Mobile CSCL: Possibilities and Challenges Arising from the Future School Experience

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Abstract: In this paper, we present the case of a future school in Singapore to illustrate the importance of designing learning spaces conducive to mobile CSCL practices from pedagogical design perspectives. Core design considerations are (a) to design activity or task types that lead to collaborative meaning-making discourse and experiences, (b) to promote intentional learning experiences across classroom and outdoor settings, and (c) to promote interdisciplinary thinking and discourse through the design of learning tasks that integrate concepts and skills in multiple subject areas. We also discuss the possibilities and challenges arising from the experiences of studying the design and enactment of mobile CSCL practices in a future school context. Challenges and tensions in our research trajectory include the enculturation process of collaboration, the appropriation of technological platforms, and the conflicts in assessment methods and designed learning experiences.

Keywords: Knowledge building, mobile learning, future school, CSCL

1. Introduction

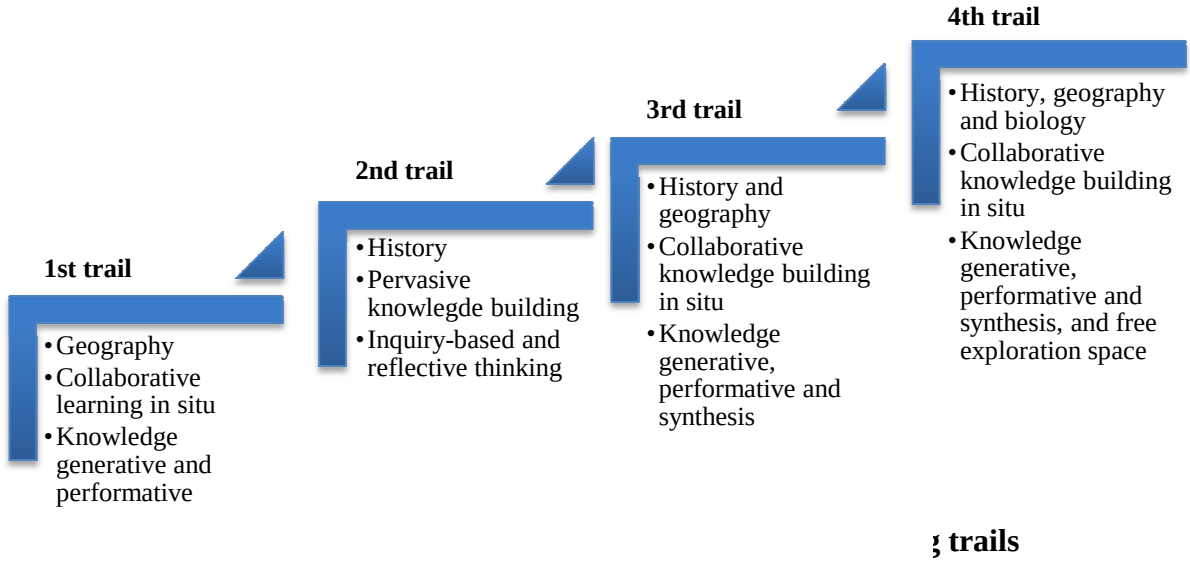
The design of learning spaces conducive to computer-supported collaborative learning (CSCL) with mobile devices (mobile CSCL hereinafter) can be considered from architectural, technological, and pedagogical design perspectives [1]. Here, the *architectural design* means the spatial and material arrangement of objects and resources in the physical environment. Schratzenstaller [2] argues for the criticality of architectural spatial design in schools: "even the best technological or pedagogical ideas cannot be used to their full effect if they are not architecturally integrated into the classroom" (p.35). The *technological design* refers to the arrangement and utilization of technological tools and artefacts in both physical and virtual forms. The challenge in technological design is to establish the high level of *compatibility* between technological tools and core practices of teaching and learning in schools. Lastly, the *pedagogical design* includes the planning and enactment of teaching and learning activities, involving changing roles, agency, and identity of teachers and students in future learning environments. In this paper, we present the case of a future school in Singapore to illustrate the importance of designing learning spaces conducive to mobile CSCL from pedagogical design perspectives. In particular, we discuss the possibilities and challenges arising from the experiences of studying the design and enactment of mobile CSCL practices in a future school context.

2. Brief Summary of Research Goals and Trajectory

The three-year design research in a secondary school, a member of the FutureSchools@Singapore program, has a particular goal to promote mobile CSCL

practices to foster collaborative learning and critical thinking skills among students, through the mediation of mobile technologies and applications. In terms of the technical infrastructure, the future school studied leverages on 1:1 computing and small class size of 20-25 students to create a technology-rich environment. The design of school buildings provides architectural spaces for open and flexible learning where students can freely discuss their ideas in a small-group setting. Under such socio-technical infrastructure, the research team together with participating teachers has designed and implemented mobile learning trails where students build their knowledge in-situ with the mediation of mobile devices and applications by linking their learning in classroom and outdoor settings.

Under this overarching research goal, our implementations involved topics in the lower secondary integrated humanities and science curriculum, which were redesigned to integrate knowledge, skills and attitudes to solve real world problems in authentic places via mobile learning. To date, four mobile learning trails have been implemented from January 2010 to August 2012. As design-based research, each trail has a different emphasis and research focus from knowledge building perspectives (see Figure 1 below). In the first implementation of the Geography Learning Trail in Sentosa, we sought to enculturate students into the practices of small group collaborative learning. For the second trail on the fall of Singapore, to promote continuous learning experiences, pre- and post-trail lessons were phased in so that students could engage in pervasive knowledge building practices in and out of school contexts. The third trail on British defence strategies at Fort Siloso, saw a rich integration of History and Geography topics where students engaged in both application-based and higher-level thinking questions. The fourth trail at the Singapore River was a concerted effort of the Biology, Geography and History teachers to scale up the project in the final intervention. Collaborating teachers and the research team seek to foster the integration of conceptual understanding through the three different subjects and different questioning techniques.



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3. Core Considerations for Pedagogical Design

We employed the knowledge building pedagogy as an overarching design framework to emphasize the criticality of "cognitive collective responsibility" [3] in making mobile CSCL as core practices. Toward this goal, explicit considerations to "*design the situation*" where mobile CSCL practices were embedded in the pedagogical design. In this section,

we discuss three core considerations for the enactment of the mobile learning trails and associated activities in and out of classrooms.

The first design consideration is to design activity or task types that lead to collaborative meaning-making discourse and experiences. Designed task types are largely categorized into and *performative* and *knowledge generative* tasks along the continuum of structuredness of problems [4]. In general, performative tasks require rather fixed and procedural application of concepts and skills whereas knowledge generative task types do not lead to single correct answers and require students to generate, experiment and justify their ideas. We designed and embedded both performative and knowledge generative types of tasks to examine the level and pattern of collaborative meaning-making under each task type condition.

The second design consideration is to promote *intentional learning experiences* across classroom and outdoor settings. Students tend to perceive field trips or outdoor learning trails as one-day outdoor activities and have difficulty to see the connection between classroom and outdoor learning experiences [5]. To help students make explicit connections between their classroom experiences and learning trail experiences, our design approach includes three stages from pre-trail to post-trail for continuous and international learning. In the pre-trail lessons, teachers scaffold students' cognitive understanding through the introduction of a Big Question that encompasses core ideas and concepts required in a chosen topic. Then, students in small-groups generate their own inquiry questions and ideas about the Big Question. During the outdoor learning trail, small groups engage in pursuing their group inquiry questions and the set of questions/tasks given by the teachers. Post-trail lessons are conducted to help students consolidate their whole experiences and ideas gained from the mobile learning trail and further help them rise above their ideas related to the Big Question.

The last design consideration is to promote *interdisciplinary thinking and discourse* through the design of learning tasks that integrate concepts and skills in multiple subject areas. Our design intention is to change students' beliefs about the simplicity of knowledge as separate and disconnected ideas. We wanted students to see the intricate yet complex relations among several concepts and skills learned in multiple subject areas, and how such integration of knowledge helps better construct deeper understandings. In the design of mobile learning trails, for instance, we designed and implemented several tasks integrating concepts and skills learned in biology, geography and history.

4. Mobile CSCL: Possibilities and Challenges

From the trajectory of the three-year design-based research, we draw some implications pertinent to the possibilities and challenges of CSCL classrooms in a transitory status toward future classrooms. Overall, we found that the research school has the strong socio-technical infrastructure, compared to many other local schools, which helped the initial stage of the research design and implementation. The school put a particular emphasis on the development of so-called 21st century skills such as collaboration, critical thinking and creativity, which are compatible with our main research goals. As a future school, the school provides facilities, tools, and resources where teachers and students can easily access and utilize for collaborative learning. The school also allocated fixed time slots for teacher professional development where teachers and researchers could collaboratively design learning tasks for research implementation and discuss the core ideas and principles underlying the knowledge building pedagogy. Under such school culture and infrastructure, we found that the teachers and students exhibit positive beliefs and disposition toward the importance of collaborative learning and the role of computer

support in the teaching and learning process. In addition, we observed positive impacts of the mobile learning trails and activities for critical thinking skills [6]. Teacher narratives revealed that they observed the differences in student discourse quality between the classrooms with and without mobile learning trail experiences. Teachers also perceived that the early experiences of mobile learning trails help students better connect concrete and abstract ideas and ask questions that exhibit higher levels of critical interdisciplinary thinking.

While it was encouraging to see many possibilities for promoting mobile CSCL as core practices in this future school context, we also found several challenges and tensions in our research trajectory, which include (a) the enculturation process of the know-how of collaboration, (b) the appropriation and coupling of technological platforms and tools leveraging on the affordances of physical environments and resources, and (c) the conflicts in assessment methods and designed learning outcomes/experiences. First, while students in general perceived positively about the role of collaborative learning, concurrently, we noticed that students exhibited conflicts in their espoused beliefs and real practices [6]. That is, students could articulate the meaning and importance of collaborative learning based on their espoused beliefs, but they tend to lag behind in their practices for engaging in meaningful collaborative discourse. Competitive and task-oriented disposition often led to the division-labor approach where students employed an efficient method to complete given tasks rather than engaging in collaborative meaning-making process. Overall, the sense of "cognitive collective responsibility" is still lacking even with the students with positive espoused beliefs about collaborative learning.

The second challenge lies in the appropriation and coupling of technological platforms and devices. Recently, we have witnessed the emergence of various technological platforms that claim to support collaboration. We, however, found that many of existing platforms do not support the type of CSCL practices for emerging non-linear activities and discourse. In the implementation of the four mobile learning trails and associate activities in classroom and outdoor settings, we increasingly recognized the importance of intentional learning in unstructured learning spaces where students can engage in their own inquiry questions and ideas rather than following the linear sequence of designed tasks. Particularly in the context of mobile learning trails, the process of collaboration can be emerging and non-linear with the learner's interaction with the situated resources, tools, and information. Our analysis of group discourse indicates that even performative tasks could generate high levels of collective meaning making when the tasks are designed to incorporate the unforeseen variables in the physical environment [4]. As more situational and complex variables are embedded into the design of collaborative learning tasks in authentic situations, we believe that there is a critical need to design CSCL technological platforms that effectively accommodate and support non-linear emergent types of learning at multiple levels (e.g., individual, cross-groups, community, etc.) and across time scales, events, and topics.

The last tension is related to rather macro-issues in the educational system about the conflict between desired learning outcomes and assessment methods. As argued by several CSCL researchers, assessment is a critical issue that makes the adoption and spread of CSCL practices more challenging in schools [7]. While the research school was built and designed as a future school, the school was not flexible from the requirements of the existing traditional assessment methods and high-stake exams that merit individual performance over collective cognitive understanding. More research seems necessary to develop assessment modes that value and measure productive critique and collective undertakings.

5. Conclusion

In this paper, we discussed core pedagogical considerations for designing learning situations where mobile CSCL practices can be meaningfully embedded and enacted to promote collaborative learning and critical thinking skills. Some possibilities and challenges arising from our research trajectory in a future school context are also discussed to inform researchers and practitioners who are working in a similar line of research toward designing future learning spaces. In conclusion, we emphasize that the conceptualization of teaching and learning toward future schools necessitates the fundamental transitions at technological, epistemological, and institutional levels. In particular, making mobile CSCL as core practices in schools entails changes in both teachers' and students' beliefs about the nature of knowledge and knowing, dispositions toward desired learning experiences, and serious considerations for designing right situations where collaborative meaning-making is critical.

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