Technology and Pedagogy Design for Collaborative Second Language Learning

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Abstract—This article describes a design research project on Rapid Collaborative Knowledge Improvement (RCKI) supported by a networked technology called “GroupScribbles” (GS) in the context of secondary classroom language learning in Singapore. The paper illustrates the technology design of the GS software to support students’ in-class collaborative learning. A pedagogical model is proposed to provide a structured representation of the functions and processes to enable RCKI practices. It is found that the GS technology and its corresponding pedagogical model effectively scaffold students’ collaborative learning to achieve desired secondary language learning outcomes.

Keywords—GroupScribbles; Computer-Supported Collaborative Learning; Second Language Learning; Rapid Collaborative Knowledge Improvement

I. INTRODUCTION

There has been much emphasis on the integration of collaborative learning into second language (L2) learning [1][2]. A promising line of work looks at the seamless integration and orchestration of individual learning, small-group and whole-class interactions in the classroom. Various technologies are used in classrooms to enhance the teacher-student and student-student interactions with the belief that technologies promote productive meaningful interaction for L2 learners [3][4]. How to design technology supported learning experiences through computer-supported collaborative learning (CSCL) is always a challenge. This is particularly true in real classroom language learning where the context is complex and dynamic. This study discusses how we use GroupScribbles (GS) technology equipped with appropriate pedagogical design to enhance students’ L2 learning in Singapore classrooms.

Singapore is a multiethnic and multilingual country, in which bilingualism refers to proficiency in English which is recognized as the L1, and the L2 known as a “Mother Tongue Language” (MTL). Chinese or Mandarin is Chinese students’ MTL. The Ministry of Education in Singapore defines MTL not by the language used at home or the first language learned by the student but by ethnicity [5]. For this reason one of the characteristics of L2 learning in Singapore is the difference of students’ language abilities in a class due to their different MTL backgrounds. For typical ethnic Chinese students in Singapore, their lack of motivation and limited basic linguistic capability continue to be the fundamental challenges to their learning in Chinese Language [6]. Our school-based research is to address the typical linguistic weaknesses of younger Chinese in their L2 proficiency. We introduced CSCL in face-to-face (F2F) Chinese language classrooms to help the students learn better by collaboratively constructing language knowledge together through authentic verbal discussion (in Chinese) mediated and enhanced by GS. A design-research approach is adopted to address complex problems in real classroom contexts in collaboration with practitioners and to integrate design principles with technological affordances to render plausible solutions [7][8].

II. LITERATURE REVIEW

Collaborative learning has been extensively investigated in the context of L2 learning [9][10]. It has a ‘social constructivist’ philosophical base, which views learning as construction of knowledge within a social context and which encourages acculturation of individuals into a learning community [11]. Learners co-construct knowledge by working on joint problems or tasks, including making individual contributions, partaking in discussion and arriving at joint solutions. In the literature on Second Language Acquisition (SLA), learners’ active involvement in interaction with other learners of the target language has been identified as a fundamental aspect of the learning process as it provides opportunities for students to engage in negotiation of meaning. In doing so, they adopt ideas from peers and share specific conceptions after collaborating. They influence one another, and converge or diverge with respect to language knowledge.

When learners learn together, members of the group are becoming similar with respect to their knowledge, as knowledge equivalence and as shared knowledge prior to, during, and subsequent to collaborative learning [12]. This will lead to knowledge convergence, which is an increase in common knowledge that all collaborating learners had [13]. Learners who converge in knowledge have been found to benefit more from collaborating than learners who do not [14]. Computer technologies play an important role in supporting students’ collaborative learning. Networked technologies offer the potential to bring collaborative learning to new heights. In a CSCL environment, participants are actively and collaboratively engaged in creating knowledge, and collaboratively is taking place through a computer network. They engage in a coordinated effort to perform a task together to establish common knowledge [15].

III. RESEARCH DESIGN

Our GS-based collaborative activities are co-designed by the teachers and researchers. The school provides a technology-rich environment for students. Each student is equipped with a laptop (Apple Macbook) and the class size is 20-25. Teachers and students have sufficient experiences in technology-supported teaching and learning. The students work on groups of four in their collaborative discussions. The students in a group are seated next to each other with a Tablet PC, and they engage in F2F talk.

A. Technology Design

The technology tool we used to support students’ collaborative learning is GroupScribbles (GS), which was co-
developed by SRI international and National Institute of Education Singapore. The GS user interface presents each user with a two-paned window. The lower pane is the user’s personal work area, or ‘private board’, with a virtual pad of fresh ‘scribble sheets’ on which the user can draw or type (see Figure 1). When the scribble sheet is moved to the public board, it can be synchronized to all the Tablet PC’s public board so that all the members can view it. A student can select any group board by clicking the board number on the right-top, and browse all other groups’ postings on their individual public board. The essential feature of the GS client is the combination of the private board where students can work individually and group boards or public boards where students can post the work and position it relative to others’, view others’ work and take items back to the private board for further elaboration. It enables collaborative generation, collection and aggregation of ideas through a shared space based upon individual effort and social sharing of notes in graphical and textual forms. In our design research GS is used routinely in F2F classroom setting. Effectively supporting students’ F2F interactions as well as coordination in collaborative learning becomes possible with the use of GS.

**B. Activity Pattern**

Figure 2 shows a generalized student activity pattern supported by GS has been found to be successful. One particular set of affordances of the GS-based learning environment is the ability for students to engage in private interactions in the GS private board, group interactions in the group board together with F2F verbal discussion, and class-level interactions through GS. When students work in the GS private space without others being able to see or directly impact them, they can engage with their materials and sense-making processes individually in a focused way [16]. When they drag the posting to the group board, they engage in the group interaction by constructing and discussing about the product or their work [17]. Then they visit other group boards to engage in class interactions where they are exposed with full range of ideas and artifacts, and they critique these ideas/artifacts. At the end of this activity, they go back to their own group board to engage in group or private interactions where they improve their ideas/artifacts after seeing other groups ideas/artifacts and comments. It is evident that GS technology scaffolds the process of different levels of interactions and the seamless switch between them: private interaction - group interaction - class interaction – group/private interaction. It enables a synergy between autonomy and collaboration by combining both private and collaborative learning. The F2F GS environment leverages resources such as shared screen, gestures, and conversation norms to help students jointly construct meaning, become more proficient in participating in representation-based interactions, and build a common understanding of the subject matter [18].

![Fig. 1. The User Interface of GS](image)

**C. Pedagogy Design**

The innovation in student learning is not about the technology but the integration of technology and pedagogical practices in supporting the meaningful language learning activities. The pedagogy we used is Rapid Collaborative Knowledge Improvement (RCKI), which refers to the notion of democratizing participation and idea refinement in the context of live dynamic classroom settings, that is, face-to-face collaborative knowledge construction and improvement over the duration of a class session, and supported by certain technologies for lightweight instant interaction [19]. Implemented concretely in the classroom, RCKI takes the form of alternative ways to promote classroom interactions that enable students to co-construct knowledge and learn skills. At the same time, it is designed to address, the constraints faced by classroom teachers, namely, the short duration of a classroom lesson ranging from half an hour to one and a half hours. The notion of “rapid” stems from 3 main dimensions: 1) within a limited time of participation; 2) using lightweight form of expression; 3) enabling quick cycles of interaction. RCKI therefore owns its distinguished value for guiding real classroom teaching and learning in which learning efficiency is particularly emphasized.

RCKI focuses on knowledge sharing democratically as well as cycles of individual and group knowledge enhancement. It is distinguished from Knowledge Building process of Scardamalia and Bereiter [20] which connotes the process of idea improvement over a protracted or extended period of time, and strongly emphasizes on its coherent effort to initiate students into a knowledge creating culture [21]. The concept of RCKI hence may be more suitable for guiding language learning, especially L2 learning. L2 teachers typically handle the low proficiency of students in the target language by focusing primarily on vocabulary and grammar, and hence approaches like ideas generation and expression are seldom brought to the fore [22] [23]. When students’ cognitive load is not just expended on language expression, the enthusiasm and capacity of L2 learners to engage in reading and writing of on-line based interaction could be enhanced [24].

In order to provide an intuitive grasp of the RCKI for teacher facilitators and learners, especially for beginners, we
proposed a collaboration model that embodies the concept of RCKI. The model is called a Funnel Model to make tangible the stages of the construction of knowledge. The Funnel model mainly includes 4 parts, of which the main body is consisted by 3 parts (See Fig.3). From the left to the right, they are “Seek diversity of ideas”, “Pool collective wisdom”, “Seek greater perfection” respectively. The funnel shape implies sharing ideas or related information at the first stage should obey the rule “Seek diversity of ideas”. The separated and continued steps refer to the requirement for consistent ideas improvement. The bottom space is left for inter-group interaction, where students from other groups are encouraged to give their feedback after visiting.

D. A Lesson Example

We take one learning comprehension activity as an example to describe the learning design in details. The teacher assigned some questions for each group, and those questions were designed to assist students to get to the pith and marrow of the text. After reading the text, the students in each group brainstormed responses to their individual group question. Following the “lightweight” principle, the students were encouraged to contribute their rough ideas or share their prior knowledge in a few words within a short time (usually 5-6 minutes). All the postings in this part were not necessarily very mature, but each new idea was appreciated. Subsequently, students conducted a face-to-face discussion to organize, synthesize and further modify their existing individual postings or create new postings that build on the individual ideas. After that, they were required to visit other group boards, posting their suggestions or comments on the bottom of individual group board. When the students returned back to own group board, they needed to further refine their group answer based on the feedback given by other groups. After further verbal negotiation and combination, they were required to seek consensus and finalize their group idea, and posted it onto the final stage of the model.

When we collecting data in classroom, two researchers observed each class and took down detailed field observation notes. One video camera was set behind the classroom to record the classroom session, while the other video camera was focused on the target group of students. Screen capturing software iShowU was installed on all students MacBook to capture the process of each student’s work on the PC and their verbal talks and facial expressions. After each lesson, students wrote their feedback on the class’s blog. The teacher and the students shared with us their experience and new understanding of collaborative learning over a whole semester in the teacher’s interview and a focus group discussion.

TABLE I. READING COMPREHENSION ACTIVITY DESIGN BASED ON FUNNEL MODEL

<table>
<thead>
<tr>
<th>Step1: Seek diversity of ideas</th>
<th>Step2: Pool collective wisdom</th>
<th>Step3: Inter-group visiting</th>
<th>Step4: Seek greater perfection</th>
<th>Step5: Group presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate questions as many as possible after reading the text</td>
<td>Discuss all of the posted questions, give the answers to these questions and pick out the questions that they cannot reach an agreement within the group</td>
<td>Look through other groups’ questions and answers; help other groups to improve answers for those complex questions</td>
<td>Look back in own group to modify own group answers based on comments given by other groups</td>
<td>Present the process of solving the complex questions which had no answers at the beginning, but was lastly solved.</td>
</tr>
</tbody>
</table>

IV. PRELIMINARY FINDINGS

Due to the page limit, we skip the detailed analysis on students’ learning processes and outcomes in the above mentioned lesson. Here is the summary of the findings. We observed successive communal engagements with the given reading materials and knowledge sharing which allowed the building and internalization of knowledge. We analyzed how the group students built comprehension by interrelating different understandings of the text. It seemed that following the funnel model, students who have just started how to do collaborative learning tended to contribute their understanding based on their individual language proficiencies and built new, collaborative and agreed-upon meanings. Students’ post-class reflections showed that most of them had a basic understanding of the intention of the funnel model design. Student A wrote:

"I like very much the first stage of the model, in which each student can post own ideas, and then we proceed to do analysis and synthesis. It enhances our thinking skills.

Student B posted:

"My favorite is the last part of the activity that requires students to do group discussion. We can learn and help one another through the group discussion. This can help those students who are week in Chinese."

This GS-supported RCKI pedagogy provides a kind of scaffolding for teachers to embark on collaborative learning activities in the classroom and to manage the risks of the activities breaking down or not reaching any kind of fruitful collaboration. In the interview, the teacher said that she became more confident of conducting the GS lesson using the funnel model. She said that she derived a better understanding of collaborative learning and RCKI. Students shared in their interviews that after a series of lessons they had been familiar with the funnel model, and even internalized it:

"We’re already used to it. Perhaps we will not write it down. But our mind still works the same way. Because we’ve used it a lot of times, we are familiar with how we should think, or how to give suggestions and then gradually turn it into a perfect answer. We might not use your method. But the idea behind remains the same. From everyone’s ideas to one combined answer."
V. CONCLUSION AND DISCUSSION

The GS technology and funnel model jointly scaffold students’ collaborative reading comprehension. Scaffolding is distributed across the tools and context in which learning is happening. The GS technology scaffolds students’ collaboration and distributed cognition occurring across activities, artifacts, within group and across groups. The GS is a shared workspace for all the students to share knowledge and ideas. Students are able to view the artefacts generated by other students. They provide feedback to other groups’ artefacts, question each other and argue about the meanings, which in turn build community knowledge.

Therefore, in this F2F CSCL environment, language knowledge is not an object that is acquired and possessed by individuals, but embedded in the conversations and social discourse. Without a specific pedagogical design, GS is a general collaboration tool that supports different level of interactions by taking into account both individual and social processes in CSCL. When equipped with the funnel model to help students plan and organize their problem solving, GS is transformed from a general tool for enabling seamless interactions to a scaffolded software tool integrated with pedagogical design for supporting specific learning goal by problematizing important disciplinary content.

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