



Carnegie Mellon University

Analytics of Communicative Patterns in Tutoring Dialogues

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About Me

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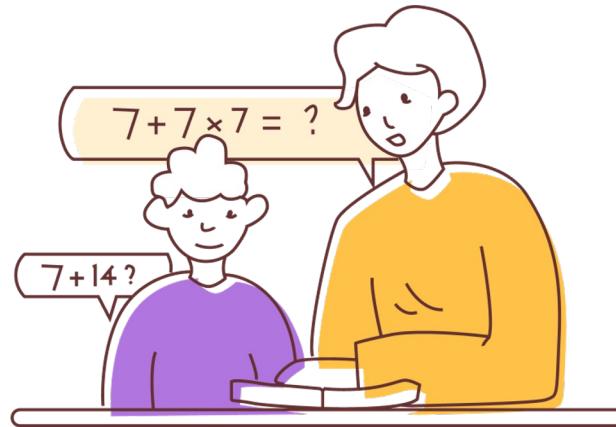
Research Keywords:

- Learning analytics
- Dialogue analysis
- Large Language Models
- Natural Language Processing



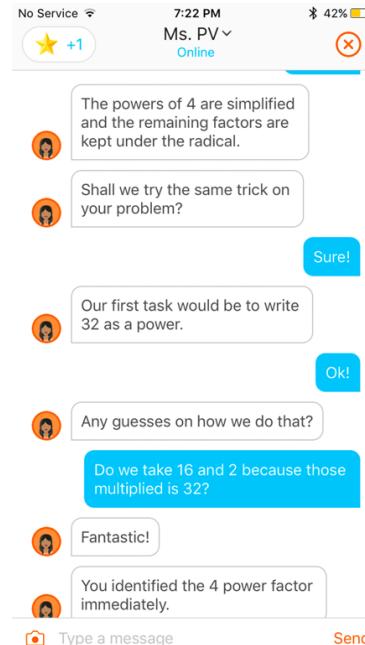
Background

Tutoring is one of the **most effective instructional methods** which can help student improve their learning achievements.



VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist*, 46(4), 197-221.

Background



Background

Challenge:

providing personalized tutoring dialogues for the large student cohorts

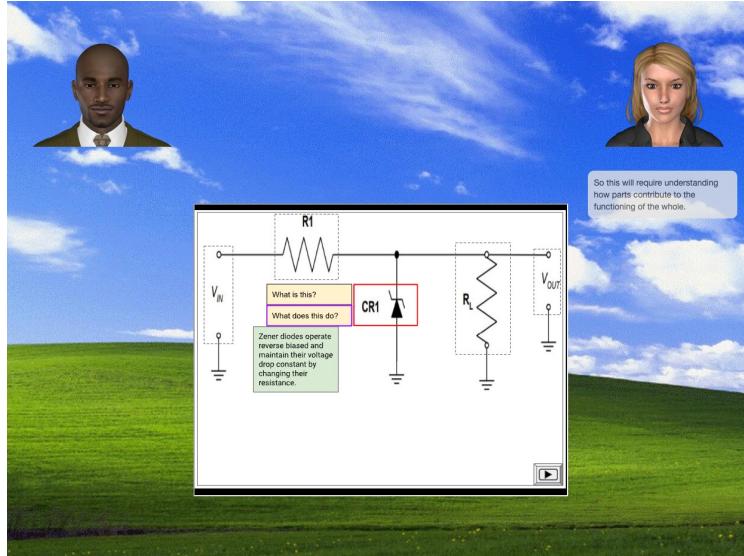
Background

An opportunity for the provision of dialogue tutoring

Dialogue-based Intelligent Tutoring System (ITS)

Paladines, J., & Ramirez, J. (2020). A systematic literature review of intelligent tutoring systems with dialogue in natural language. *IEEE Access*, 8, 164246-164267.

Background



AutoTutor

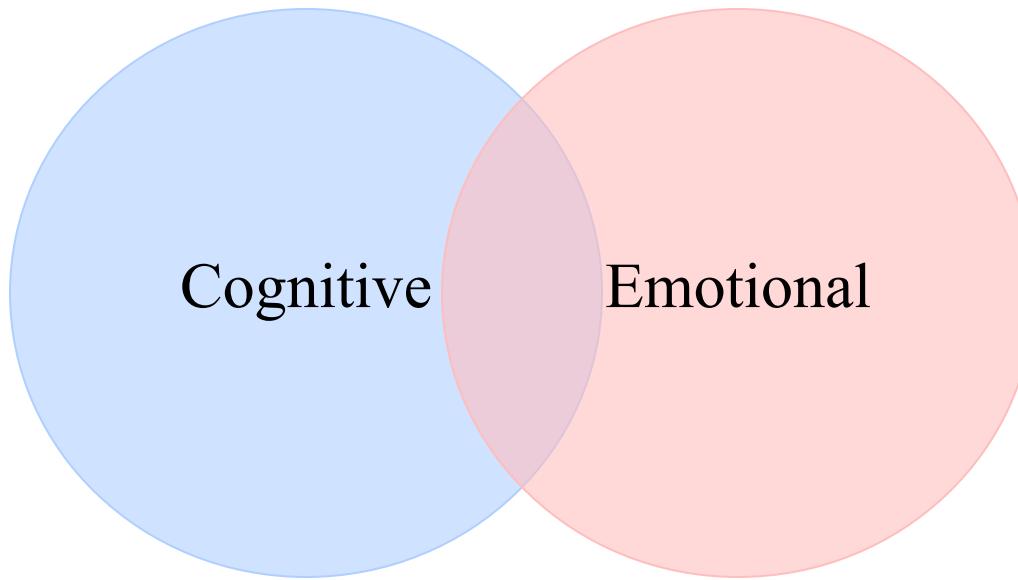
Paladines, J., & Ramirez, J. (2020). A systematic literature review of intelligent tutoring systems with dialogue in natural language. *IEEE Access*, 8, 164246-164267.

Background

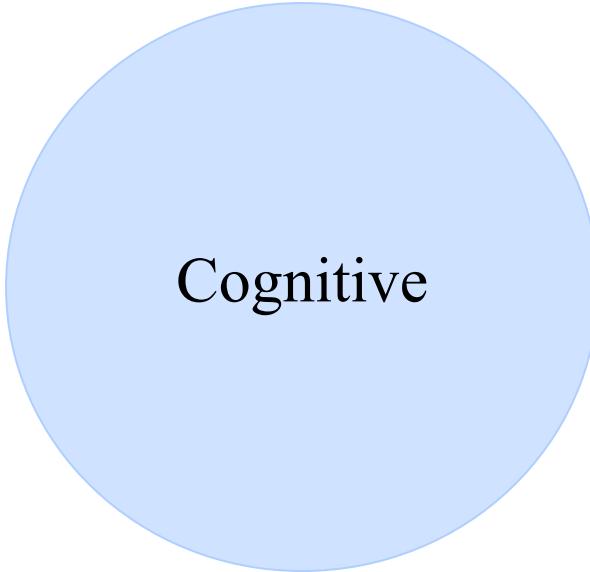
However, the dialogue-based ITSs still need to be improved to provide effective dialogue feedback

Paladines, J., & Ramirez, J. (2020). A systematic literature review of intelligent tutoring systems with dialogue in natural language. *IEEE Access*, 8, 164246-164267.

Background



Background



Cognitive

Background

The use of the instructional strategies

Sottilare, R. A., DeFalco, J. A., & Connor, J. (2014). –A Guide to Instructional Techniques, Strategies and Tactics to Manage Learner Affect, Engagement, and Grit. *Design recommendations for intelligent tutoring systems*, 2, 7-33.

Background

Instructional strategy is defined as the approaches or principles employed by instructors to support students' learning

Sottilare, R. A., DeFalco, J. A., & Connor, J. (2014). –A Guide to Instructional Techniques, Strategies and Tactics to Manage Learner Affect, Engagement, and Grit. *Design recommendations for intelligent tutoring systems*, 2, 7-33.

Background

Instructional strategies can be represented at the level of dialogue acts

Vail, A. K., & Boyer, K. E. (2014). *Identifying effective moves in tutoring: On the refinement of dialogue act annotation schemes*. Paper presented at the International conference on intelligent tutoring systems.

Background

Dialogue acts analyze the communicative intention in dialogue

<i>Tutor</i>	<i>Student</i>
Directive (D)	Test your program.
Information (I)	Variable names must be one word.
Reassurance (R)	We have plenty of time left.
Ready Question (QR)	Ready to move on?
Questions (QQ)	Any questions?
Factual Question (QF)	What line is it waiting on?
Open Question (QO)	How can you fix it?
Evaluative Question (QE)	Does that make sense?
Probing Question (QP)	Do you think that looks correct?
Positive Feedback (FP)	Very good!
Positive Feedback (with Elaboration) (PPE)	That's a very good approach.
Negative Feedback (FN)	No, that's incorrect.
Negative Feedback (with Elaboration) (FNE)	That's not the right syntax.
Other Feedback (FO)	That's an okay implementation.
Other Feedback (with Elaboration) (FOE)	That's alright, but you need to fix line 9.
	Why does that happen? It's line 6, right? What do I do next? Yes, I'm ready. Oh, that makes sense! I don't know why that works.

Dialogue act scheme by Vail & Boyer (2014)

Vail, A. K., & Boyer, K. E. (2014). *Identifying effective moves in tutoring: On the refinement of dialogue act annotation schemes*. Paper presented at the International conference on intelligent tutoring systems.

Background

Using dialogue acts for tutoring dialogue analysis

Background

Why is it important to analyze tutoring dialogues?



Background

Why is it important to analyze tutoring dialogues?

Improving tutoring practice

Understanding student learning behaviors

Assessing tutoring effectiveness

Building dialogue-based Intelligent Tutoring Systems

....



What is the role of **dialogue acts** in dialogue tutoring?

Data

Yup Tutoring Dialogue Data (dataset for immediate feedback)

Total tutorial sessions: 14,562

Tutors: 116

Students: 5,165 (K-12 level)

Student Performance

Gap-clarified (low performance, **ineffective** tutoring session)

Gap-explained (medium performance, **less effective** tutoring session)

Gap-bridged (high performance, **effective** tutoring session)

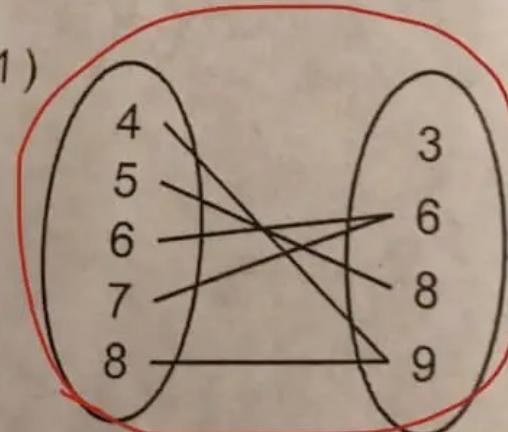
AT&T 8:33 PM 41%

teacher : 

Dom

Determine whether each dia

1)



Request Math Tutor

π

Great.

What are we asked to do in your problem?

I am not able to see the instructions.

I am trying to determine if it is a function or not

Ok.

...

Type a message

Send

Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M ↺
123 ⚡ space return

Dialogue Act Scheme

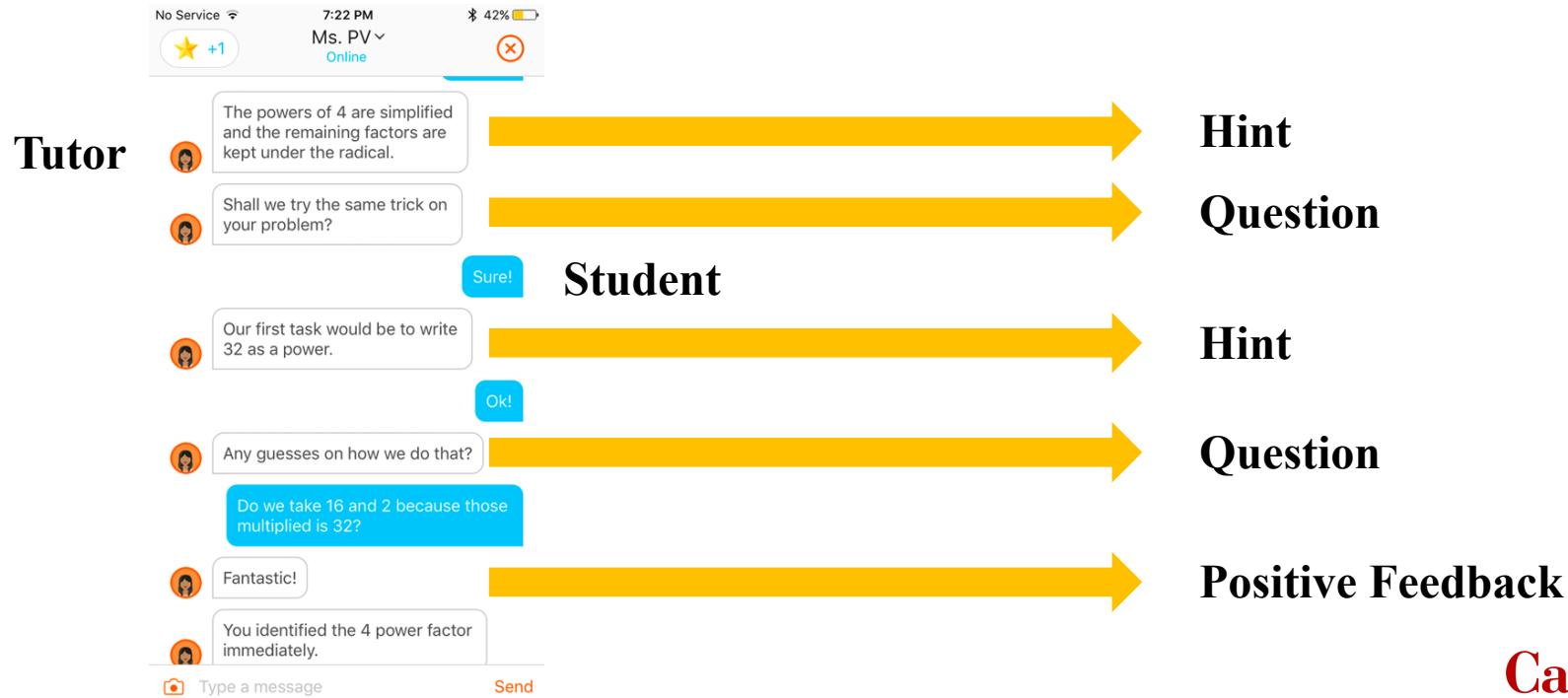
Dialogue acts analyze the communicative intention in dialogue

<i>Tutor</i>		<i>Student</i>
Directive (D)	Test your program.	Why does that happen?
Information (I)	Variable names must be one word.	It's line 6, right?
Reassurance (R)	We have plenty of time left.	What do I do next?
Ready Question (QR)	Ready to move on?	Yes, I'm ready.
Questions (QQ)	Any questions?	Oh, that makes sense!
Factual Question (QF)	What line is it waiting on?	I don't know why that works.
Open Question (QO)	How can you fix it?	
Evaluative Question (QE)	Does that make sense?	
Probing Question (OP)	Do you think that looks correct?	
Positive Feedback (FP)	Very good!	
Positive Feedback (with Elaboration) (PPE)	That's a very good approach.	
Negative Feedback (FN)	No, that's incorrect.	
Negative Feedback (with Elaboration) (FNE)	That's not the right syntax.	
Other Feedback (FO)	That's an okay implementation.	
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Dialogue act scheme by Vail & Boyer (2014)

Vail, A. K., & Boyer, K. E. (2014). *Identifying effective moves in tutoring: On the refinement of dialogue act annotation schemes*. Paper presented at the International conference on intelligent tutoring systems.

Dialogue Act Annotation



Joono's Time (10 minutes)

Annotate dialogue acts

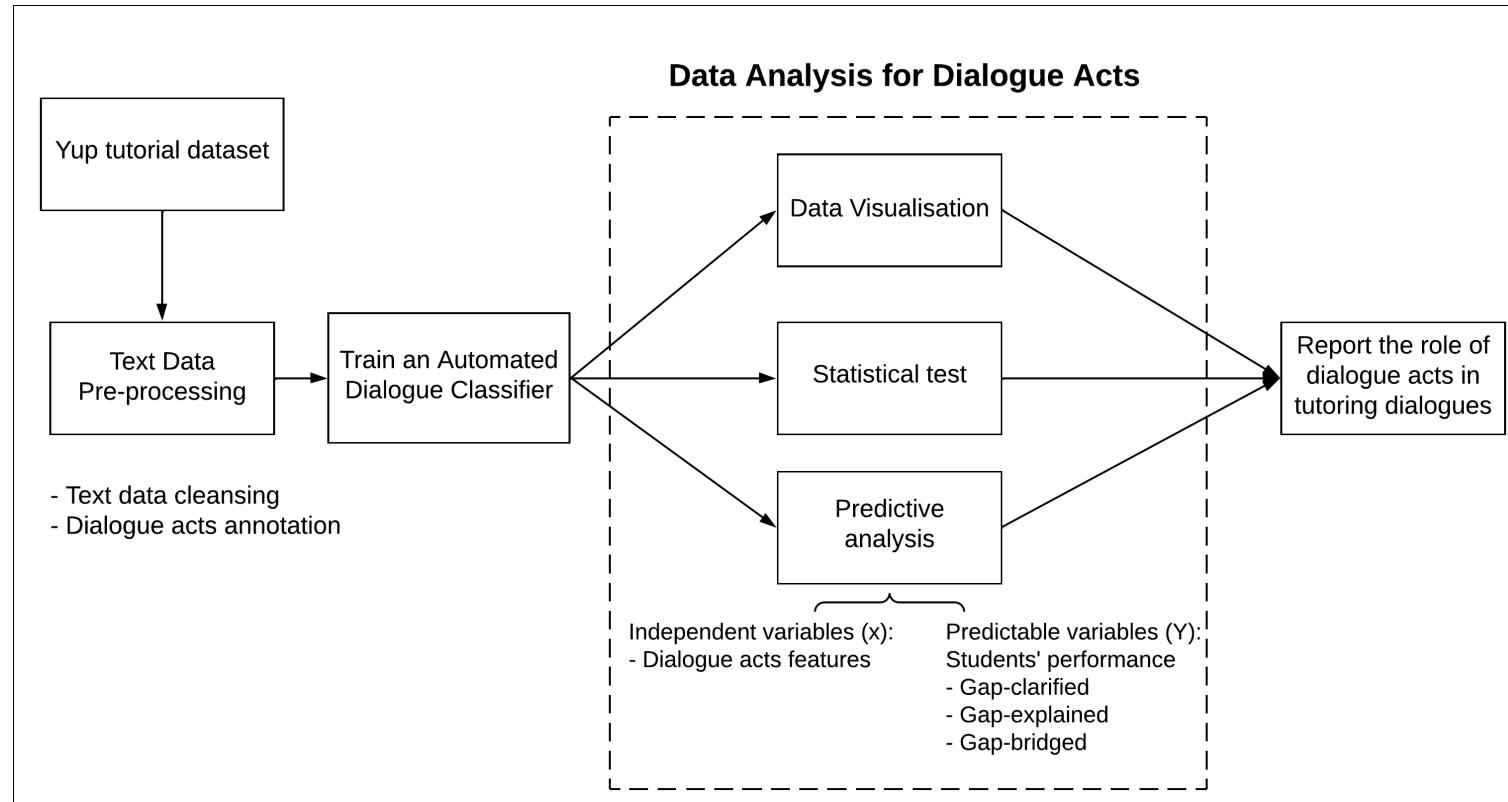


Student Prior Knowledge

Student prior progress (i.e., the progress that students made before joining the tutorial secessions) as the proxy of prior knowledge



Lin, J., Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human-human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207



Lin, J., Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human-human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207

Findings

Dialogue Act	Role	All	Gap-clarified		Gap-explained		Gap-bridged	
			With PP	Without PP	With PP	Without PP	With PP	Without PP
1. General Positive Feedback	T	10.16%	9.18%	6.71%	8.16%	7.73%	11.41%	11.16%
2. Information	T	8.62%	6.57%	8.03%	9.05%	10.35%	7.77%	8.96%
3. Probing Question	T	8.10%	6.81%	7.23%	◊ 8.33%	8.46%	◊ 7.87%	8.50%
4. Yes-No Answer	S	7.19%	8.22%	9.49%	6.66%	◊ 7.59%	6.49%	◊ 7.02%
5. WH Answer	S	6.41%	6.64%	† 6.97%	◊ 6.78%	† 6.39%	◊ 6.15%	6.44%
6. Acknowledge	S	5.67%	7.37%	7.12%	5.35%	◊ 5.93%	5.32%	◊ 5.34%
7. Request Feedback by Image	S	5.10%	8.60%	6.34%	◊ 5.13%	3.84%	◊ 5.45%	3.95%
8. Extra Domain Other	T	4.93%	9.43%	11.13%	5.34%	5.70%	3.46%	3.30%
9. Confirmation Question	S	4.89%	◊ 5.39%	5.19%	4.65%	4.59%	◊ 4.92%	4.93%
10. Operational Question	T	4.73%	7.93%	8.53%	4.12%	◊ 4.45%	3.89%	◊ 3.98%



Lin, J., Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human-human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207

Findings

The top 10 discriminant actions or action patterns in the group of *With Prior Progress* and *Without Prior Progress*. Action patterns that only occurred in either *With Prior Progress* or *Without Prior Progress* are in bold. Here, T denotes tutors and S denotes students. The value of Pearson Residual is used to compare the dispersion of the observed action pattern with the expected occurrence. The action patterns are sorted according to their Pearson Chi-square statistics in each group in a descending order, which indicate the extent to which an action pattern can be used to discriminate the three different categories of dialogues.

	Action Patterns	Pearson residual		
		Gap-clarified	Gap-explained	Gap-bridged
With prior progress	1 (T, Information)-(T, General Positive Feedback)-(T, General Positive Feedback)	-22.87	-3.34	13.62
	2 (T, Probing Question)-(T, General Positive Feedback)-(T, General Positive Feedback)	-19.78	-2.60	11.62
	3 (S, Request Feedback by Image) (T, Information) (T, General Positive Feedback)	20.25	0.17	10.59
	4 (T, Information)-(T, General Positive Feedback)	-20.25	-0.17	10.59
	5 (T, General Positive Feedback)-(T, Information)-(T, General Positive Feedback)	-22.48	-0.96	12.16
	6 (T, General Positive Feedback)-(T, Probing Question)-(T, General Positive Feedback)	-19.67	-1.46	10.97
	7 (T, Information)-(T, Probing Question)-(T, General Positive Feedback)	-22.80	-0.99	12.34
	8 (T, Greeting)-(T, Information)-(T, General Positive Feedback)	-20.21	-0.06	10.51
	9 (T, Probing Question)-(T, Probing Question)-(T, General Positive Feedback)	-21.09	-1.02	11.47
	10 (T, Information)-(T, Information)-(T, General Positive Feedback)	-23.41	0.01	12.13
Without prior progress	1 (T, General Positive Feedback)-(T, General Positive Feedback)-(T, General Positive Feedback)	-24.35	-4.64	16.33
	2 (T, Probing Question)-(T, General Positive Feedback)-(T, General Positive Feedback)	-24.06	-3.97	15.73
	3 (T, Information)-(T, General Positive Feedback)-(T, General Positive Feedback)	-24.72	-3.97	16.09
	4 (T, General Positive Feedback)-(T, General Positive Feedback)	-20.99	-2.02	12.76
	5 (S, Request Feedback by Image)-(T, General Positive Feedback)-(T, General Positive Feedback)	-20.98	-2.02	12.76
	6 (T, General Positive Feedback)-(T, Probing Question)-(T, General Positive Feedback)	-23.83	-2.60	14.70
	7 (T, Information)-(T, General Positive Feedback)	-22.13	0.08	11.99
	8 (S, Request Feedback by Image)-(T, Information)-(T, General Positive Feedback)	-22.12	0.09	11.99
	9 (S, Yes-No-Answer)-(T, General Positive Feedback)-(T, General Positive Feedback)	-22.07	-2.61	13.75
	10 (T, Probing Question)-(T, General Positive Feedback)	-20.69	-0.13	11.35



Lin, J., Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human-human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207

Findings

Understanding the use of instructional strategies in tutoring

In **effective** tutorial sessions, tutors provided **more hints, thought-provoking questions, and less off-topic statements** to students

The student **with prior progress** received **fewer hints and thought-provoking questions** from a tutor.



Lin, J., Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human-human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207

Findings - Predictive power of using dialogue acts

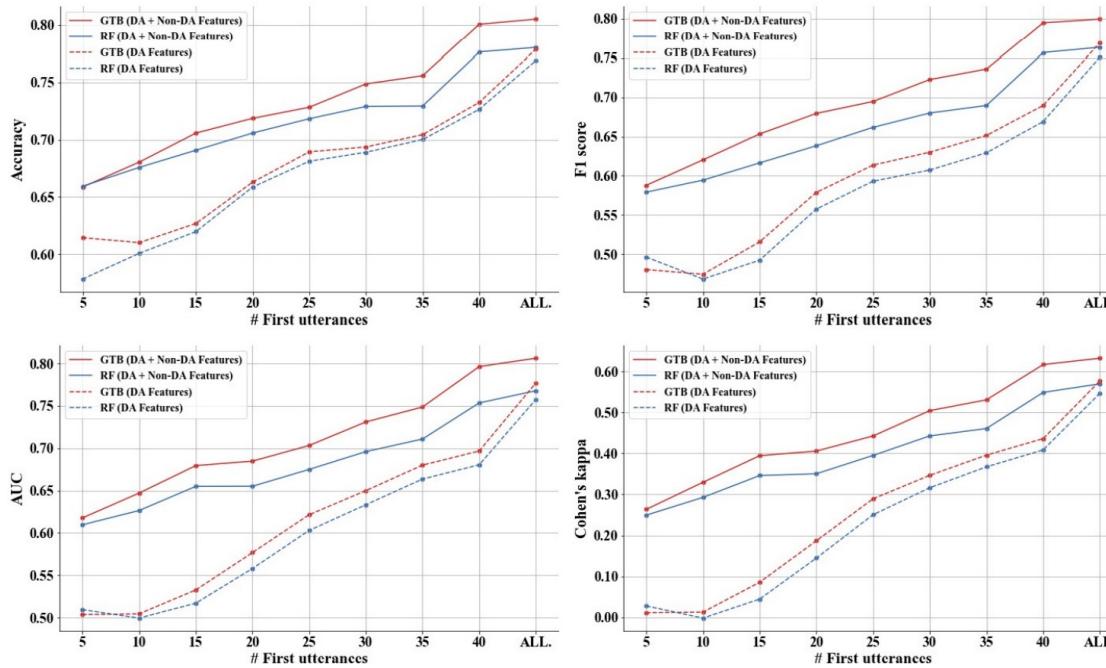


Fig. 1. The performance of GTB and random forests in predicting student performance in solving problems.

 **Lin, J.**, Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human-human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207

Findings

Predictive power of using dialogue acts

The use of dialogue acts (DAs) has the **potential** to predict students' problem-solving performance.

Incorporating DAs with **other factors** (e.g., sentiment contained in utterances) into the student performance prediction can **enhance the prediction accuracy**



Lin, J., Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human-human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207

Bonus

Annotating the dialogue act is cost demanding and time-consuming

Rus, V., Maharjan, N., & Banjade, R. (2017). Dialogue act classification in human-to-human tutorial dialogues. In Innovations in smart learning (pp. 185-188). Springer, Singapore.

Bonus

Second-level DA Tag	Role	Examples in our dataset
Information	T	"It can be any one of the cards in the deck."
Hint by Image ♣	T	[Image]
Observation	T&S	"We have 80."
Directive	T	"Check this definition."
Acknowledge	T&S	"Alright!"
Evaluation Question	T	"Does that make sense?"
Request Feedback by Image ♣	S	[Image]
Confirmation Question	S	"Would the answer be 30?"
General Positive Feedback	T	"Correct!"
Elaborated Positive Feedback	T	"Your formula for period is correct!"
Negative Feedback	T	"No, it is incorrect."
Lukewarm Feedback	T	"Almost correct, but the sign is missing."
Correction	T&S	"We will"
Direction Question	S	"How do I do that?"
Information Question	S	"What are the units for W?"
Probing Question	S	"How many options can it be?"
Open Question	T	"What do you think we could try next?"
Factual Question	T	"What is the value of x?"
Operational Question *	T	"Any questions on this?"
Ready Question	T	"Are you ready to begin?"
Extra Domain Question	T&S	"How are you doing today?"
Yes-No Answer	T&S	"Yes, that would be very helpful."
WH Answer	T&S	"It is 6."
Ready Answer	S	"Yes, I'm ready."
Extra Domain Answer	T&S	"I'm good."
Explanation	T&S	"The straight line is the line on the bottom."
Greeting	T&S	"Hello!"
Extra Domain Other	T&S	"Welcome to use this app!"
Reassurance	T	"No problem, I will help you."
Understanding	T	"Ok, got it."
Not Understanding	S	"I don't know why."

Bonus (Optional Readings)



July 3-7, 2023 Tokyo, Japan



Does Informativeness Matter? Active Learning for Educational Dialogue Act Classification

Wei Tan¹, Jionghao Lin^{1,2(✉)}, David Lang³, Guanliang Chen¹, Dragan Gašević¹, Lan Du¹, and Wray Buntine^{1,4}

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² Carnegie Mellon University, Pittsburgh, USA

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⁴ VinUniversity, Hanoi, Vietnam
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Abstract. Dialogue Acts (DAs) can be used to explain what expert tutors do and what students know during the tutoring process. Most empirical studies adopt the random sampling method to obtain sentence samples for manual annotation of DAs, which are then used to train DA classifiers. However, these studies have paid little attention to sample informativeness, which can reflect the information quantity of the



Robust Educational Dialogue Act Classifiers with Low-Resource and Imbalanced Datasets

Jionghao Lin^{1,2}, Wei Tan^{1(✉)}, Ngoc Dang Nguyen^{1(✉)}, David Lang³, Lan Du¹, Wray Buntine^{1,4}, Richard Beare^{1,5}, Guanliang Chen¹, and Dragan Gašević¹

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⁴ VinUniversity, Hanoi, Vietnam
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⁵ Murdoch Children's Research Institute, Melbourne, Australia
richard.beare@mcri.edu.au

Abstract. Dialogue acts (DAs) can represent conversational actions of tutors or students that take place during tutoring dialogues. Automating the identification of DAs in tutoring dialogues is significant to the design of dialogue-based intelligent tutoring systems. Many prior studies employ machine learning models to classify DAs in tutoring dialogues and

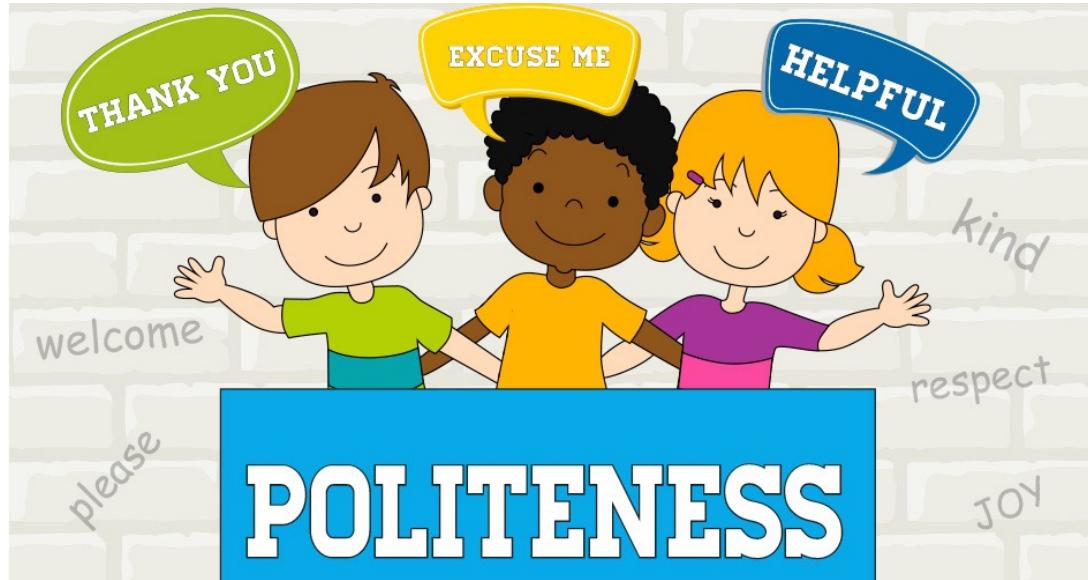
★ **Lin, J., Tan, W., Nguyen, N. D., Lang, D., Du, L., Buntine, W., ... & Gašević, D. (2023, June). Robust Educational Dialogue Act Classifiers with Low-Resource and Imbalanced Datasets. In *International Conference on Artificial Intelligence in Education* (pp. 114-125). Cham: Springer Nature Switzerland.**

★ **Tan, W., Lin, J.*., Lang, D., Chen, G., Gašević, D., Du, L., & Buntine, W. (2023, June). Does informativeness matter? Active learning for educational dialogue act classification. In *International Conference on Artificial Intelligence in Education* (pp. 176-188). Cham: Springer Nature Switzerland.**



Emotional

The use of the linguistic politeness



Background

Brown and Levinson (1987) theorized that expressing politeness is associated with **how a person would like to be perceived by other persons**

Background

Brown and Levinson (1987) theorized that expressing politeness is associated with **how a person would like to be perceived by other persons**



Tips for Polite and Diplomatic Language

Don't Say	Say
✗ That's a bad idea.	✓ I'm not so sure that's a good idea.
✗ Can I smoke here?	✓ Would you mind if I smoked here?
✗ Come here.	✓ Could you come here?
✗ This report is awful.	✓ This report is not really up to standard.
✗ No.	✓ No, thanks
✗ Can I borrow your pencil?	✓ Could I borrow your pencil?



Image from International TEFL and TESOL Training

Brown, P., & Levinson, S. C. (1987). *Politeness: Some universals in language usage* (Vol. 4). Cambridge university press.
<https://www.teflcourse.net/english-grammar-corner/tips-for-polite-and-diplomatic-language/>

Background

Students prefer to work with the polite tutors

Wang, N., Johnson, W. L., Rizzo, P., Shaw, E., & Mayer, R. E. (2005, January). Experimental evaluation of polite interaction tactics for pedagogical agents. In *Proceedings of the 10th international conference on Intelligent user interfaces* (pp. 12-19).

Background

Tutors' politeness can improve students' performance

Wang, N., Johnson, W. L., Mayer, R. E., Rizzo, P., Shaw, E., & Collins, H. (2008). The politeness effect: Pedagogical agents and learning outcomes. International journal of human-computer studies, 66(2), 98-112.

Mikheeva, M., Schneider, S., Beege, M., & Rey, G. D. (2019). Boundary conditions of the politeness effect in online mathematical learning. Computers in Human Behavior, 92, 419-427.



What is the role of tutors' **politeness** in the online one-on-one dialogue tutoring?

Data

Yup Tutoring Dialogue Data (dataset for immediate feedback)

Total tutorial sessions: 14,562

Tutors: 116

Students: 5,165 (K-12 level)

Student Performance

Gap-clarified (low performance, **ineffective** tutoring session)

Gap-explained (medium performance, **less effective** tutoring session)

Gap-bridged (high performance, **effective** tutoring session)

Analyze Politeness

Tool for analyzing politeness	Description
Politeness Strategy Identifier (PSI) (Danescu-Niculescu-Mizil et al., 2013)	This tool can extract 21 politeness strategies including <i>Direct_start</i> , <i>Please_start</i>
Politeness Level Identifier (PLI) (Niu & Bansal, 2018)	This tool can predict the level of politeness for a sentence

Danescu-Niculescu-Mizil, C., Sudhof, M., Jurafsky, D., Leskovec, J., & Potts, C. (2013). A computational approach to politeness with application to social factors. *arXiv preprint arXiv:1306.6078*.

Niu, T., & Bansal, M. (2018). Polite dialogue generation without parallel data. *Transactions of the Association for Computational Linguistics*, 6, 373-389.

Politeness Strategy Identifier (PSI)

Danescu-Niculescu-Mizil et al.
(2013)

Strategy	Example
HasPositive	I am <u>glad</u> to hear that
2nd_Person	As you can see , it would be outside the triangle
1st_Person_PL	Next, <u>we</u> will pick a pair of factors
HasNegative *	Why are you unsure about what you did?
Direct_Start *	but it's already given
1st_Person	yes, <u>I</u> will start working on it
1st_Person Start	<u>I</u> will try how I'm doing
HasHedge	Probably being careful
Direct_Question *	<u>What</u> is the subscript on it?
Deference	<u>Awesome!</u>

Danescu-Niculescu-Mizil, C., Sudhof, M., Jurafsky, D., Leskovec, J., & Potts, C. (2013). A computational approach to politeness with application to social factors. *arXiv preprint arXiv:1306.6078*.

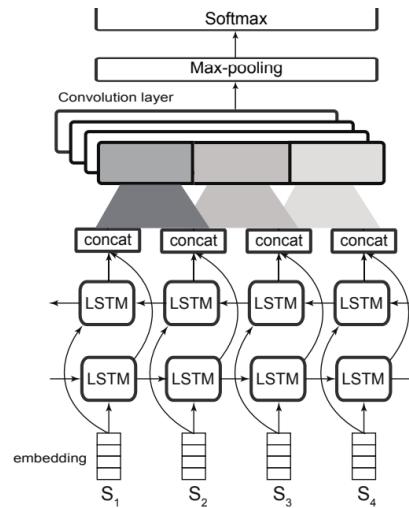
Politeness Level Identifier (PLI)

Input

Model

Output

Tutors' utterances
(e.g., "No, it's wrong!")

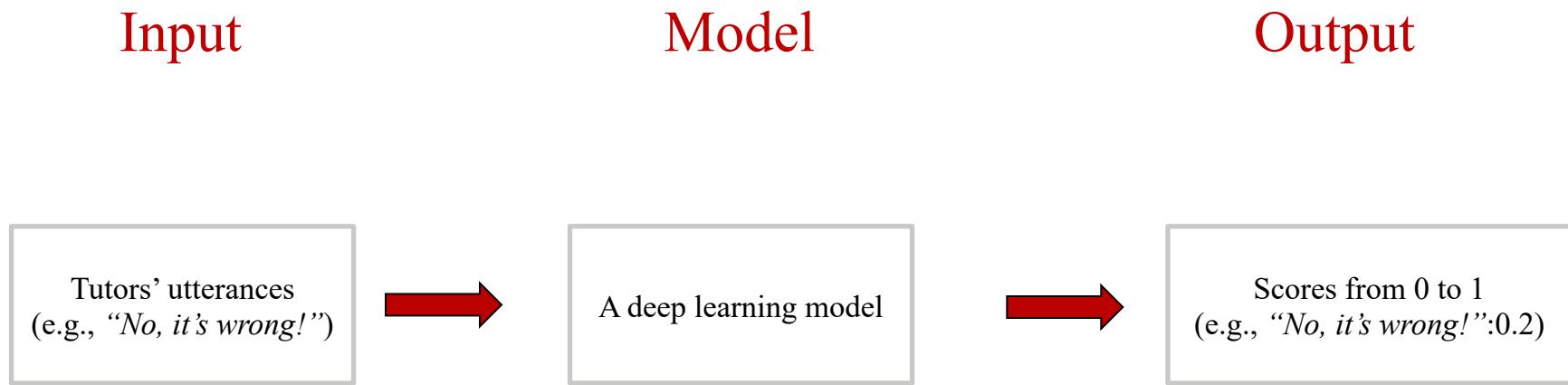


Scores from 0 to 1
(e.g., "No, it's wrong!":0.2)

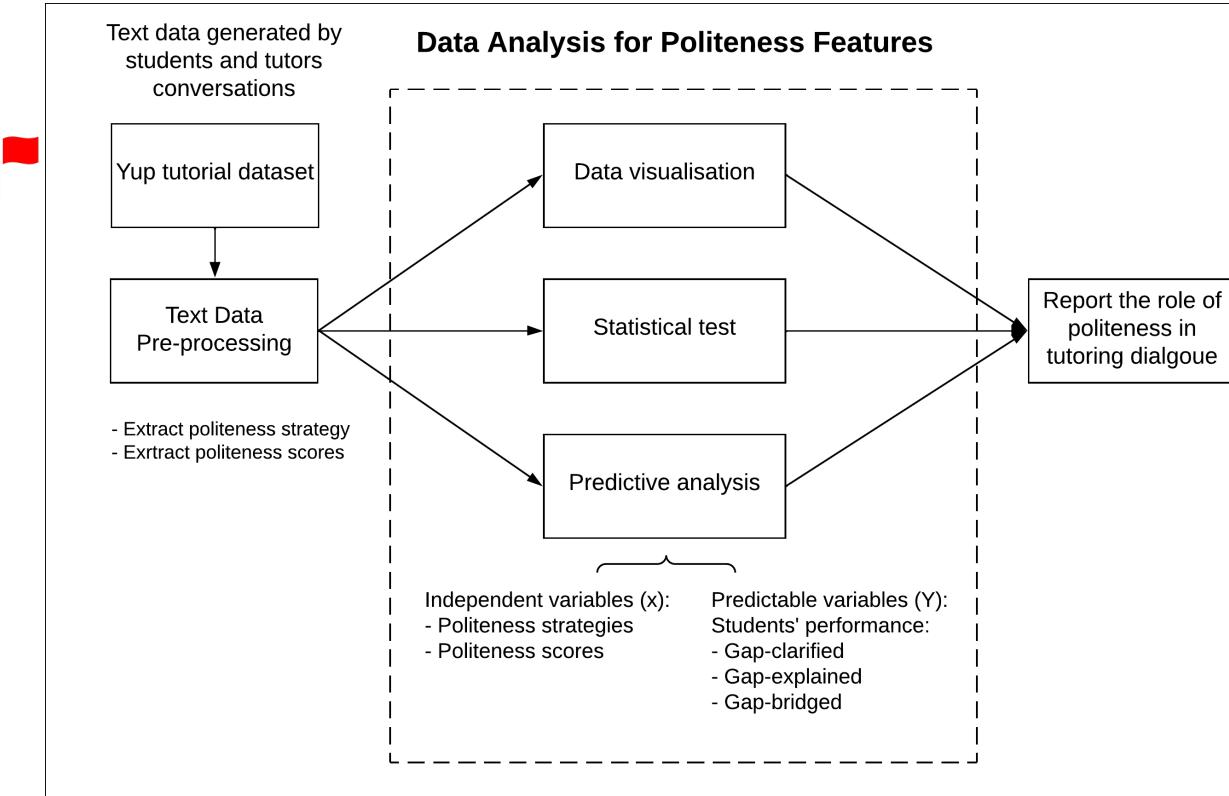
Figure 1: Our LSTM-CNN politeness classifier.

Niu, T., & Bansal, M. (2018). Polite dialogue generation without parallel data. *Transactions of the Association for Computational Linguistics*, 6, 373-389.

Politeness Level Identifier (PLI)



Niu, T., & Bansal, M. (2018). Polite dialogue generation without parallel data. *Transactions of the Association for Computational Linguistics*, 6, 373-389.



Lin, J., Raković, M., Li, Y., Xie, H., Lang, D., Gašević, D., & Chen, G. (2023). On the role of politeness in online human–human tutoring. *British Journal of Educational Technology*.

Joono's Time (10 minutes)

Rate politeness scores

A tutor says:

What do you think is the next step?

What is the next step?

What do you think we could try first?

Do you understand what I mean?

I hope this make sense?

Would that make sense?

Not exactly

Sorry, I saw the wrong numbers.

You made on slight mistake

Joono's Time (10 minutes)

Rate politeness scores



The perception of politeness is culturally dependent

Brown, P., & Levinson, S. C. (1987). *Politeness: Some universals in language usage* (Vol. 4). Cambridge university press.

Joono's Time

Rate politeness scores

Politeness Groups Examples	
Direct	<i>Do you understand what I mean?</i>
Neutral	<i>Would that make sense?</i>
Polite	<i>I hope this make sense?</i>
Direct	<i>Not exactly!</i>
Neutral	<i>You made one slight mistake.</i>
Polite	<i>Sorry, I saw the wrong numbers.</i>
Direct	<i>What is the next step?</i>
Neutral	<i>What do you think is the next step?</i>
Polite	<i>What do you think we could try first?</i>

Findings

Track the change of politeness in tutoring sessions

TABLE 3 The top 10 most frequent politeness strategies in our dataset.

Strategy	Role	All	Gap-clarified		Gap-explained		Gap-bridged	
			Without PP	With PP	Without PP	With PP	Without PP	With PP
HASPOSITIVE	T	23.23%	◊ ↗22.33%	◊ ↗25.91%	† ↗20.84%	† ↗22.25%	† ↗23.03%	† ↗24.29%
2nd_person	T	20.72%	◊ ↗28.38%	◊ ↗25.92%	† ↗21.17%	† ↗21.83%	† ↗18.21%	† ↗19.06%
1st_person_pl	T	12.68%	◊ ↗11.41%	◊ ↗7.04%	† ↗15.86%	† ↗13.80%	† ↗13.79%	† ↗11.77%
HASNEGATIVE *	T	10.73%	◊ ↗18.38%	◊ ↗13.55%	† ↗11.98%	† ↗10.86%	† ↗9.23%	† ↗8.65%
Direct_start *	T	6.84%	◊ ↗4.99%	◊ ↗4.53%	◊ 7.35%	◊ 7.40%	♦ 7.52%	♦ 6.96%
Direct_question *	T	5.76%	6.68%	◊ ↗5.43%	6.00%	◊ 6.02%	5.72%	♦ 5.45%
HASHEDGE	T	5.50%	6.20%	◊ ↗5.15%	† ↗5.95%	† ↗6.56%	† 5.13%	† ↗5.26%
1st_person	S	5.33%	5.33%	◊ ↗7.47%	4.41%	◊ 6.01%	4.45%	♦ 5.82%
HASPOSITIVE	S	5.24%	♦ 4.28%	◊ ↗7.93%	† ↗3.50%	† ↗4.59%	† ↗4.74%	† ↗6.21%
1st_person_start	T	5.01%	◊ ↗9.57%	◊ ↗8.65%	† ↗5.55%	† ↗5.61%	† ↗3.42%	† ↗3.86%

Note: We used three symbols (e.g., †, ♦ and ◊) to mark the statistical differences. † marked the significant difference between Gap-explained and Gap-bridged, ♦ marked the significant difference between Gap-clarified and Gap-bridged, ◊ marked the significant difference between Gap-clarified and Gap-explained.



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Lin, J., Lang, D., Xie, H., Gašević, D., & Chen, G. (2020, July). Investigating the Role of Politeness in Human-Human Online Tutoring. In *International Conference on Artificial Intelligence in Education* (pp. 174-179). Springer, Cham.

Findings

Track the change of politeness in tutoring sessions

TABLE 4 The average politeness score of tutors and students across dialogues in various session categories.

	All	Gap-clarified		Gap-explained		Gap-bridged	
		Without PP	With PP	Without PP	With PP	Without PP	With PP
1. Avg. politeness score (tutor & student)	0.62±0.06	◊ ♣0.64±0.12	◊ ♣0.67±0.11	† ♣0.60±0.09	♣0.60±0.09	† ◊0.59±0.08	◊0.61±0.08
2. Avg. politeness score (tutor)	0.66±0.08	◊ ♣0.71±0.10	◊ ♣0.72±0.09	† ♣0.65±0.08	♣0.65±0.08	† ◊0.64±0.07	◊0.65±0.07
3. Avg. politeness score (student)	0.56±0.07	◊ ♣0.58±0.10	◊ ♣0.62±0.11	◊0.54±0.07	† ◊0.55±0.07	♣0.55±0.06	† ♣0.56±0.07

Note: We used three symbols (e.g., †, ♣ and ◊) to mark the statistical differences. † marked the significant difference between Gap-explained and Gap-bridged, ♣ marked the significant difference between Gap-clarified and Gap-bridged, ◊ marked the significant difference between Gap-clarified and Gap-explained.

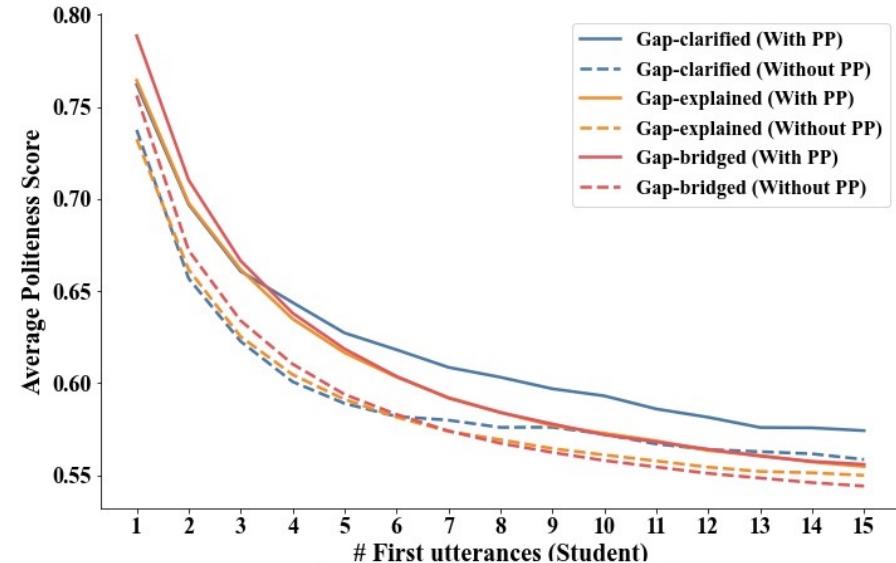
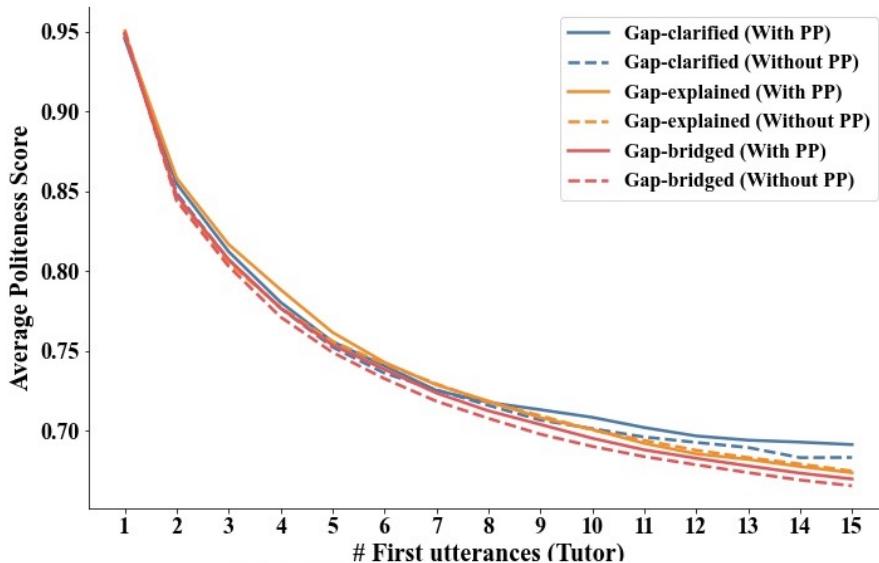


Lin, J., Raković, M., Li, Y., Xie, H., Lang, D., Gašević, D., & Chen, G. (2023). On the role of politeness in online human–human tutoring. *British Journal of Educational Technology*.

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Findings

Track the change of politeness in tutoring sessions



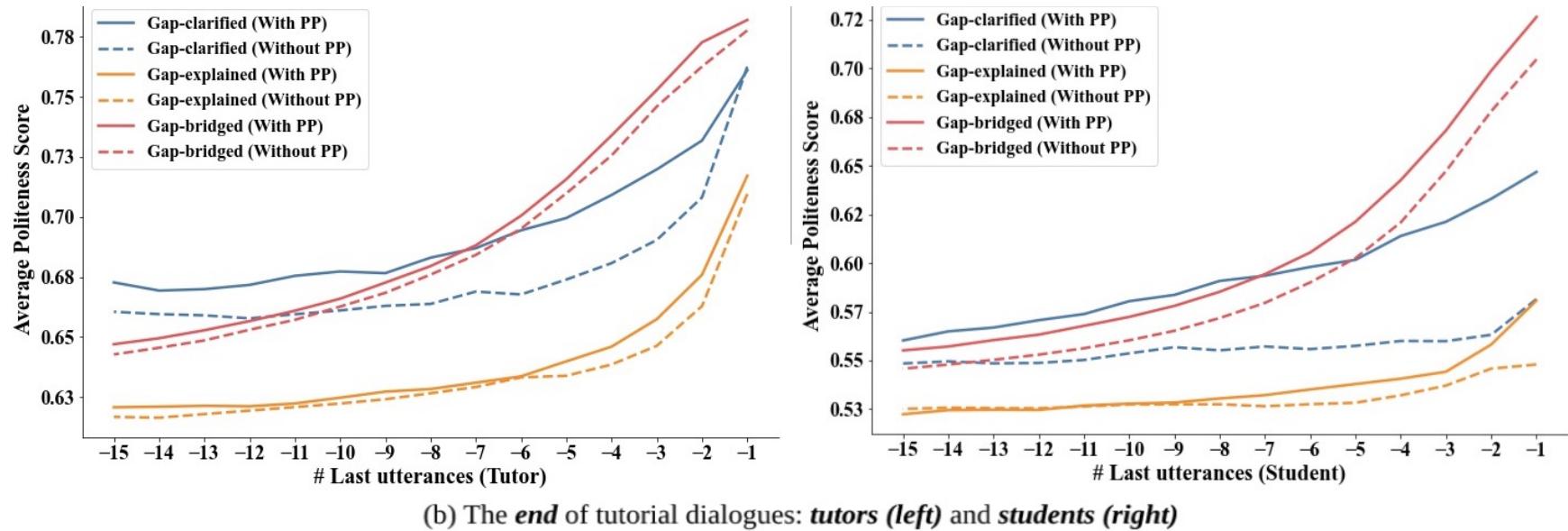
(a) The **beginning** of tutorial dialogues: **tutors (left)** and **students (right)**



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Findings

Track the change of politeness in tutoring sessions



(b) The *end* of tutorial dialogues: *tutors* (left) and *students* (right)



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Findings

Track the change of politeness in tutoring sessions

In effective tutorial sessions, tutors tended to be **very polite at the start** of a tutorial session and became **more direct** in guiding students as the session progressed.

High-achieving students tended to be more polite at the beginning and the end of a tutorial session than their counterparts who failed to solve problems

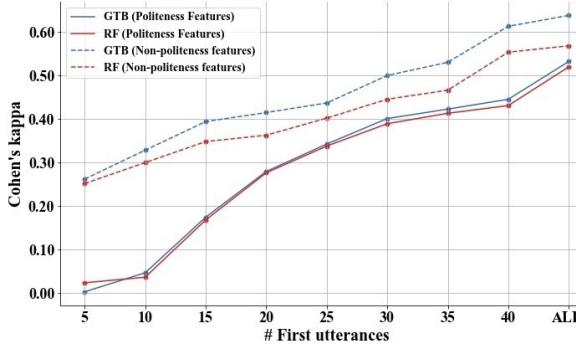
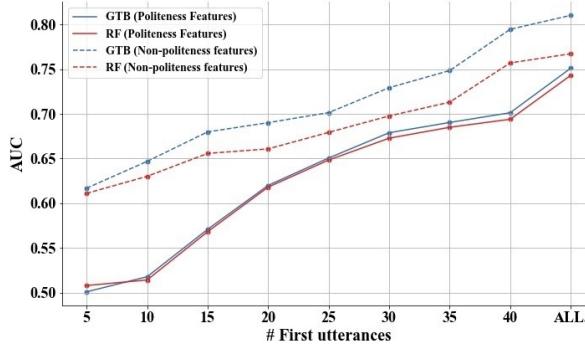
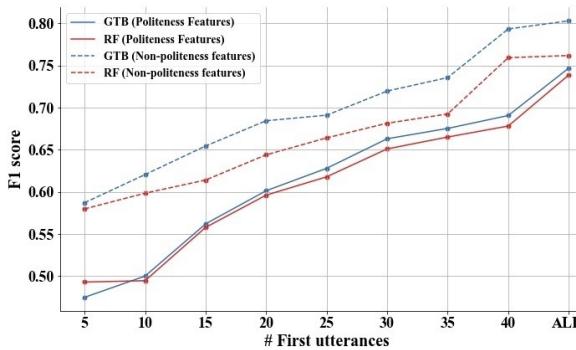
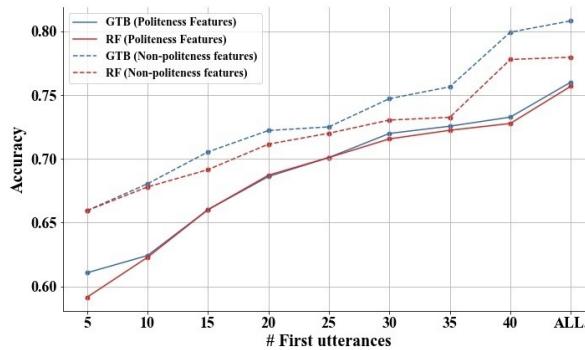
Tutors from effective tutoring sessions communicate **more politely when asking open-ended questions** to students with less prior knowledge than those with higher prior knowledge.



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[Lin, J.](#), Lang, D., Xie, H., Gašević, D., & Chen, G. (2020, July). Investigating the Role of Politeness in Human-Human Online Tutoring. In *International Conference on Artificial Intelligence in Education* (pp. 174-179). Springer, Cham.

Findings - Predictive power of politeness in tutoring sessions



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Findings

Predictive power of politeness in tutoring sessions

Politeness has the potential to predict students' problem-solving performance. Incorporating politeness with other factors (e.g., sentiment contained in utterances) into the student performance prediction can enhance the prediction accuracy



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Main conclusion

The construction of dialogue-based ITSs with the consideration of **politeness is important** for supporting students solving problems.



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[Lin, J.](#), Lang, D., Xie, H., Gašević, D., & Chen, G. (2020, July). Investigating the Role of Politeness in Human-Human Online Tutoring. In *International Conference on Artificial Intelligence in Education* (pp. 174-179). Springer, Cham.

Joono's Time (20 minutes)

Using R to analyze politeness strategies from tutoring dialogues



Should tutors express
politeness **all the time** in the
tutoring dialogue?



**Any research related to
ChatGPT, GPT-4?**

Recommended Readings

- Lin, J.,*** Singh, S., Sha, L., Tan, W., Lang, D., Gašević, D., & Chen, G. (2022). Is it a good move? Mining effective tutoring strategies from human–human tutorial dialogues. *Future Generation Computer Systems*, 127, 194-207.
- Lin, J.,*** Tan, W., Nguyen, N. D., Lang, D., Du, L., Buntine, W., ... & Gašević, D. (2023, June). Robust Educational Dialogue Act Classifiers with Low-Resource and Imbalanced Datasets. In *International Conference on Artificial Intelligence in Education* (pp. 114-125). Cham: Springer Nature Switzerland.
- Tan, W., **Lin, J.,*** Lang, D., Chen, G., Gašević, D., Du, L., & Buntine, W. (2023, June). Does informativeness matter? Active learning for educational dialogue act classification. In *International Conference on Artificial Intelligence in Education* (pp. 176-188). Cham: Springer Nature Switzerland.
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- Lin, J.,*** Lang, D., Xie, H., Gašević, D., & Chen, G. (2020). Investigating the role of politeness in human-human online tutoring. In *Artificial Intelligence in Education: 21st International Conference, AIED 2020, Ifrane, Morocco, July 6–10, 2020, Proceedings, Part II 21* (pp. 174-179). Springer International Publishing.
- Lin, J.,*** Raković, M., Li, Y., Xie, H., Lang, D., Gašević, D., & Chen, G. (2023). On the role of politeness in online human–human tutoring. *British Journal of Educational Technology*.
- Lin, J.,*** Rakovic, M., Lang, D., Gasevic, D., & Chen, G. (2022, March). Exploring the politeness of instructional strategies from human-human online tutoring dialogues. In *LAK22: 12th International Learning Analytics and Knowledge Conference* (pp. 282-293).
- Lin, J.,*** Thomas, D. R., Han, F., Gupta, S., Tan, W., Nguyen, N. D., & Koedinger, K. R. (2023). Using large language models to provide explanatory feedback to human tutors. *arXiv preprint arXiv:2306.15498*.
- Lin, J.,*** Thomas, D. R., Han, Z., Tan, W., Nguyen, N. D., Gupta, S., ... & Koedinger, K. R. (2023). Personalized Learning Squared (PLUS): Doubling Math Learning through AI-assisted Tutoring.
- Hirunyasiri, D., Thomas, D. R., **Lin, J.,*** Koedinger, K. R., & Aleven, V. (2023). Comparative analysis of gpt-4 and human graders in evaluating praise given to students in synthetic dialogues. *arXiv preprint arXiv:2307.02018*.

The background of the left section features a dark blue gradient with a grid pattern of colored lines (red, green, yellow, blue) forming a diamond mesh.

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University



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