

Dialogue Act Pairs for Automated Analysis of Typed-Chat Group Problem-Solving

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COMPS Computer Mediated Problem Solving

- COMPS supports typed-chat student group problem-solving dialogues
- A goal of COMPS is to capture, observe, and measure collaboration between people in a group
- For this research, student dialogue is classified with collaborative dialogue acts (Hao et al., 2014):
 - A) Sharing Ideas
 - B) Negotiating Ideas
 - C) Regulation of problem solving
 - D) Maintaining Communication
- We use these categories to find patterns of interaction

COMPS Chat

- This is administered in a lab setting, where the group members communicate only electronically in a chat window

Login **COMPS**

Try not to use **refresh** or **back** to change pages while on this site

◀ Info **Group 11**

Hover to Show Previous Answer

```
1: 12
2: 56
4: 56
5: 100
```

Answer is unlocked

Student B is requesting submission

Student C agrees

Student A agrees

Submit

Student A: The Typed of the exception does not really matter in this problem because the catch block covers all types of exception 14:31:50.308

Student B: so it would be 4 14:32:28.221

Student C: don't we need to go through the finally block? 14:33:08.647

Student A: I think the program outputs the first couple of lines before the code crash before go through the catch and finally blocks 14:34:38.726

Student B: ok so 1: 12 14:35:32.376

Student B: 2: 56, 4: , 5:100? 14:35:49.452

Student C: I agree with you, but i think 56 should be in front of 4 14:37:02.953

Student A: I think it also print 4: 56 14:37:28.485

Student B: Why wouldn't 56 go with 2 14:38:08.470

Student A: It goes with both 14:39:05.829

Student C: I agree with A 14:39:15.314

Student B: oh so 1: 12 ,2: 56, 4: 56, 5: 100 14:39:57.795

Student A: Yes 14:40:04.001

Student C: I believe so 14:40:31.724

Student B: Let lock in the answer and wait for TA to check 14:40:57.228

type and press enter to chat Chat

Annotation of Dialogue Acts

- This experiment studied lab exercises are from a 2nd semester Java programming class.
- Hand-annotated 1200+ turns of student dialogue.
- Four studies utilizing the annotated dialogues:
 - A. Do students with different pretest knowledge exhibit different collaborative dialogue acts?
 - B. **Are there observable patterns significantly different from chance in successive dialogue acts (dialogue act bigrams), which correspond to plausible interpretations of dialogue processes?**
 - C. Can we use machine classifiers to identify dialogue acts?
 - D. Can we identify different styles of dialogue when the teaching assistant engages in the conversation?
- This talk is about B.

Dialogue Act Categories

Category	Description	Label
Sharing Idea	Student shares their idea with the group. The idea must be task-relevant or information that contributes to the process.	A
Negotiating Idea	The student will listen to a previous conversation and express their idea to the group. They may agree or disagree with an 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

Example Annotated Dialogue

Person	Text	Acts	Sub-category
St1	<pre>public String toString(){ String result = null; result = lendingInstitution + ' ' + PAmount + ' ' + iRate + ' ' + etc.</pre>	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 mybad 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

Frequencies of Dialogue Acts

Tag	Count	Fraction (= probability)
A – Sharing	377	0.30
B – Negotiating	406	0.32
C – Regulating	259	0.20
D – Maintaining	228	0.18

Frequency of dialogue acts in 1270 turns not involving TA teaching assistant

Tag Pair Counts

Pair	Count	Null Hyp
A-A	121	112
A-B	172	121
A-C	48	77
A-D	36	68
B-A	116	121
B-B	167	130
B-C	79	83
B-D	44	73

Pair	Count	Null Hyp
C-A	64	77
C-B	52	83
C-C	78	53
C-D	65	46
D-A	49	68
D-B	34	73
D-C	63	46
D-D	82	41

- The null hypothesis is that pairs of dialogue acts are independent:
 - Students are not reacting to each other's dialogue acts.
 - Or markup is fatally flawed.
- Chi-squared test, distribution of 1270 events among 16 categories. The result $p < 10^{-29}$ is unambiguously significant.

Tag Pair Analysis

The result of Tag Pair Analysis shows pairs that far exceed chance are:

- A-B represent sharing ideas followed by negotiating ideas.
- B-B two negotiating turns in a row
- C-C two regulating turns in a row
- C-D regulating followed by maintaining
- D-D two maintaining turns in a row
- D-C maintaining following by regulating

Tag Pair Analysis Result Discussion

Problem-Solving Cycle

This suggests that a probabilistic model of dialogue acts might be possible. The table of probabilities suggests that:

- A cycle starts with A Sharing Idea followed by B Negotiating.
- It randomly switches between A and B until somebody contributes a C Regulating turn.
- Following C, the most common dialogue act would be another regulating turn, with possibly some D Maintaining turns interspersed.
- Then it probably cycles back to A.

Tag Pair Analysis Result Discussion

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 mortgages 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

Participant behavior and preparedness

- Measured the learning gain from the pretest and posttest in the lab. The three students in a discussion group are ranked based on pre-test score.
- Rank 1 is the student within the discussion who was most prepared, rank 3 was the least prepared student.

	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%

Conclusion & Future Work

Dialogue Act Analysis is Promising

- COMPS could build a linguistic dialogue model similar to a Markov model, based on probabilistic sequences of dialogue acts.
- It might be possible to distinguish among more and less knowledgeable students by dialogue act counts.
- Work is needed for machine classification of dialogue acts.

References

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Q&A

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