Measuring Collaborative Behavior in COMPS Student Problem Solving Discussions

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Introduction

- This project attempts to observe and measure collaboration between students who are working together to solve problems in a computer programming class.
- In COMPS (Computer Mediated Problem Solving) exercises students work together via online typed-chat.
- The communication is recorded and stored for further analysis. Using these student dialogue files, the main research activity consists of manually classifying student dialogue according to four categories of collaborative utterance.
- In concert with other researchers, we are using the hand-labeled data to attempt to train computer text classifiers to identify these behaviors. From there we will count the different behaviors and look for patterns of interaction. This is expected to reveal the conversational fingerprints which are characteristic of successful and unsuccessful student collaborations.
- This research advances toward computer assessment of student collaboration skills and will aid in understanding of collaborative learning.

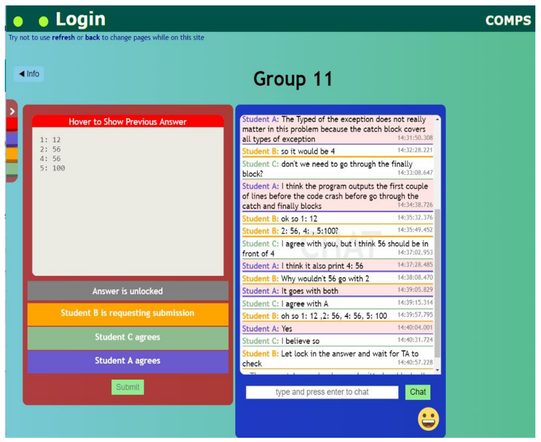

Figure 1: COMPS Chat Interface

Annotation Rules

- By analyzing the student dialogue files, we have developed rules that aid us in defining what dialogue belongs in which of the four categories of collaboration.
- We have grouped these rules into a 'markup manual' which we use to help us develop our reasoning of why certain dialogue belongs to a certain category of collaboration.

Table 1:Collaboration Categories

Category	Description	Label
Sharing Idea	Student shares their idea with the group. The idea must be	A
Negotiating Idea	The student will listen to a previous conversation and express their idea	B
Regulation of Problem Solving	The participant shows intent to direct or regulate workflow. General management of the group.	C
Maintaining Communication	The participant engages with the group that is casual or not related to the task work	D

- Table 1 describes how we have described each category of collaboration as well as our abbreviated label when referring to them.
- We break down each category into subcategories to further identify various examples within each category.

Table 2: Markup Manual Excerpt

(A) Sharing Idea	
Description:	Student shares their idea to the group. The idea must be task-relevant.
Subcategory 1:	Student gives task-relevant information (e.g. individual response) to group member.
Subcategory 2:	Student points out or responds to question with a resource to retrieve task-relevant information
Subcategory 3:	The student responds to the teammate's request for task-relevant information

Annotation

Table 3: Transcript Markup

Student	Text	Label
St1	I think for a and b they are both public and c is private	A
St2	i believe a is a) principleAmount = private double or int it says it supports encapsulation so shouldnt that mean all variables ore private	B
St3	a) principalAmount	A
St1	no because since the total mortages are a class variable it should be static so shouldnt that be public?	B
St2	private int or double	B
St1	double because it could be a decimal	A
St2	ight so a is dont lets get on b	C
St3	a) principalAmount - private String princple amount;	A
St1	b) private double interest rate thats what i think	A
St2	so a and b are private double and i think c is private int?	B,A

- Analysis of the collected student dialogue files involves categorizing each turn of dialogue into one of the four categories of collaboration.
- Some turns of dialogue display elements of more than one category, so we mark it as both categories as shown in Table 3 and Table 4.

Table 4: Transcript Markup

Student	Text	Label
St1	hey hey	D
St2	Hey	D
St1	do u know what it means when it says the mortgage class has a lending institution?	A,C
St2	it means it has place to manage that mortgage (A String) , as it's given in the example in #1	A

- We have annotated 500 turns of dialogue. Analysis of the first 175 turns found 68 instances of 'A' dialogue, 44 instances of 'B' dialogue, 42 instances of 'C' dialogue, and 21 instances of 'D' dialogue.
- These annotations allow us to document the flow of collaboration within the group and observe dialogue patterns.

Annotation Results

Tables 5-8: Transition Statistics

transitions	pct
A-A	29.40%
A-B	27.90%
A-C	19.10%
A-D	7.40%

transitions	pct
B-A	34.10%
B-B	27.30%
B-C	20.50%
B-D	2.00%

transitions	pct
C-A	26.20%
C-B	19.00%
C-C	16.70%
C-D	21.40%

transtions	pct
D-A	42.90%
D-B	9.50%
D-C	28.60%
D-D	9.50%

- The above tables show transitions between categories as well as the percentage of how often these transitions occur when compared to other transitions from the same category of collaboration.
- We have found that A to A as well as A to B transitions occur more frequently compared to other transitions.
- These results help us in observing and analyzing collaborative behaviors, which help us to further understand how collaboration aids in understanding and learning.

Future Work

Our future work will focus on further analysis of collaboration patterns we find through our annotations. We will also use our annotations to train a classifier to automatically recognize the category of each dialogue turn.

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