

LENA in the Classroom

Using LENA to Provide Elementary School Teachers with Timely

Automated Feedback on Classroom Discourse

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Project Background

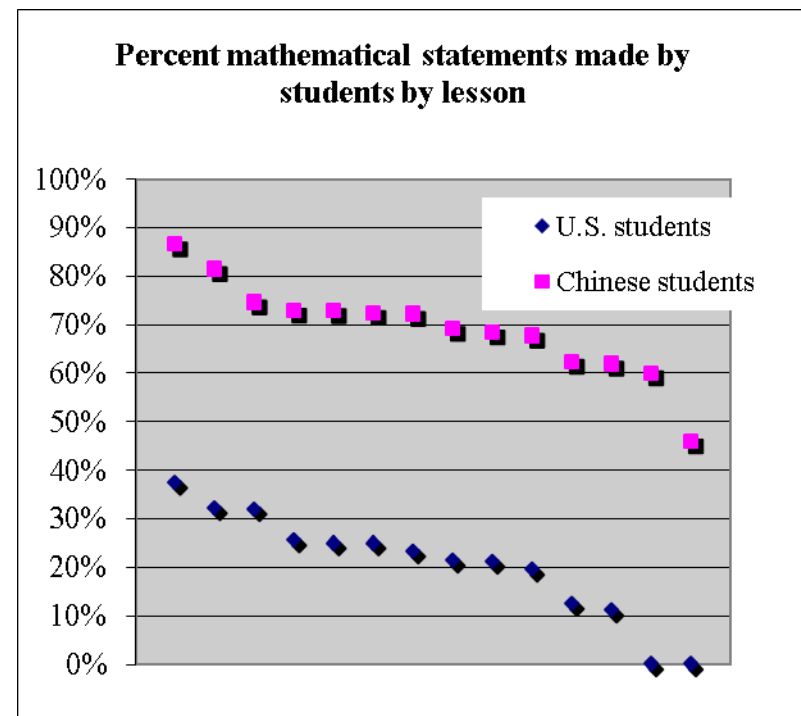
Making Room for Student Thinking (MrsT)

- Institute of Education Sciences,
U.S. Department of Education
- 2010-2013
- Grant #: R305A100178
- PI: Dr. Kevin Miller
- Co-Pi's: Dr. Kai Cortina, Dr. Vilma Mesa,
Dr. Mark Thames

Division of Labor in the Classroom

As reflected by talk

- Elementary school math classes in US & China
- Teacher? Students?
- The fact
 - Pianta et al. (2007)
 - Sims (2008)
- Little room for students to think

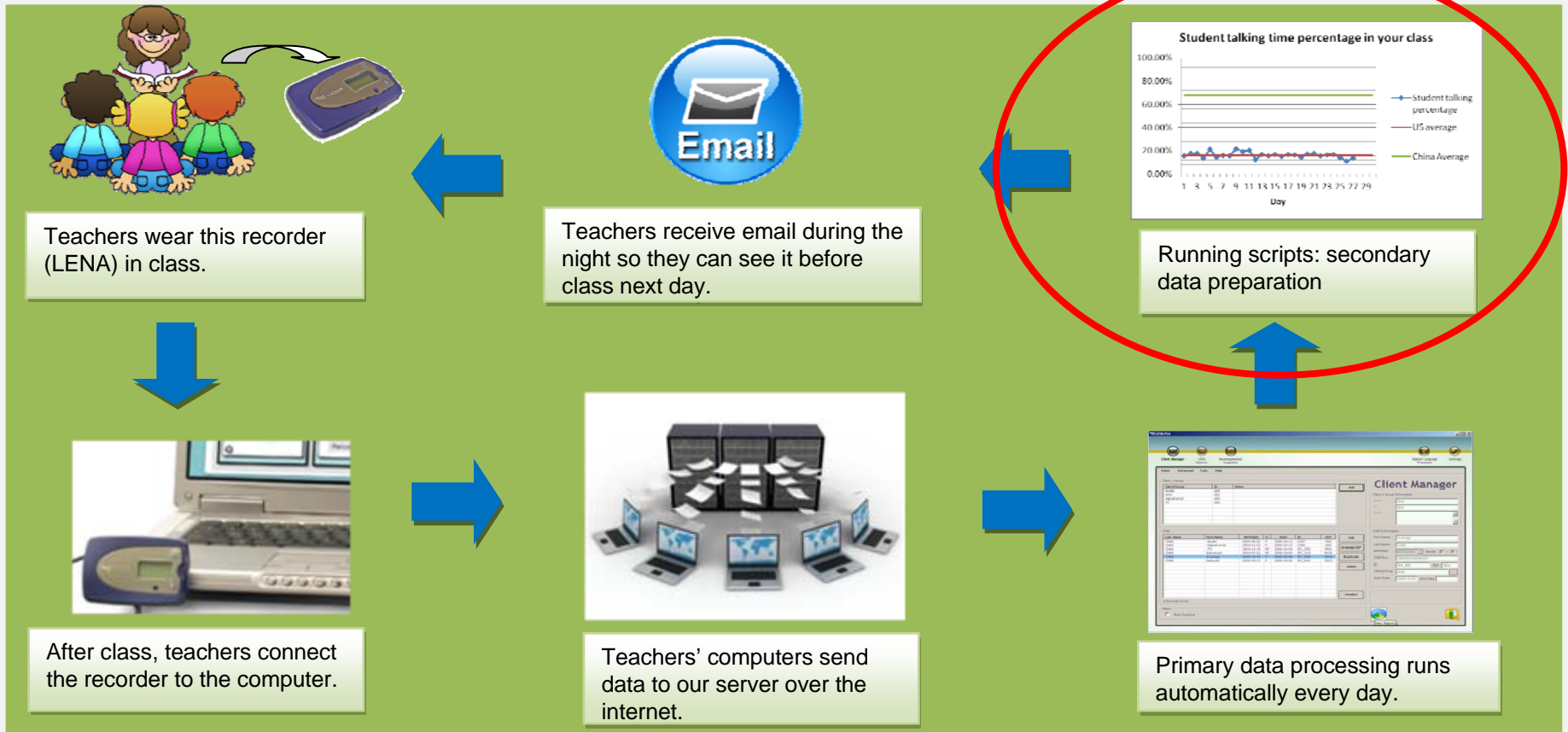


Making Room for Student Thinking (MrsT)

How can we change this?

- Help teachers realize this issue
- Help teachers change
- Scientific data, timely feedback
- Use LENA!

The LENA-MrsT System



LENA-MrsT: Classroom Validation (1)

Using LENA in the classroom

- Teacher wears LENA
- No key child
- Older children (1st – 3rd grade)
- Noisier

Validation

- 107 hours math class recording
- Listen and correct the coding of LENA
- Develop statistical model to predict corrections

LENA-MrsT: Classroom Validation (2)

Predicting corrections

- Teacher recognized as other child
- Student recognized as female adult

Predictors

- Sound level
- Segment duration

LENA-MrsT: Classroom Validation (3)

Validation Results

Category	Hit	False Alarm
Teacher	97%	5%
Student	79%	18%

What's Next?

How to apply the validated system to teacher training?

- Amount of teacher talk
- Amount of student talk

More meaningful feedback?

- Amount of different classroom activities?

Detection of Classroom Activities

Classroom Activities

- Teacher lecturing
- Discussion
 - Teacher-student discussion
 - Student-student discussion
- Group work
- Individual seat work

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Question

Sitting in a Chinese elementary school math class, without any knowledge of Chinese language, can you figure out what activity is going on in the class?

Of course!

HOW?

Detection of Classroom Activities

Task

- Ask the computer to learn to detect different classroom activities, without knowing the content.

Procedure

- Manual classification of class activities
- Using the validated classroom LENA data to predict these manual classifications

Detection of Classroom Activities

Computer Classification Results

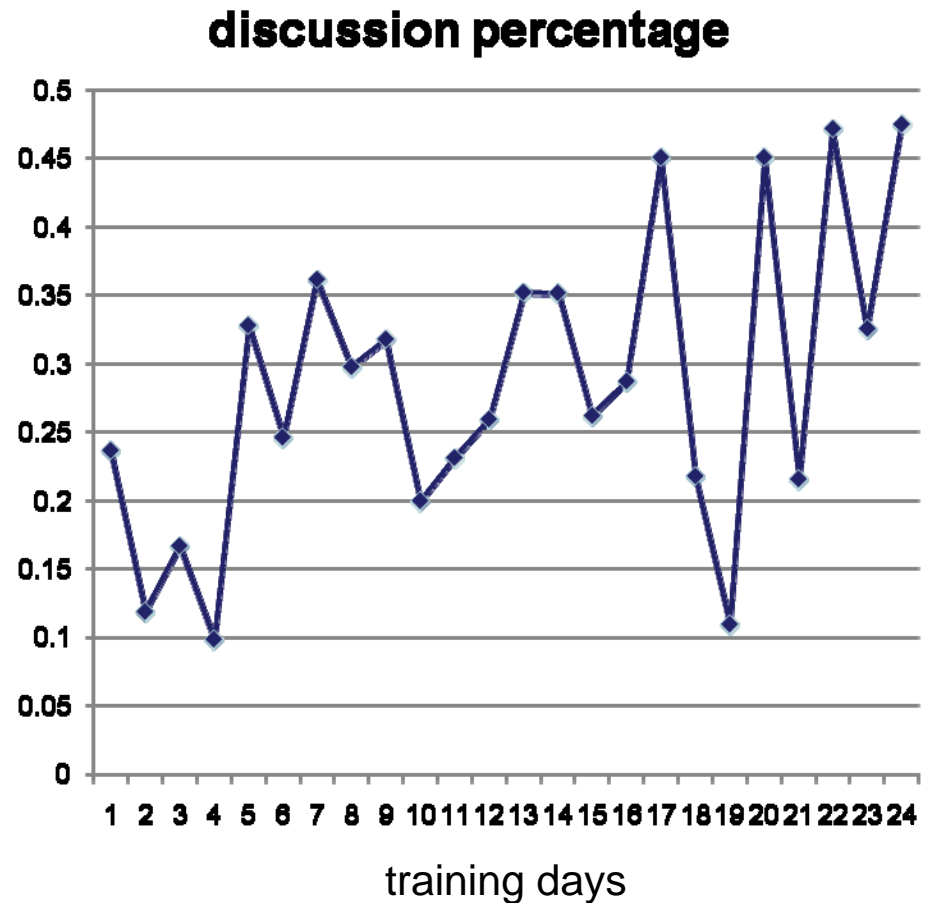
- Human Coder T and E
 - Cohen's Kappa: 0.72
 - Accuracy: 82.7%
- Computer and Coder E
 - Cohen's Kappa: 0.68
 - Accuracy: 83.3%

Note: computer learns from Coder T and tested by Coder E

Generating Feedback

Teachers receive daily feedback on the amount of discussion they had in that day.

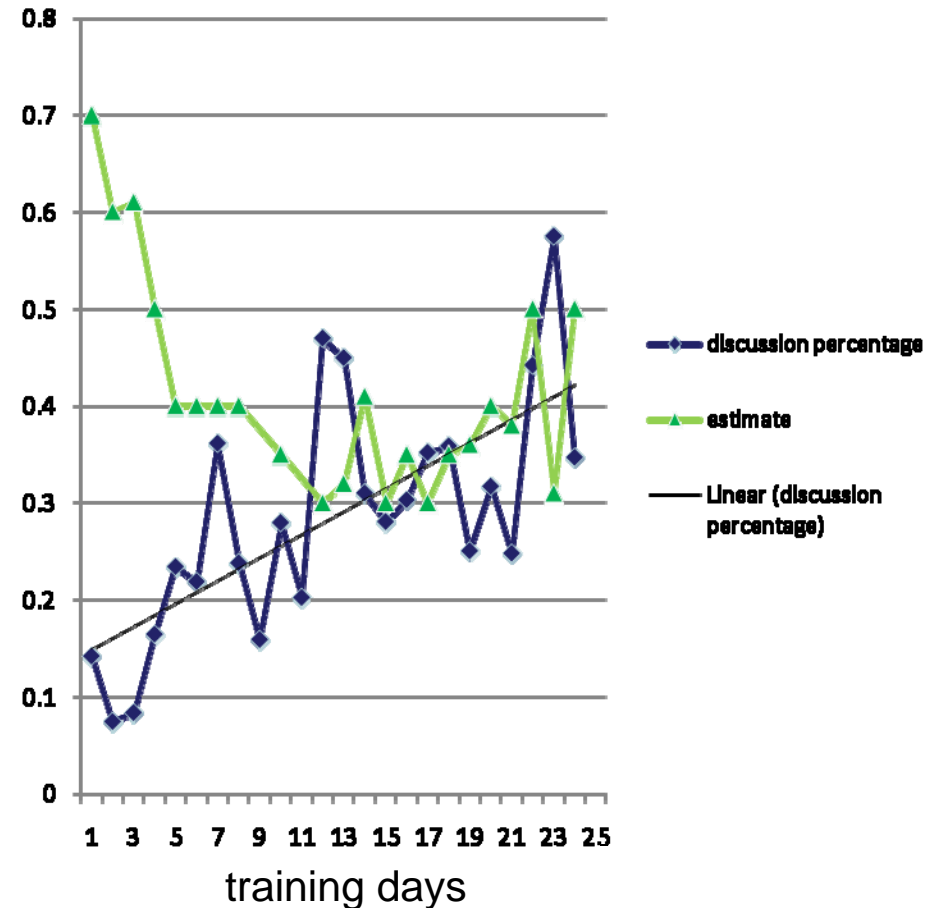
A total of ~25 training days.



Effect of Feedback (1)

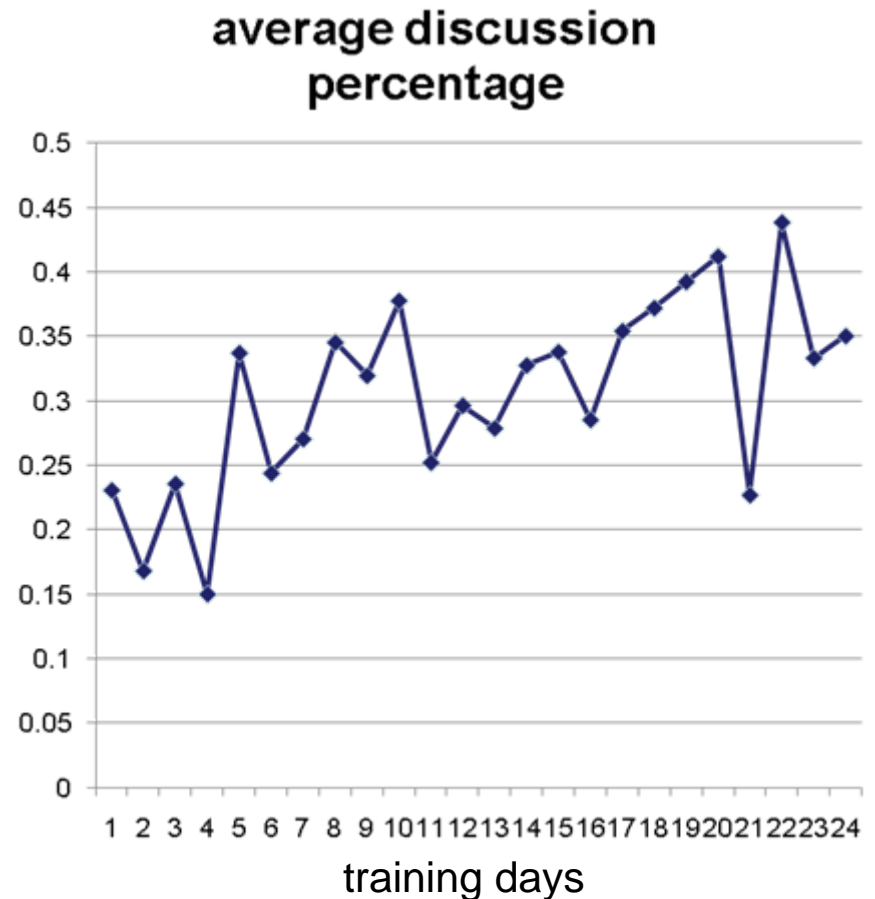
The amount of discussion increased over training.

The teacher developed a better estimation of the amount of discussion in her class.



Effect of Feedback (2)

The training effect was also significant on the group level (8 teachers).



Beyond LENA-MrsT

Automatic detection of different speech activities

- Detecting bed time storytelling activity
- Detecting desired/undesired language environment
- Detecting peer interaction
- “LENA-Detection”

LENA-Detection

Steps for detecting different speech activities based on LENA data

- Self inflection
 - Can foreign language speakers identify the activity?
- Creating supervising data
 - manual coding of the activities
- Machine learning
 - Develop statistical models so that computers can learn this detection

LENA in the Classroom

Potential Future Directions

- Noisy classroom
 - Better speech diarization algorithm that can deal with overlap
- Students who sit far from the recorder
 - Support for multi-microphone recording and analysis
- Adding basic content detection
 - E.g. wh- words detection
- Seeking for internship opportunities!

Acknowledgement

IES Grant

LENA Foundation

MrsT Project members

Teachers and Students

And you all, thanks for listening!