learning” where participants esteemed the independent learning platform to make decisions in their respective small groups to locate stations using Google maps and to undertake tasks with minimal supervision. Likewise, it is also evident that a correlation between “Self-directed learning” and “Collaboration” could be identified where in situ collaborative learning has fostered greater cohesion and cooperation amongst the small groups as they were required to move from station to station on their own and complete given tasks at each station. Decision-making and finding solutions necessitated closer working relations, team work and support.

Table 5. Summary of Responses on the Three Points They Disliked Most about the Mobile Learning Trail

Category	Factors	Frequency
Duration	Insufficient time for tasks; didn't experience whole trail; duration too short for mobile learning	77
Mobile Device & Wireless Modem	Macbook was heavy; Can't see screen under glaring sun; unstable connections at times	41
Activities	Too challenging ; lack of challenge ; too few stations	30

Collaboration	Working with difficult people; unable to choose members ; prefer gender mix	20

Table 5 showed four main aspects of the mobile learning trail that participants liked least. It appeared that for the case of "Activities", controversial comments such as "too challenging" and "lack of challenge" could be related to the issue of duration. For those who were unable to complete tasks could have considered the activities too difficult and duration too short. Conversely, those groups that finished their tasks comfortably, showed preference for a longer mobile learning trail with more stations and tasks. "Collaboration" was surfaced with remarks on problems working with some team members. For a successful and progressive collaborative learning to take place, grouping of members is a crucial determinant too. Finally, "Mobile device and wireless modem" forms an important determinant of a successful mobile learning trail as the type of mobile device used and stable wireless access for location-based learning becomes critical in maximising the affordances of in-situ learning opportunities.

4.3 Student Perspectives on In-situ Collaborative Learning Process

Focus group interview was conducted with all the twelve participants of the three experiment groups. The face-to-face small group interview of about 40 minutes long allowed participants to share in greater details the reflections on their first in-situ collaborative learning experience. All participants voiced unanimously that the learning experience was refreshing as the activities at each station require them to interact with the environment in order to resolve their tasks. Lucas shared, "it's very fun so sometimes you forget that you are actually learning about something." Cayden commented, "I guess you could say this was a memorable experience. If you need to memorise facts; you will never forget certain mistakes you made during the Sentosa trip so I guess that helps..." It is evident that curriculum design leveraging on the affordances of the real world interaction in location-based learning, plays a vital role in engaging students and helping them to make meaning of their learning experiences.

Students also shared that the nature of the tasks and their immediate connection to real environment creates an unique experience of collaborative learning and building on each other's ideas to arrive at a final solution. Nathan shared on one of the tasks that impressed him most, "According to our geography teacher, using a clinometer and the distance between our position and our target, we can actually find out the height…so we actually use that to find out the height of the tallest tower." Lucas recounted, "Looking across the ocean at the tower for factories and all those - practical thinking and sightseeing..." The application of geographical knowledge and the critical reflections on location with the real environment became a whole new learning experience. New learning opportunities emerged when sense of place is leveraged (Lim & Barton, 2006). Making constant reference to their real environment for answers to the activities concretized their understanding of the topics learned in the classroom.

On their first experience at in situ collaborative learning, Nathan asserted, "We really need to work together in order to succeed." Casey explained, "The thing is everyone needs to accept everyone else and it has to be focused...accept one another and come to a consensus after everybody else has contributed". Akin to Brown and Adler's (2008) notion of "learning to be" where learning is conceived of as "the process of joining a community of practice", the students were conditioned into a learning environment that fosters collective responsibility - discussion of findings and affirmation of ideas and resolutions are part of the enculturation process towards collaborative knowledge building.

As mentioned earlier, another crucial element of in situ learning is the availability and affordances of mobile device and wireless which enabled them to source information and affirm solutions on the spot. Nathan commented, “we have more resources to work with: able to use the Google maps to locate stations and calculate distance to the tower” and Farizah underscored the perspective, “at least we get to use the Macbook more, take pictures, learn about features. It kind of refreshes your geography topics... measure height of the observation tower and figure out the types of tourism industries.” Apart from being able to use the mobile device to collect and host their findings for later references, participants find it a needful tool to maximise their learning opportunities in an outdoor setting. Evident in the findings from the survey and focus group interview, the Sentosa mobile learning experience has certainly acquainted the students with in-situ collaborative learning and paved the way towards collective responsibility in knowledge building.

5. Discussion and Conclusion

In this paper, we discuss issues and challenges for fostering collaborative knowledge building culture in the context of teaching and learning integrated humanities. Specifically, we focus on the design and enactment of one mobile learning trail that aims to scaffold students toward explicit idea sharing and productive discussion in authentic contexts. Pervasive knowledge building culture emerges when social conditions are conducive to such knowledge creation practices and epistemic views. Further, such conditions need to be carefully designed, embedded and fostered from an early stage. The school described in this paper holds much potential for promoting pervasive knowledge building culture since the school is new, teachers are open to constructivistic approaches, deeper understanding is emphasized in all curriculum design, and collaborative learning is an important skill across all subject areas. In sum, we found that the school is in a situation with relatively low barriers for introducing and adopting knowledge building pedagogies. One challenge that we face, however, is to shift student epistemic view on knowledge and knowing. This becomes more challenging to Secondary one students who just went through an extensive preparation for the national exam.

Data drawn from the Sentosa mobile learning trail show that students appreciated the authentic learning experiences where they had opportunities to apply what they learn in classroom. Further, in focus group interviews, a number of students expressed the necessity and enjoyment of working together as a group. While the teachers involved in this project expressed some concerns about student levels and gender differences in carrying out technology-mediated activities, our data show that there are no statistically significant differences. We are in the process of analyzing discourse of the three experimental groups, and in fact our preliminary analysis reveal that what matters in successful groups is not academic ability grouping or gender but group interaction to create knowledge building kind discourse.

It should be noted that data presented in this paper are drawn primarily from the mobile learning trail in one specific topic and cannot be generalized to other topics or subject areas. For our future plan, we are working toward creating more continuous and accurate indicators showing the progression of knowledge building discourse in and out of school. Moreover, we plan to further explore the affordances of mobile technology and associated applications in order to support pervasive knowledge creation practices. We have just began our trajectory to foster pervasive knowledge building culture where “a sense of the spirit of classroom communities in which ideas are at the center, knowledge building is the job, and collective cognitive responsibility is nurtured.” Scardamalia 2002, p.80), and more research will be conducted to document and share our experiences with the knowledge building community.

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