Group Scribbles-Enhanced Collaborative Learning Improves Reading Skills: An Experiment Study in Primary Classrooms

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Abstract: To improve reading skills of students in primary schools, we introduced Group Scribbles-enhanced collaborative learning into a language classroom. The quasi-experiment study conducted confirmed the positive role of technology intervention in improving learning effectiveness and improved learning attitudes. Further analysis carried out revealed the collaboration patterns emerged in the learning environment designed.

Keywords: CSCL, language learning, expository text, primary education,

Introduction

Researchers and practitioners on language learning have made great efforts to identify effective pedagogies to improve students' reading skills (Alvermann & Earle, 2003). The course of reading, in essence, is mining and analyzing information from the reading material and recalling and relating existing knowledge and past experiences to make meaning (Dole, et al., l991). This meaning-making process can be facilitated through inter-psychological interactions where meanings are negotiated, constructed and consolidated from multiple perspectives. Besides deepening comprehension, social interactions can also enhance students' motivation, interest and confidence in reading (Hollingsworth, et al., 2007; Spörer, et al., 2009). These benefits endorse the adoption of collaborative pedagogies where interactions between\among learners are pursued and promoted in language classrooms.

To better support student collaboration, network technologies are introduced into classrooms as the virtual medium is insulated from physical limitations. In our research, we are investigating how to leverage on networked technology-enhanced collaborative learning to improve students' language learning. In this study, one of our endeavors made in a primary school and its outcomes are reported. We hope the achievements and pitfalls encountered in our exploration can help the community better visualize the need and the method to engage technology intervention in collaborative language classrooms.

1. Research Background

In our school-based research, we introduced Group Scribbles (GS), a networked technology co-developed by Learning Sciences Lab and SRI International to a local primary school. Based on the metaphor of whiteboard and sticky notes for collaborative knowledge

construction (Roschelle, et al., 2007), GS has been regarded as an effective and flexible tool for collaborative activity design and enactment in classroom settings (Looi, et al., 2011). Previous research has affirmed that GS enhanced collaborative learning can improve students' learning outcomes, attitudes and epistemology in learning science and math (Looi, Chen & Ng, 2010; Looi & Chen, 2011) and L2 (Chen, Wen, & Looi, In press) in primary schools. Here we translated GS-enhanced collaborative learning into L1 (Chinese language) classrooms. A quasi-experiment study was designed and implemented to examine whether the integration of online interaction could produce improved learning outcome. In the GS experiment class, student perceptions of the learning experience and interaction patterns emerged were also documented and analyzed. Through combining triple sources of data, i.e. learning performance, perception and process data, the role of technology intervention in promoting classroom collaboration and language learning could be better revealed.

2. Research Design

2.1 Participants

Two Grade 4 classes (each of 30 students) participated in our quasi-experiment design. We randomly chose one as the experiment class and the other as the control class. Students in the GS experiment class had received considerable ICT training since Grade 3 and attained good ICT literacy. After GS enculturation, they had developed satisfactory proficiency in using the technology. Students in each class were then equally distributed into 6 groups. In grouping, students of different L1 proficiency (indicated by students' Chinese language test scores before intervention) and gender were put into one group. The grouping was made so as it was proved in previous research that 3-5 students of different ability and gender composing one collaborative group benefits language learning (Salvin, 1985).

2.2 GS Technology

Unlike the control class where student collaboration was achieved through F2F interaction, students in the experiment class could engage in both F2F discussion and GS interaction in learning. In GS lessons, each student group was provided a laptop with GS installation. GroupScribbles 2.0 presents users with a two-paned interface encompassing a private working area, the "private board" in the lower section, and a public working area, the "public board" in the upper section (Figure 1). Students generate virtual pads of "scribbles" on the private board to draw, write and type in their ideas. All the actions performed and contents produced in this area are invisible to others. Scribbles are published and shared as students drag them onto the public board which is synchronized among all learning devices. Scribbles on public board can be removed, replaced, and withdrawn to private boards for editing. The essential feature of GS technology is the synergy of autonomous cognition (on private board) and collaborative cognition (on public board). The GS technology is highly customized as users can insert pictures, templates and movie clips on the public board. In our study, graphic organizers that helped students analyze text structures were incorporated.

2.3 Pedagogical Design

In our intervention, altogether 8 lessons on Expository Text reading (40 minutes per lesson, 2 lessons per week\per text) were designed and implemented. Student Teams Achievement Division (STAD) was adopted to guide the pedagogical design (Slavin, 1987). To facilitate students' meaning-making process, two reading strategies, namely text structure analysis

and summarization, were employed. In text structure analysis, students were required to complete a graphic organizer for the given text by extracting the themes\topics introduced and connect ideas\information presented (Tree chart for conceptual structure; concept chart for conceptual structure; flow chart for sequential structure). In summarization, students were requested to sum up the main idea and write an abstract for each paragraph. All these reading activities could help students to better grasp the anatomy of the text and its key components. In the experiment class and the control class, identical learning activities were carried out with occasional teacher scaffolding (Table 1). To ensure consistency in instructions, lessons in both classes were delivered by the researcher.

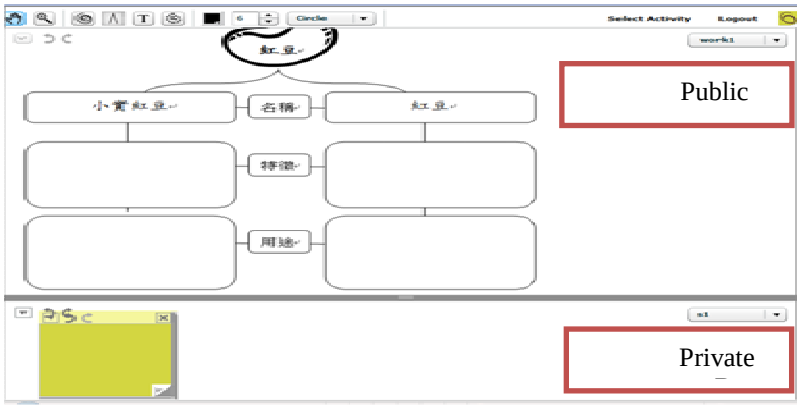

Figure 1. Group Scribbles Interface

Table 1. Collaborative Pedagogical Design

Step	Learning Activity	Description
1	Topic Introduction	Teacher introduces the theme\topic of the expository text.
2	Text Reading	Students read the text.
3	Text Discussion	Teacher proposes questions and leads student to discuss these questions.
4	Text Structure introduction	Teacher explains and elaborates on the structure of expository texts.
5	Text Structure Analysis	Students interact within the group to complete the graphic organizer provided (experiment class: F2F + online; control class: F2F).
6	Group Sharing 1	Each group presents the completed graphic organizer. Students review and comment on the graphic organizers presented. (experiment class: GS; control class: pen & paper)
7	Text Summarization	Students interact within the group to compose abstracts for each paragraph.
8	Group Sharing 2	Each group presents the completed paragraph abstracts. Students review and comment on the abstracts presented. (experiment class: GS; control class: pen & paper)
9	Reward & Round-up	Students vote for the best group work. Teacher rewards the best group and rounds-up the lesson.

3. Data Analysis & Discussion

3. 1 Performance Analysis: GS Enhanced Improvement in Students' Reading Skills

To measure students' improvement in reading skills, a reading comprehension test was developed. Three types of questions were incorporated in the test paper: 1) "Literal" questions, the answers to which can be obtained by "quoting" the text; 2) "Inferential" questions, the answers to which can be obtained by drawing inferences and implications

after analyzing ideas\information embedded in the text; 3) "Integrated interpretation" questions, the answers to which can only be obtained by associating and relating ideas\information embedded in the text, student's existing knowledge and personal experiences. In the test paper, there were both multiple-choice questions (including all three question types) and open-ended questions (type 3 questions only). To ensure validity of the test paper, we invited expert teachers to review the questions constructed. A pilot test in another Grade 4 class was administered to further improve the test. According to Ebel & Frisbie (1991), the level of difficulty and discriminability of good test items should fall in the range of 0.4-0.8 and 0.4-1 respectively. After several rounds of modification, the 13 test items developed on average reached good difficulty (0.54) and discriminability (0.71). Moreover, a Pearson correlation analysis between student Chinese test scores and pretest scores was conducted. The strong correlation observed (experiment class: r= .772, p= .001; control class: r= .936, p= .000, table 2) further suggested the test paper crafted was of good validity. A pre-test and post-test design was employed to assess student learning gains. In both rounds of test, the same items were used but presented in different orders.

Table 2. Correlation analysis between Chinese test scores and pretest scores

Class	Test	Mean	SD	Correlation	Sig.(2- tail)
Experiment class	Pre-test	91.78	5.719	.772	.000
	Chinese Test	34.23	10.846		
Control class	Chinese Test	92.61	4.540	.936	.000
	Pre-test	36.97	11.577		

Considering students in two classes might vary in reading competence, when comparing their performances in the post-test, we used their pre-test scores as the covariant. The assumption of Analysis of Covariance (ANCOVA) was met as the regression coefficients between the dependent variable and covariant were consistent in the two classes ($F=2.216$, $p=.142>.05$). Analysis shows that there was significant difference in the post test between these two classes that couldn't be explained by the discrepancy in the pre-test ($p= .045< .05$, table 3). Therefore conclusion can be drawn that GS intervention has produced enhanced improvement in students' reading skills in the collaborative classroom.

Table 3.1 Student post-test scores

Class	Experiment class			Control class		
	M	SD	Progress	M	SD	Progress
Pre-test	51.07	16.599	21.33	54.47	17.878	17.66
Post-test	72.40	11.060		72.13	13.574	

Table 3.2 Comparison of student scores in post-test: ANCOVA analysis

Sources	Type III Sum of Squares	df	MS	F	Sig.
Pre-test	7611.080	1	7611.080	339.040	.000
Class	94.645	1	94.645	4.216	.045
Error	1279.587	57	22.449		

3. 2 Perception Analysis: GS Enhanced Collaboration & Learning Interest

In this study, both quantitative and qualitative data were mined and analyzed to probe students' attitudes toward collaborative learning and GS learning activities. The quantitative data came from a survey conducted after GS intervention. In the survey questionnaire, a 5 point Likert scale was used (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree). The higher the score was, the more students agreed with the statement given. In-depth semi-structured interviews were administered to obtain qualitative data. All

students in the GS experiment class participated in the interview. The interview sessions were recorded, transcribed and translated for analysis.

3.2.1 Student Perception of Collaborative Learning

In the questionnaire, four items were generated to probe students' perception of collaborative learning. As indicated in the descriptive data (Table 4), most students held positive attitude towards classroom collaboration. In GS lessons, students shared and negotiated ideas within a group, and seek and offer help in times of need.

Table 4 Descriptive statistics of student perceptions of Collaborative Learning (N=30)

Item	Strongly Agree%	Agree %	Neutral %	Disagree %	Strongly Disagree%	Mean	SD
I would like to share ideas in my group.	42.9	28.6	25.0	3.6	0	4.11	0.916
I would like to accept different ideas in my group.	46.4	32.1	17.9	3.6	0	4.21	0.876
I would like to assist others in my group.	46.4	25.0	25.0	3.6	0	4.14	0.932
I would like to seek help form others in my group.	39.3	32.1	25.0	3.6	0	4.07	0.900

In interview, students explained and elaborated on the benefits they received from collaborative learning in the language classroom, which could be summarized as:

1) Classroom collaboration promoted confidence in students

Compared with individual learning, students were more willingly to express ideas in group discussion as they could receive peer feedback and assistance, with which they improved their answers. This promoted their confidence and encouraged their participation in class.

--"When learning in a group, we can discuss our answers. Thus I can always come up with an answer to the question, no matter how difficult it may be."(S3, S21)

--"You can ask your group members for help if you don't know the answer."(S8)

--"You can participate in the activity even when you don't have many ideas."(S21)

2) Classroom collaboration encouraged sharing and negotiation of ideas

Students had more opportunities to air their opinions in collaborative learning scenarios. In group discussion, ideas from multiple perspectives were discussed, reflected on, and synthesized, based on which answers of improved depth and breadth could be constructed.

--"In group discussion, you can express your ideas and opinions freely."(S17)

--"You can learn from different ideas proposed within the group."(S20)

3) Classroom collaboration improved collaborative skills in students

Collaborative problem solving demanded mutual engagement and coordination among all the participants. If students were more involved in group work, they could attain better skills in communication and show more respect and appreciation to others' work, all good to development in collaborative skills.

--"In group work, you will learn to collaborate with others to finish the task."(S21)

--"Apart from knowledge improvement, I have learnt to collaborate with others." (S24)

--"After group work, I am more aware of the importance of collaboration."(S10, S26)

--"You have to listen to others' opinions. You cannot only count on yourself."(S22)

4) Classroom collaboration nurtured good relationship among students

When engaged in group work, students had more opportunities to communicate and interact with each other. This helped breaking the ice among the students. Through group work, students became more aquatint with each other and had made more friends.

--“Discussing with others can develop better relationships between us.”(S15, S23, S29)
--“Group work promotes interaction among us.” (S17, S20,S23)
--“In group discussion, we develop better understanding about each other.”(S23)
--“I have more chances to communicate with the ones I am not familiar with.”(S18)

3.2.2 Student Perception of GS Learning Activities

To measure students’ attitudes toward GS learning activities, we examined how students perceived about using the GS technology and participating in GS activities. In the questionnaire, 4 questions items were on GS technology adoption. Data analysis unveiled that generally students held positive attitude towards GS. With GS, they could express their opinions and initiate discussions with ease and comfort.

Table 5 Descriptive statistics of student perceptions of using GS

Item	Strongly Agree%	Agree %	Neutral %	Disagree %	Strongly Disagree%	Mean	SD
GS is easy to use.	50.0	32.1	14.6	3.6	0	4.29	0.854
I can express my opinions easily on GS.	25.0	46.4	25.0	3.6	0	3.93	0.813
I don’t think it is difficult to discuss with others on GS.	50.0	25.0	21.4	0	3.6	4.18	1.020
I work smoothly on GS without encountering any trouble.	39.3	32.1	17.9	10.7	0	4.00	1.018

Student interview data shows that the integration of GS technology promoted student interest and motivation in learning:
--“Using computers to learn is very interesting.”(S10, S14, S23, S25)
--“It’s much more boring in traditional classrooms.”(S20)
--“You don’t have to write down your ideas. You can express them simply by typing.”(S13)

In student interview, areas for improvement were also revealed. Some students described the technical issues they experienced. There were occasions when they couldn’t type in the words or publish\move the scribbles. Sometimes, scribbles published would disappear mysteriously. As each group was only equipped with one computer, some ideas that were orally expressed were not timely and sufficiently documented in the virtual medium.

How students perceived GS activities was another important dimension examined in the survey. Data shows students in general held favorable opinions on GS activities (Table 6).

Table 6 Descriptive statistics of student perceptions of GS learning activities

Item	Strongly Agree%	Agree %	Neutral %	Disagree %	Strongly Disagree%	Mean	SD
In GS lessons, I have more opportunities to express my ideas.	50.0	25.0	21.4	3.6	0	4.21	0.917
In GS lessons, I can learn different ideas from others.	57.1	28.6	14.3	0	0	4.43	0.742
In GS lessons, I can develop better relationships with others.	67.9	7.1	21.4	3.6	0	4.39	0.956
GS lessons are interesting.	57.1	28.6	10.7	3.6	0	4.39	0.832
I prefer GS lessons.	60.7	21.4	10.7	3.6	3.6	4.32	1.056
I would like to have more GS	67.9	10.7	21.4	0	0	4.46	0.838

lessons.

3.3 Process Analysis: Group Collaboration Patterns

We also examined group collaboration patterns in GS lessons. Process data obtained included group videos and field observation notes. After analysis, 2 collaboration patterns emerged in 6 students groups (Figure 2). In interactive groups, work was distributed among group members and they took turns to control the computer. Communication and interaction was frequent in the group. Though high ability students were dominating the talk, the ones of medium and low ability also contributed their ideas and opinions. In fragmented groups, computer was under the control of a single student and some students (usually low ability ones) were isolated from group discussion and remained silent. In these groups, communication and interaction mostly occurred between two students. The fact that not all groups achieved satisfactory collaboration shows that long term efforts are needed to develop the collaborative skills in students and nurture the collaborative culture in class.

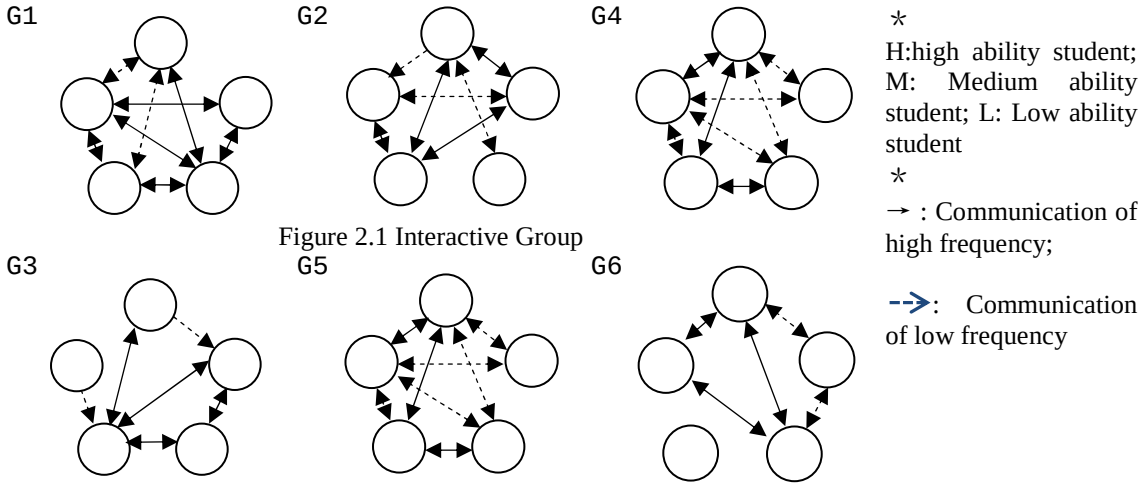

Figure 2.1 Interactive Group

Figure 2.2 Fragmented Group

4. Conclusion

In this paper, we reported how we integrated network technology in a primary reading class to enhance collaborative learning. Through a quasi-experiment design, we confirmed the role of technology intervention in producing enhanced learning gains and improved attitudes. Problems encountered (concerning learning environment design and collaborative culture development) were also elaborated. However, as the study was of small scale and context specific, any application of the findings should be done with caution.

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