Patterns of Collaboration Dialogue Acts in Typed-Chat Group Problem-Solving

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Abstract. This study observes patterns of dialogue acts in typed-chat student group problem-solving. Quantitative differences are observed according to the relative preparedness of the students within the discussion.

Keywords: collaborative problem-solving dialogue

1 Introduction and Background

The COMPS project administers computer-mediated problem-solving chat dialogues in undergraduate college classes [1]. A goal of COMPS research is to characterize typical problem-solving dialogue activity. Characterizing typical activity advances toward a future goal of providing assessments of the chat activities, so the instructor can gauge whether students and chat groups are collaborating productively.

Our research hypothesis is that the students in a problem-solving dialogue behave differently according to their relative level of knowledge: the best-prepared student within the group may take on a different role than the least-prepared. To test this, we examined the frequencies of several categories of collaborative-activity dialogue acts.

This study used approximately a thousand dialogue turns of COMPS project transcripts manually tagged according to four categories of collaboration dialogue acts. Then we measured the different frequencies of the dialogue acts according to preparedness rank of the student.

The students in this study were in a 2nd-semester undergraduate computer programming class. They worked together in three-person groups for approximately an hour. The exercise in this study involved analyzing the object-oriented aspects of some Java code. The exercise prompt instructs the students to come to an agreement on successive segments of the problem. A teaching assistant (TA) then joins the discussion at the end of each segment to pass judgment and perhaps provide assistance. This script is intended to promote mutual dependence (the students don't signal for the TA until they all agree) and accountability (students should exhibit understanding

for each part of the problem). An extract from one of these conversations is shown in Figure 1.

Pre- and post-tests were administered before and after the dialogues. We ranked the three students in a discussion group, based on pre-test score. Rank 1 is the student within the discussion who was most prepared, rank 3 was the least prepared student. We computed learning gains as (post–pre score)/(1–pre). We also measured each student's participation based on numbers of turns, using a formula which normalized according to the number of participants. Thus in a 3-person group, a person contributing 1/3 of the turns was recorded with a participation statistic of 0.5.

This study annotated the type of collaborative dialogue act in 1000 turns of dialogue from 10 group discussions. The four categories of dialogue acts are as follows. The categories are adopted from a project of one of the testing services which is building assessments of student collaborative conversations [2].

A) Sharing ideas, or pointing at where ideas can be found
B) Negotiating, including agreement/disagreement
C) Regulating problem-solving
D) Maintaining communication, e.g. politeness, joking or small talk

Dialogue acts do not exactly correspond to typed-chat dialogue turns, where the student presses <enter> to mark a turn. One dialogue turn can contain several acts, or a single person can utter a several-turns-long dialogue act without interruption by other students. Another complication is COMPS chat software permits overlapping dialogue turns, everybody can type at once and observe each other's typing without interruption [3]. In these transcripts overlapped turns are serialized according to when they ended. Note also that conversation segments with the TA present might plausibly show different student behaviors as they are no longer solving the problem but checking their answers. These segments were not counted in our results here.

Person	Text	Acts	Sub-category
St1	public String toStrong(){ String result = null; result = lendingInstitution +' '+ PAmount +' '+ iRate +' '+ etc.	A	Sharing Idea
St2	lol yall going in i think thats right tho	D, B	Joking, Agreement.
St1	we just have to explain the getters and setters now	C	Suggest next step
St3	Student 1 can u explain them	C	Check understanding
St1	besides excapsulation, accessors make it easier to change future things my-bad on the spelling	A, D	Explanation, politeness
St4	So everything except the setters and getters are explained right?	C	Reflect
St1	encapsultion allows validation	A	Continue explanation
St3	I dont believe we've explained the properties	C	Suggest next step

Fig. 1. Extract of dialogue, with dialogue acts annotated.

2 Results

Table 1 shows how the differently prepared students had different conversational behaviors within a discussion. Table 1 records behaviors from the 30 students in the 10 discussion groups, all working on the same problem in the same semester. Most important is the relative mix of dialogue acts. Chi-squared tests show that the rank 3 least prepared students significantly differ in their mix of dialogue acts from rank 2 ($p < 0.05$) and from rank 1 ($p < 0.01$). A rank 3 student also participates significantly less than a rank 1, contributing fewer dialogue acts in each dialogue ($p < 0.01$). Consistent with previous COMPS results, the most prepared students showed little or no learning gain, while the least prepared showed the most [1].

A conclusion is: learning gains do not directly correlate with problem-solving participation acts. The lowest rank students had the largest learning gains, with lower percent of problem-solving dialogue acts in categories A) through C), and a higher proportion of category D) acts which do not contain problem-solving content. Assessing collaborative dialogues may need to take this differential into account.

Table 1. Different styles of contribution, based on relative preparedness within the group.

	Rank 1: n=10	Rank 2: n=10	Rank 3: n=10
Avg learning gain	0.0	0.1	0.5
Numb. Dialogue Acts	442	311	220
A: sharing	30%	27%	25%
B: negotiating	28%	33%	33%
C: regulating	28%	27%	21%
D: maintaining	14%	13%	22%

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