Reasoning and Reformulating for Linguistic Knowledge Improvement: A Comparative Case Study in a CSCL Classroom

Wenting XIE*, Wenli CHEN, Yun WEN & Cheekit LOOI
Learning Sciences Lab, Nanyang Technological University, Singapore
*wenting.xie@nie.edu.sg

Abstract: This paper reports a comparative case study to explore the discrepancies in learning outcomes attained by two student groups in an identical CSCL activity in the language classroom and the differences in group behaviors that contributed to these discrepancies. From micro-analysis, group behaviors that are desired for language development are identified. The findings can inform future pedagogical and technological design to improve language learning in classrooms.

Keywords: CSCL, language learning, comparative study, collaborative dialogue

Introduction

According to Swain, Brooks & Tocalli-Beller [8], Collaborative Dialogue (CD) where learners co-construct language or knowledge about language to solve complex linguistic problems is a legitimate source for language learning. This validates CSCL intervention into language classrooms. This study examined the learning behaviors of two student groups in an identical CSCL activity and investigated their impacts on group learning outcomes. This comparative analysis can inform future learning design.

1. Research Context

This study is part of a 3 year project in a secondary school where researchers and teachers co-design Group Scribbles (GS) (refer to [2] for GS descriptions) supported collaborative learning to promote L1 learning. A Grade 2 class (22 students, randomly distributed into three 4-student and two 5-student groups) participated in the 1st cycle. The two groups each consisted of 4 students (Figure 1). As indicated by the school English test scores before GS intervention, these two groups were equally competent in L1 ($t=-1.050$, $P= .334< .05$, G1: $M=36.5$, $SD=3.69$; G2: $M=39.3$, $SD=4.35$). In GS lessons, group collaboration occurred in dual-interactional spaces, F2F and online. Each student was given a Macbook with GS 2.0 and seated in physical proximity. The GS activity reported was the 2nd one in the Persuasive Writing lesson where students worked together to plan an argumentative essay on the topic of Cyber Bullying. This activity, followed the 1st GS activity on *Content Generation*, focused on *Organizing and Linearizing* the contents produced and pooled [1] (Table 1).

Table1. Activity Design

Activity	Description	Time
Introduction	Teacher shows a video clip about Cyber Bullying	5 mins
Content Generation	Intra-group interaction: brainstorm to mine possible ideas\ arguments \ examples related to Cyber Bullying	10mins
	Inter-group interaction: Gallery walk visit other groups' boards for more ideas	5 mins
Content Organization & Linearization	Intra-group interaction: 1) select, categorize, synergize, and arrange contents 2) devise thesis \topic sentences	20mins
	Inter-group interaction: Presentation 1) present group work ; 2) offer constructive comments;	10mins

Group 1

Fiona	Kim
Michael	Peter

Group 2

Richard	Jack
Ada	Tom

Figure 1. Group seating arrangements

2. Analytical Framework

The data included group artifacts, post-lesson interview transcripts, group audio\video transcripts, student Morae transcripts. In transcripts, student GS act\verbal talk was comprehensively and chronologically documented. Group learning behaviors, perceptions and outcomes mined in G1 and G2 were inclusively mined and put into comparison.

2.1 Comparing Learning Outcomes in Group Work

The learning outcomes included group final artifacts and Linguistic Knowledge Improvement (LKI). The former concerned with whether the artifacts constructed were: 1) suffice to solve the linguistic problem; 2) grammatically accurate and socio-linguistically appropriate. LKI was measured by the instances of constructing understanding on linguistic concepts (including grammar, vocabulary, pragmatics and stylistics) that emerged in group language. As language occurs in collaborative problem-solving is the spontaneous verbalization of cognitive processes, turning them into objects for analysis [3], the language produced in G1 and G2 (spoken and written), was exhaustively coded to mine LKI (Table 2). One turn in verbal talk or GS text(s) that expressed one idea was coded as one unit.

Table 2 Linguistic knowledge improvement

Description	Example
Verbal talk\GS texts in the form of a statement that contained explicit linguistic knowledge (usually with technical terms), including: 1) Grammar 2) Vocabulary 3) Stylistics	1) (Some students are able to deal with the problem, its deal or deal with?) --Deal with, deal with the problem. 2) --Overlook means you just ignore. Oversees means take charge. 3) --A thesis statement. It's the main stand. It's the main stand that you would take.

2.2 Comparing Social Interactions in Group Work

Social interactions are mainly mediated through language. The mediating function of language is identified as: 1) a cognitive tool for meaning making; 2) a social tool for communication [8]. In CSCL environments, language mediated interactions construct two pivotal dimensions of learning: 1) social\psychological dimension, which relates to social-emotional aspects of group forming and group dynamics; 2) educational\cognitive dimension, which relates to group learning [4]. CD embedded in cognition-related interactions is the very source for language development. In a CSCL classroom, social interactions can go for multiple purposes. The fact that classroom learning is a zero-sum game for the limited physical time makes CD more cherished from the perspective of language learning. To explain discrepant group learning outcomes and perceptions, we

compared the social interactions occurred in G1 and G2 (Table 3). One turn in conversation\ one GS act (publishing\withdrawing GS posts on group public board) was coded as one unit.

Table 3 Social interactions in group work

Category	Description	Example
Collaborative Dialogue	Interaction units for solving the linguistic task, including: 1) formulating the required linguistic form; 2) reflecting on the linguistic form; 3) consolidating\constructing linguistic knowledge; 4) pooling and organizing ideas\contents;	1) --Cyber bully has negative impacts on the-. (formulating the thesis statement) 2) --What? What is "brokers"? 3) --Overlook means you just ignore. Oversees means take charge. 4) --Are we gonna talk about the community as a whole or are we talk about individuals in the community?
Task Coordination	Interaction units for forming task strategy and regulating group working process, including: 1) distributing roles\work 2) managing group working progress 3) technology related issues.	1) --"Definitions and examples of cyber bullying", ok, I will handle definition. 2) --I think the first, the one… ok, anyway, put it up put it up. We are too slow. Ok, full stop. Ok, now let's talk about the examples. 3) --You need a bigger piece of scribbles.
Group Forming	Off-task interaction units including: 1) topic related jokes 2) discussion on unrelated topics	1) --Well, I feel so cyber-bullied now. 2) --Woo, The last time I ever used my Safari it was like last year.

2.3 Comparing "Linguistic Knowledge Improvement Trigger" in Group Work

LKI enhances language proficiency and are pursued in "advanced" language learning [6]. CD encourages but not ensures such improvements. LKI should be "triggered", i.e. learners "notice" the problematic linguistic forms [7]. Only when learners' attention is drawn to the linguistic problems will they "reflect on" these problems and then create knowledge to solve these problems. We call CDs that can attract and divert group attention to those problematic language "Linguistic Knowledge Improvement Triggers" (LKIT).In observation, we noted students behaved differently when confronted with problematic linguistic forms, which in turn induced different responses. In the third level of analysis, we compared the number of LKITs emergent and investigated the distribution of different types of LKITs (Table 4).

Table 4 Linguistic knowledge improvement triggers (LKIT)

Category	Description	Example
Commenting	Collaborative dialogues that contained the questioning and\or rejecting of the whole\ a part of previous linguistic form.	--Why why why it is "overlook", then "it become part of the school's norm"? I don't get what you mean.
Reasoning	Collaborative dialogues that contained justification for the grammatical inaccuracy and socio-linguistic inappropriateness of the whole\ a part of previous linguistic form.	--(But if you write that) it's kind like you say- You know it's ok to cyber bully-Because you are teaching them how to handle-
Reformulation	Collaborative dialogues rephrased or redevised the whole\a part of previous linguistic form.	--(Cyber bullying has a negative impact to schools and the school should take action.) --On school. On the school community.

3. Results & Discussion

3.1 Discrepancies in Group Learning Outcomes

There was not much difference in the group final artifacts between G1 and G2 in terms of completeness and correctness. Each group had constructed 1 thesis, 4 topic sentences and 1 concluding statements. In G1, all these were in complete sentences, while in G2, one "topic

sentence" was actually a "topic phrase". As requested, both groups produced at least one example\fact for each topic sentence. Though in total G2 had generated 4 more examples\facts than G1, but repetition plagued. After combing similar ones, G2 achieved only one more. As for grammatical accuracy and socio-linguistic appropriateness, G1 and G2 performed equally. However, significant discrepancy was observed via Chi-square test in the amount of LKI occurred in G1 (43) and G2 (9), with G1 outperforming G2 ($p = .000$, $p < .01$) (Table 5). Via collaboration, G1 had improved their understanding on linguistic concepts concerning stylistics (e.g. definition of *Thesis Statement*?) and vocabulary (e.g. the differences between *ability, skills, knowledge, maturity*). Though G2 students also expressed doubts on the functions and features of the Thesis Statement, these doubts were not solved. It was concluded that G1 achieved better learning outcomes compared to G2.

3.2 Discrepancies in Group Social Interactions

There were 211 interaction units observed in G1 and 208 in G2.Though the total numbers were almost equal, differences were mined concerning the nature of interaction. G1 highly engaged in cognitive activities (Cognitive: 99.1%), G2 in social-emotional interactions (Social: 21.6%). And G1 were more engaged in CD ($p = .000$, $p < .01$) and less in task coordination ($p = .000$, $p < .01$) (Table 5). Qualitative analysis of group learning processes revealed that G1 and G2 approached the collaborative task differently, G2 counting on "cooperation" while G1 on "collaboration". In G2 labor was divided and each member was responsible for a portion of the problem solving. Yet in G1 mutual engagement to solve the problem together with good coordination was achieved. This was further validated by how G1 and G2 perceived their group work in the interview. G1 found the group learning experience useful as "ideas were shared, pooled and improved in our group" while G2 were not that positive. They felt group work was just "a compiling of individual work to finish the task". Among the 56 task coordination units observed in G2, quite a lot were "role distribution" (e.g. *Ok, I will handle definition.*) and "progress" statements (e.g. *Ok, there we go. Ok I have done my job.*) on individual bases. In G2, collaborative task solving was a 3-staged iterative process on individual basis ("problem division-individual problem solving-individual solution aggregation"). As G2 focused on paralleled individual problem solving without paying attention to others, more regulation was needed to avoid repetitive\overlapping work, resulting in the commonly occurring inquiries where one asked about others' progress (e.g. *Are you devising already?*). Yet in G1, nearly all coordination was at the group level, either in directing group attention (e.g. *Ok, the definition and examples of cyber bullies…*) or monitoring group progress (e.g. *…put it up put it up…we are too slow.*). Moreover, in cooperation, students are only responsible for a specific piece work. This constrains their engagement with the whole task. Though wanting to contribute to other parts of the problem, they are often reluctant to do so as others may not appreciate or even get annoyed. This was observed in our case. In G2, when Richard posted on the "definition of cyber bullying", Tom, who was supposed to take care of this point, explicitly expressed his dissatisfaction (e.g. *Oh stop putting stuff on my area...*). This not only restricted one's engagement with the task but also left more time for Off-task interactions.

3.3 Discrepancies in Linguistic Knowledge Improvement Trigger

Altogether 69 LKIT were observed in G1, and 34 in G2. When the total number of CDs produced was taken into consideration, there was no difference in the number of LKIT occurred (Chi-square test: $P = .269 > .05$). This showed that both groups were equally sensitive to linguistic problems. Yet, G1 and G2 handled these problems differently (Table 6). In G2, the most frequent LKIT was pure Commenting (50%), while that was

significantly fewer in G1 (Chi-square test: P= .002< .01). In G1 Commenting LKITs were often accompanied with Reasoning. Unlike G2 who solely announced the problem area without further actions, students in G1 stretched their linguistic knowledge to defend for\against a certain linguistic form they were uncertain of. Besides discussing and reflecting on the problematic language, G1 were also more willing to offer tentative solutions to fix the problem (In G1, the most frequent LKIT was Reformulating, accounting for 42%). These extra efforts made in G1, though challenging and exhausting, were worthwhile as they brought about better harvests.

Table 5 Descriptive analysis for group social interactions

Group	Cognitive Dimension		Social Dimension	Total
	Collaborative Dialogues	Task Coordination		
G1	86.3%	12.8%	0.9%	100%
G2	51.9%	26.9%	21.2%	100%

Pearson Chi-Square	Value	df	Sig. (2-sided)
Collaborative Dialogue	57.942	1	.000
Task Coordination	13.159	1	.000

Table 7 Descriptive analysis: Linguistic knowledge improvement trigger

Group	Com	Rea	Ref	Com+Rea	Com+Ref	Com+Rea+Ref
G1	20.3%	5.8%	42.0%	21.7%	5.8%	4.4%
G2	50%	3.0%	32.4%	11.6%	3.0%	0%

4. Conclusion

Through comparative analysis, the desired group behaviors that can bring about positive perceptions and outcomes in CSCL language classrooms are identified. As this study was exploratory in nature and specific in context, further experimental studies are needed.

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