Toward Automated Feedback on Teacher Discourse to Enhance Teacher Learning

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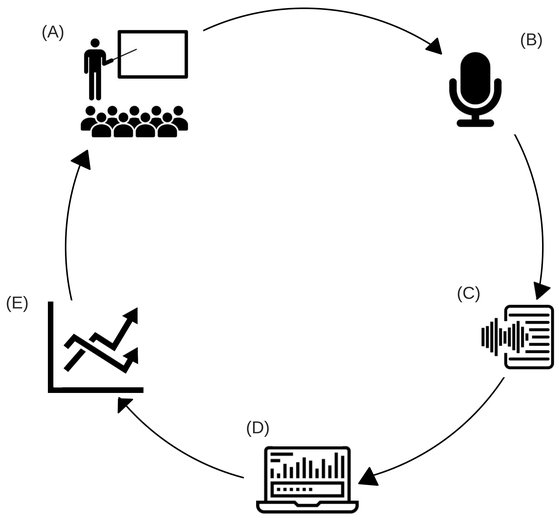
Research Questions

1. To what extent can teachers easily record high-quality audio of their own classes to enable automatic feedback?

2. To what extent can we use the recorded audio to automate the analysis of teacher discourse?

3. How robust is our approach to differences in speech recognition quality?

Automated Teacher Feedback Approach



(**A**) Classroom Teaching stage. Teachers interact with students in a normal classroom setting.
(**B**) Audio Recording stage. Teachers independently record high-quality audio of their normal classroom talk.
(**C**) Speech Processing stage. Audio recordings from part (B) are uploaded online. These recordings are then automatically transcribed and relevant speech and language information is extracted.
(**D**) Computer Modeling stage. Once language information is extracted, the automated system identifies the presence of key discourse elements using pre-trained machine learning models.
(E) Feedback and Reflection stage. The results of the automated analysis are presented to teachers along with long-term trends so they can adjust their discourse and monitor progress over time.

Background

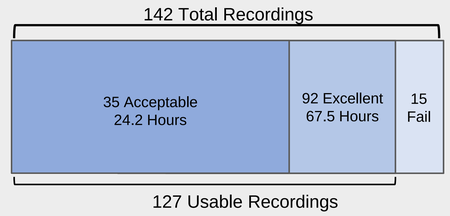
- Teacher professional development is expensive and does not help teachers improve their practice.
- We propose an automated approach that is personalized and gives frequent feedback for improvement.
- Feedback is focused on elements of Dialogic Discourse, which are associated with classroom engagement and learning.
- We aim to predict the proportion of lesson utterances that contain each element.
- Teachers should be able to use this system without assistance.

Discourse Element	Prevalence
Instructional Talk	81%
Questions	31%
Authentic Questions	5%
Elaborated Evaluation	6%
High Cognitive Level	4%
Uptake	2%
Goal Specificity	9%
ELA Terms	9%

Audio Recording

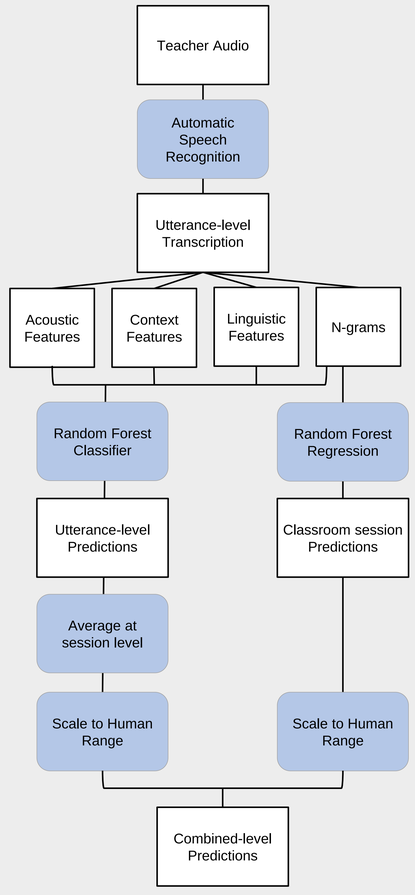
Audio recording equipment

- Teachers used a headset to record 4 lessons each in 2 classes.
- They checked the recording levels 83% of the time.
- The set-up process was rated as easy.
- The microphone was uncomfortable for some teachers.
- Some teachers felt the microphone made the class feel staged.
- Researchers rated the recordings for audio quality. 89% of recordings were of usable quality.



Modeling

Discourse Element	Distribution Mean: Human	Distribution Mean: Computer	Spearman *r*	MAE
Instructional Talk	0.809	0.716	0.349	0.127
Questions	0.306	0.270	0.564	0.088
Authentic Questions	0.051	0.094	0.565	0.061
Elaborated Evaluation	0.064	0.099	0.351	0.052
High Cognitive Level	0.035	0.135	0.305	0.108
ELA Terms	0.089	0.168	0.469	0.104
Goal Specificity	0.087	0.199	0.456	0.063



Robustness

- Manually transcribed and coded a sample of utterances from each lesson.
- Calculated Word Error Rate (WER) and Simple Word Overlap (SWO) compared to automatic transcriptions
- Calculated Spearman *r* with modeling error.
- There are no strong associations between transcription error and modeling error.

Discourse Element	WER	SWO
Instructional Talk	0.19	-0.06
Questions	-0.02	-0.01
Authentic Questions	-0.12	0.02
Elaborated Evaluation	-0.03	0.01
High Cognitive Level	-0.01	-0.12
ELA Terms	-0.05	-0.03
Goal Specificity	-0.10	0.15