Students' Capacity for Autonomous Learning in an Unstructured Learning Space on a Mobile Learning Trail

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Abstract: This research study investigates learner autonomy in the unstructured learning space on a mobile learning trail. Specifically, we examine how students leverage on knowledge resources and the physical affordances of the outdoor learning environment, to pursue their line of inquiries. Adapting Fischer and Mandl's (2005) coding scheme for the content dimension, we coded two groups' discourse, to examine the use of knowledge resource types. Analysis showed that contextual resources and the interaction with the physical affordances play a significant role in learners' capacity to see relations between given case information and new conceptual knowledge, as well as, activating prior knowledge resources. Overall findings indicate that autonomous learning rests essentially on the learning design, the appropriate measure at pre-structuring, as well as, student-and-teacher readiness.

Introduction

Building on our previous research efforts on small group collaborative learning in inquiry-based mobile learning (Tan & So, 2011), this study takes a step further to explore students' capacity for *autonomous learning* (Little, 1995) in unstructured learning space on an inter-disciplinary mobile learning trial. Here, we give emphasis to creating the conditions to support learner autonomy, where the entire learning environment be conceived as a whole in the design approach. Specifically, our research question reads:

- RQ 1. What type of knowledge resources do students use, in pursuing their line of inquiries/ hypotheses in the unstructured learning space on a mobile learning trail?
- RQ 2. To what extent do the following design constructs impact students' capacity for autonomous learning in the unstructured learning space?: a) task type & level of pre-structuring (we conceived of learning objectives, task-type and level of pre-structuring as mutually constitutive, as such, these shall be investigated as a whole); b) technological mediation.

Research Methodology

Research Context

We defined an unstructured learning space on a learning trail as a white space, designed with specific desired learning outcomes and is set apart for learners to pursue their own line of inquiries, leveraging on the physical affordances of the trail site, with minimal teacher supervision given the level of pre-structuring and scaffold support. Participants are two classes of secondary two students at one of the Singapore future schools. The mobile learning trail and the unstructured learning space took place at the Singapore River. To examine more closely the use of knowledge resource types and the impact of trail design on autonomous learning, we observed two groups of students from each of the two classes. Group A consists of four students and group B, five students.

Design Considerations

<u>A Contextualized Learning Design</u>

We employ a process-oriented framework (Strijbos, et al., 2004) to scaffold and to support learner autonomy. First, we position the learning trail as part of the larger continuum and the phasing in of an unstructured learning space was to enable greater learner autonomy in context, as aforementioned, learners can only exercise autonomy within legitimate frames of reference. Pre-to-post trail activities were co-designed by the research team and the collaborating teachers from the Geography, History and Biology department, to see how the three subjects can lend content to each other in the trail activities. To scaffold and support students learn process, collaborating teachers guide the inquiry-based learning trail by observing a gradual progression from well-structured task-types (performative and applicational) to less-structured task-types (knowledge generative and synthesis). Further, to facilitate the integration of conceptual understanding of the three different subjects on river, civilization and change, an overarching big question on "why does civilization begin at the mouth of a river?" was put in place. Pre-trail lessons on famous rivers in the world serve as a tune-in, as well as, a platform for students (in groups of four to five) to develop own line of inquiries relating to the big question. Likewise, the trail tasks at the three learning stations along the river, form part of the efforts at pre-structuring and scaffolding of learner autonomy. Students, in small group of fours or fives, were given thirty to forty minutes to pursue their pre-trail inquiry along the river vicinity, after completing all trail activities. Post-trail activities was a measure for follow-up and debrief, allowing groups to share their findings, and attempt a 'rise-above' phase of the knowledge building progressive inquiry cycle.

Technology Mediation

The appropriation of technological tools to support learner autonomy in the unstructured learning space lies primarily in two considerations: one is the requirements of the task types in relation to the trail site; two, is the students' comfort level with the mobile devices and software applications. As an initial study to investigate students' capacity for autonomous learning, the deployment of mobile technologies is, hence, viewed in the context of the learning design, desired learning outcomes, and with the intent to empower students to take on "user-led education", creating their own content with peers beyond the four walls of the classroom. Each small groups of four to five, was equipped with two iPads and two data-loggers and probes (to measure the water condition). And to reduce the physical presence of the teacher and frontal loading of information, all trail activities are hosted on the web-based platform (see Figures 1 & 2). Students were also able to host all their findings and collated artifacts (pictures etc.) on the web-based platform. The provision of the broadcast alerts and feedback features seek to enable immediacy of teacher facilitation and inter-group communication on the mobile learning trail.

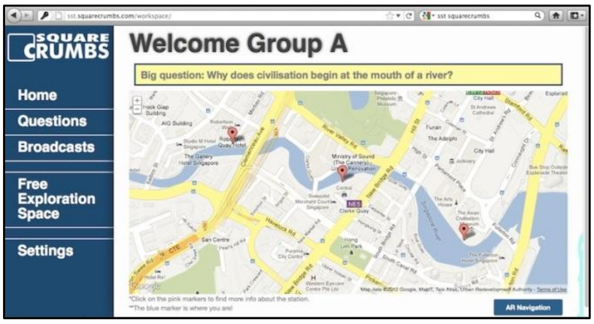


Figure 1. Web-based platform hosting all trail activities and customised Google map of trail site

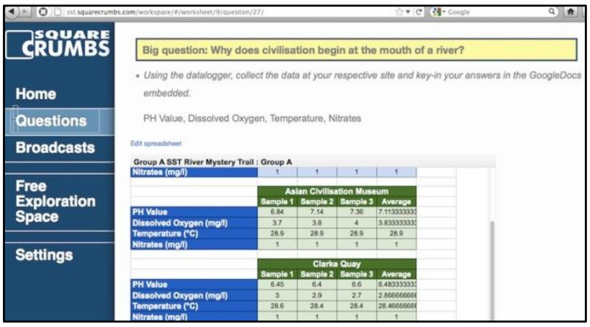


Figure 2. Well-structured task on measuring water conditions at three different sections of the river

Data Collection and Analytic Approach

Group discourse and interaction of the two experimental groups, A and B, was video- and audio-recorded and transcribed (app. 38 pages in total) for analysis. Excluding non-task talk and the sporadic private conversations, we studied and analysed a total of 113 segments of content- and task-related statements (questions statements inclusive) in the group's discourse - pursuing their inquiries and hypotheses in the unstructured learning space. Chi (1997) proposes the use of semantic boundaries to determine the unit of analysis as an idea may require a few sentences to put across, and moreover, similar idea could be surfaced several times by team members who are more vocal. Hence, each of the 113 segments forms a unit of analysis and may contain one or more than one statements/ question statements depending on the discussion threads, ideas and turn of talks. To ensure consistency and validity, three rounds of coding were conducted by the first author.

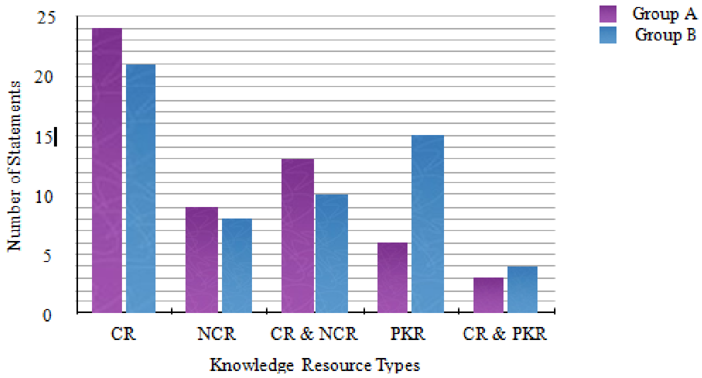
We adapted the coding scheme for the content dimension from Fischer and Mandl's (2005, p. 416) where they investigate the knowledge resource types learners leverage on, in the group discourse. Fischer and Mandl (2005, p. 406) argue for the significance of "transactivity in discourse" and the need to investigate how learners build on and advance one another's ideas to negotiate and to converge at shared meanings. More specifically, they proposed an investigation of how learners leverage the knowledge resources available and accessible to them, ranging from prior knowledge to given contextual resources, to collaboratively create and construct new knowledge and meanings. There are five categories of knowledge resources that learners use in the unstructured learning space, pursuing their inquiries and hypothesis: (1) Contextual Resources (CR), (2) New Conceptual Resources (NCR), (3) Relations Between Contextual Resources & New Conceptual Resources (CR & NCR), (4) Prior Knowledge Resources (PKR), and (5) Relations Between Contextual Resources & Prior Knowledge Resources (CR& PKR). Considering the mobile learning context and the learning design for our research study, we define contextual knowledge (case information) as resources made available at the pre-trail activities, the overarching Big Question, as well as, the trail activities at the trail site, and by theory text, it refers to the integrated conceptual understanding of the three subjects, Biology, Geography and History and Biology on river, civilization and change.

Findings

A Comparison of the Frequency of Knowledge Resource Types Used

Table 1 depicts the frequency of the range of knowledge resources both Group A and Group B tapped on, in the course of pursuing their line of inquiry in the unstructured learning space. Both groups showed relatively high usage of contextual resources as compared to other knowledge resource types. Another noteworthy finding is, students display the ability to develop new conceptual resources arising from harnessing contextual resources, as well as, the interaction with the physical environment of the riverside. Further, they were able to draw connections between contextual resources and new conceptual resources.

Table 1: Frequency of Knowledge Resource Types Used in Group Discourse



One distinguished difference between both groups lies in the activation and application of prior knowledge resources. Group B generated significantly higher number of statements (question statements inclusive) harnessing prior conceptual knowledge (ref to Table 3). We attribute this phenomenon to the nature of Group B's pre-trail inquiry on the "*timing* of the clean river campaign in the 1980s" and their hypothesis on possible significant events that could have impacted the phasing in of the clean river campaign. Contextual resources in the physical environment were insufficient for their line of inquiry. Likewise, student's capacity to develop and affirm new conceptual resources and/ or see relations between these resource types, became unwittingly contained within the availability and accessibility of the options and resources at the learning trail. Analysis of the discourse moves in the group's discourse and field notes showed them making reference to significant events and developments in the Singapore during the researched period, and affirming these inferences with authoritative sources on the Internet, before they could eventually converge at shared understanding. Conversely, group A's pre-trail inquiry on "what happened to the Singapore River as a trading point, and why it was removed and what is it now?" afforded them greater leverage on contextual resources and the physical affordances of the river site to affirm their new conceptual resources, and to draw valid inferences between contextual and new conceptual resources. The application of prior knowledge resources was also rendered more effortlessly. Similarly, it was easier for the group to identify and affirm relations between the contextual resources and the prior knowledge resources.

Impact of Learning Design and Physical Affordances on Use of Knowledge Resource Types

Pre-trail tune-in activities on famous rivers and the introduction of the big question on "Why civilization start at the mouth of a river", serve as an essential platform for students in small groups to generate their line of inquiry and hypothesis, they intended to pursue. Albeit that the eight groups from the two classes formulated varied inquiries and hypothesis, yet their intended research inquiries fall within the parameters of the big question and the integrated conceptual understanding of the three different subjects on river, civilization and change. However, the scope and subject matter of the various groups' inquiries do determine to a considerable measure the knowledge resources types they are inclined to use in their group discourse - negotiating and affirming findings and new conceptual understanding as exemplified in the case of Groups A and B, where the latter activated more prior knowledge resources to make valid inferences to their inquiries.

Noteworthy is also the *immediacy* and *interactive* feature of the knowledge resource types that students are able to identify with and make reference to. Trail activities ranging from well-structured tasks on measuring water conditions to ill-structured tasks on importance of water quality also form a significant component of the contextual knowledge resources students could leverage on, in the unstructured learning space. Table 3 shows a high usage of contextual resources in contrast to other knowledge resource types. A simple reason is the "*immediacy"* of this measure of contextual resources (trail activities that take place prior to the unstructured learning space) and the "*currentness*" of the interaction with the learning environment where learners are empowered to develop new conceptual resources and to draw sound relations between contextual resources and their new conceptual understanding. The same is also true for the activation and application of prior knowledge resources and the relations they make between contextual resources and prior knowledge resources as shown in the discourse moves. Students' capacity to draw valid inferences is largely contingent on the "sense of place" to make sense of the contextual resources, and importantly, on the interaction with the physical environment to apply prior knowledge resources.

Role of Technology in Learner Autonomy Support

The analysis of the groups' discourse shows technology assumes more than a mediatory role in some instances. It depends on the type of knowledge resources, learners deploy. Google map of the trail site (see Figure 1) with location pins indicating the three learning stations affords students a "sense of place" in relation to the vicinity and the surrounding. Both groups displayed a heavy reliance on the Google map to locate environmental artifacts for evidences to support their hypotheses and affirm findings to their inquiries. For Group B, the Google apps enable location mapping and navigational possibilities (e.g. directions, bearings, distance and scale) to test their hypothesis on the clean river campaign and possible significant events. Further, for Group B in particular, in the absence of the physical presence of teachers, they made use of the authoritative sources via the Internet to affirm their new conceptual resources relating to the contextual resources. Likewise, the application of prior knowledge resources was made possible via technology-mediated cognitive tools to confirm their inferences.

Discussion and Conclusion

Our findings carry two important implications/ challenges on promoting learner autonomy in the context of collaborative mobile learning. First, we do not ascribe autonomy to the learners, rather, we prescribe, and we do so, by means of designing the learning situation and scaffolding their learn process. The staging of the learning continuum from pre-to-post trail was a necessary and pivotal measure to facilitate the execution of the unstructured learning space and to provide learners with the cognitive autonomy support. For instance, the rich integration of the three subject areas in the design of the activity questions and the framing of the big question on civilization and river, serve as crucial cognitive support for the learners when they become agents of their own learning in the unstructured learning space. Second, the efforts of prescribing learner autonomy do not rest solely on an excellent learning design, as the student and teacher readiness remain issues of challenges. Promoting student autonomy is contingent on promoting teacher autonomy for the teacher possesses the content and the professional expertise to determine the scope and the measure in releasing autonomy to the learners by appropriating the relevant scaffolds and creating the learning conditions (Little, 1995). Students exhibited hesitations and uncertainties in affirming their findings and inferences, as they still perceive the final endorsement from the teachers as a legitimate source of confirmation of the direction they are taking.

Although we witnessed some promising results in this initial research study on learner autonomy in unstructured learning space, we acknowledge that there could be limitations such as the integration of other disciplines whose cultural and social practices differ with changing learning contexts. However, we are persuaded that promoting learner autonomy calls for more than a situation of integrating state-of-art technology into teaching and learning. It necessitates the orchestration of the entire desired learning situation for the desired learning outcomes.

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