

Natural language processing for understanding classroom dynamics

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Quantitative evidence-based research in schools



Attendance

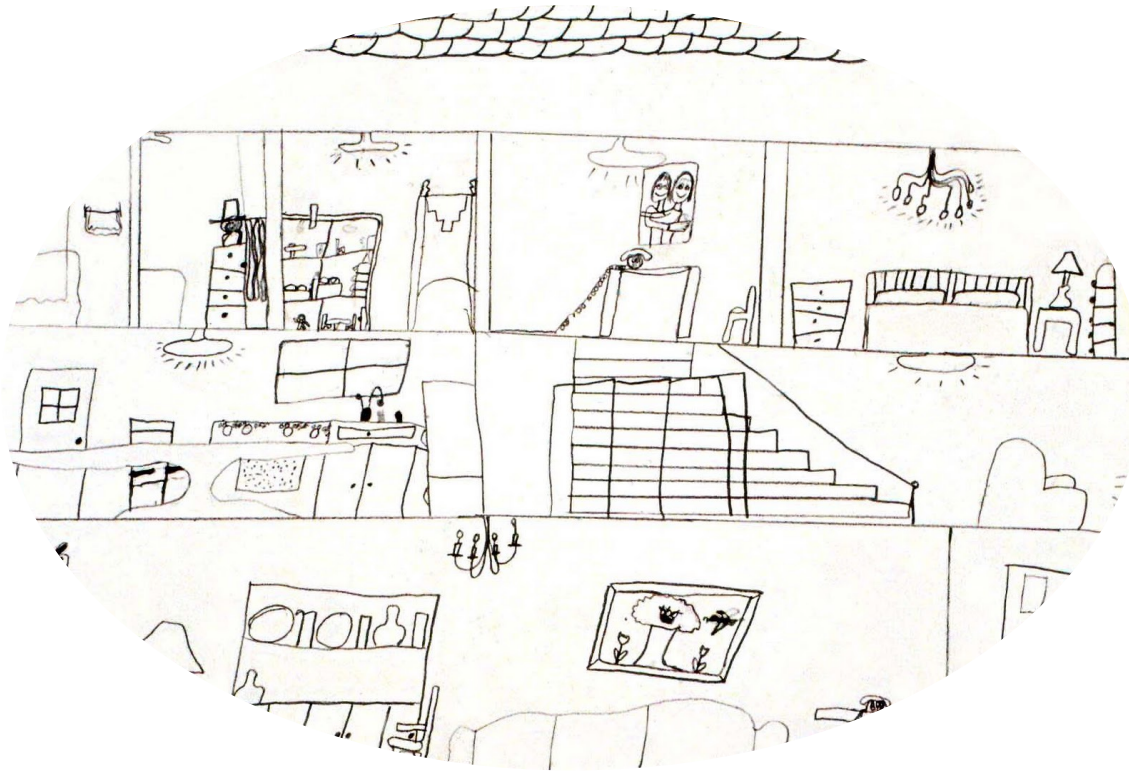


Standardized tests and surveys

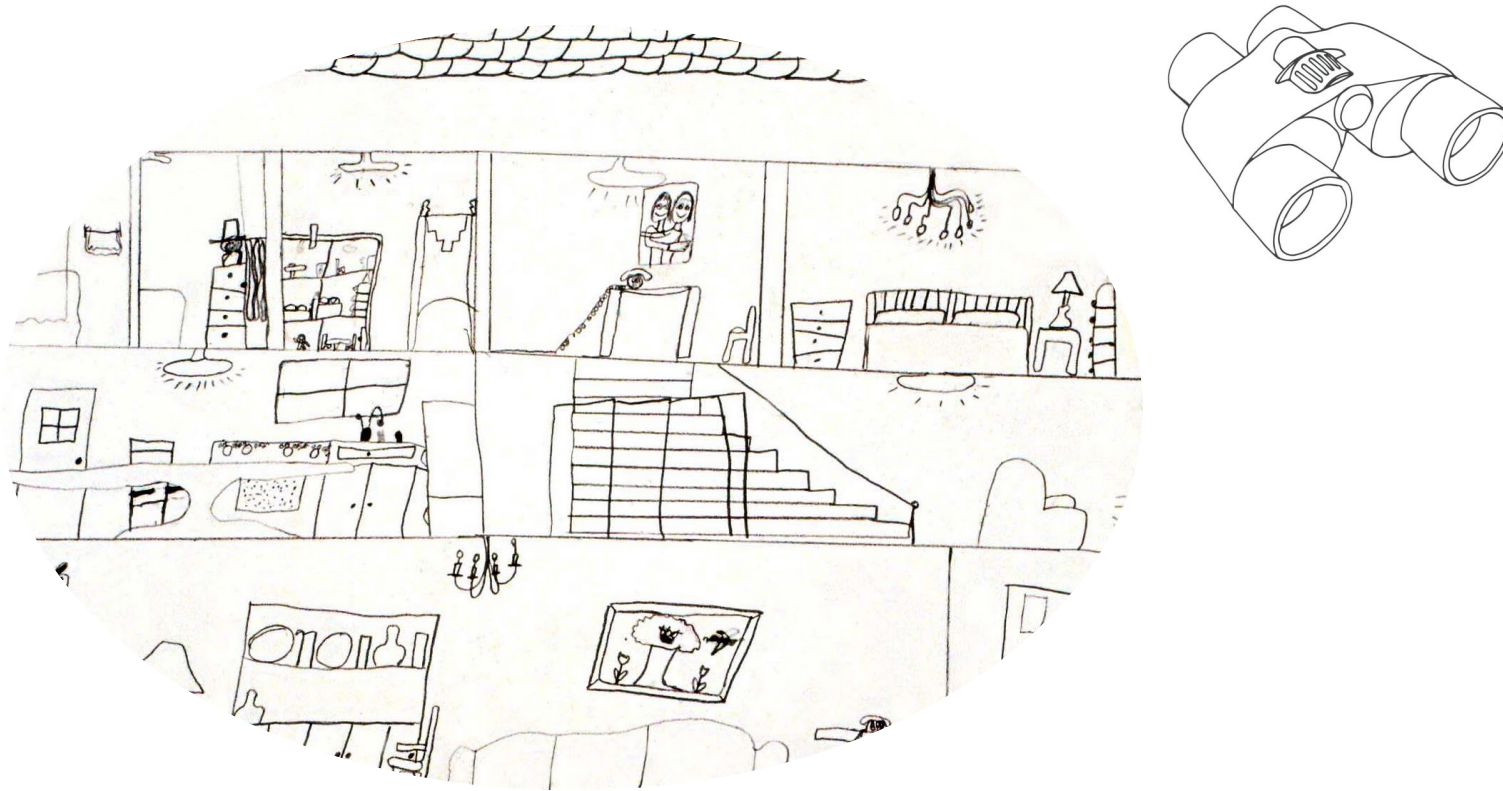


Drop-out rates

What happens within the school



What happens within the school



What things matter in the classroom?



The role of the teacher



Autonomy rate of students



Success rate of students when Facing challenges

What things matter in the classroom?



The role of the teacher



Autonomy rate of students



Success rate of students when Facing challenges

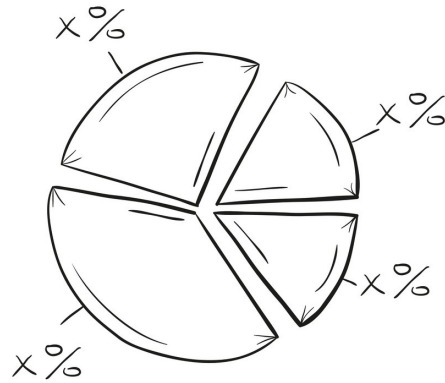
Why it matters to have quantitative measures of the role of the teacher?

Start testing
interventions for a
better classroom

Understand the
dynamic between
student and
tutor/teacher

Help teachers
become better

Our goal



Create a multidimensional
numeric representation of a class

Outline

Obtaining class transcripts

Creating latent variables out of transcripts using pre-trained language models

Testing two outcome variables: learning and class content

Latent variables are efficient to predict outcome variables

Interpretability of latent variables

JANN: A tutoring program in Mexico

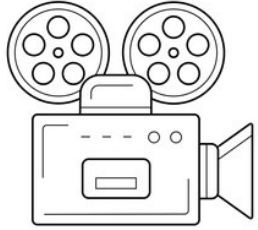


University students are randomly assigned to k-12 students as tutors

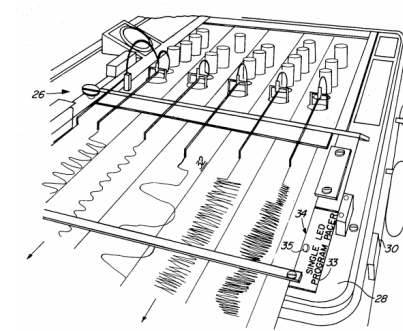
Tutors are asked to record classes for security and research purposes

Participants consent to have the recordings passed through software to advance research in education

Converting transcripts to data



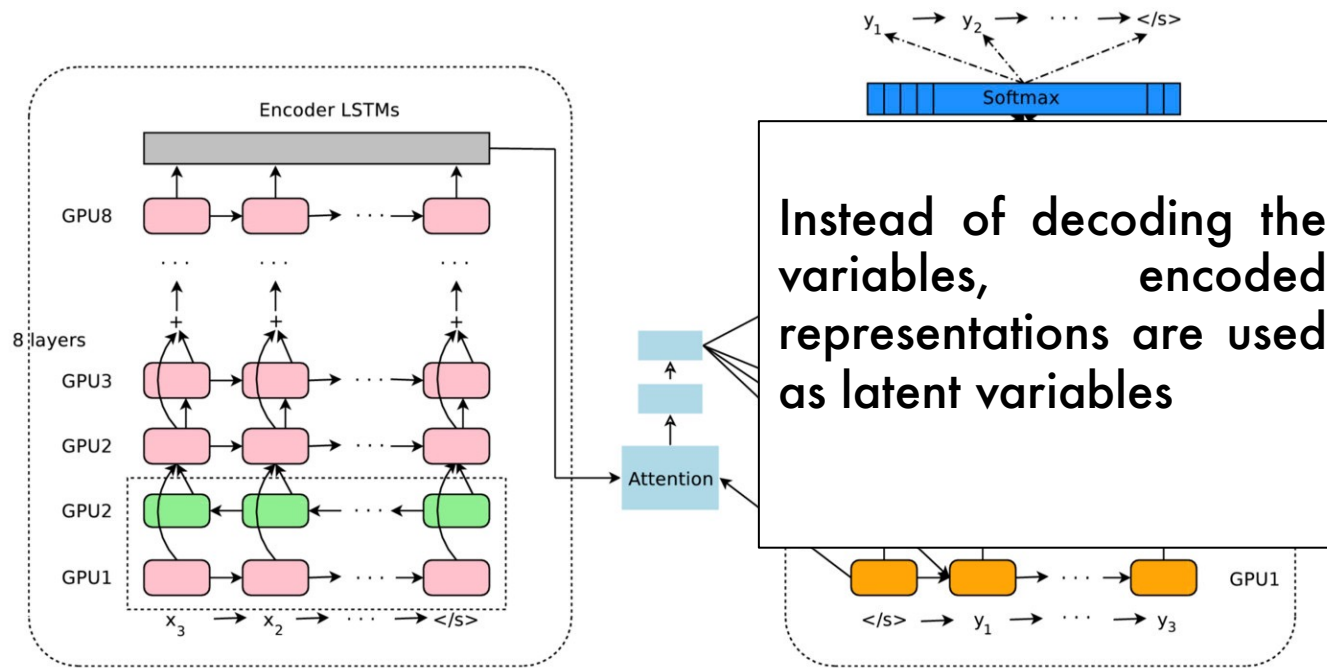
Google Cloud



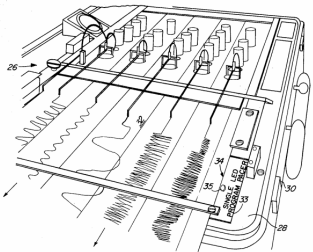
Raw audio/video files

Transcripts

Creating latent variables from transcripts



Transcripts are inputted to NLP model
In this case we used a translator model

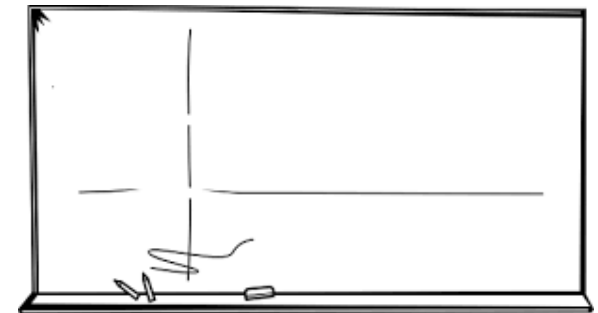


Two outcome variables

TVA

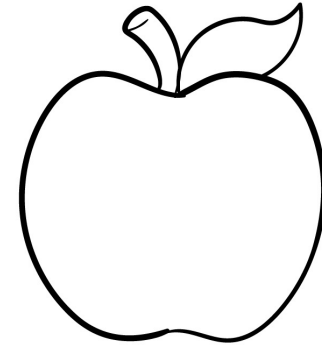
$$Score_{it+1} = \alpha Score_{it} + E_{it}\beta_0 + \epsilon_{it}$$

Effect in class by asking tutors to
create socioemotional activities



Predictability for outcome variables

We can predict



12% Learning outcomes

25% Predicting which tutors had socioemotional activities

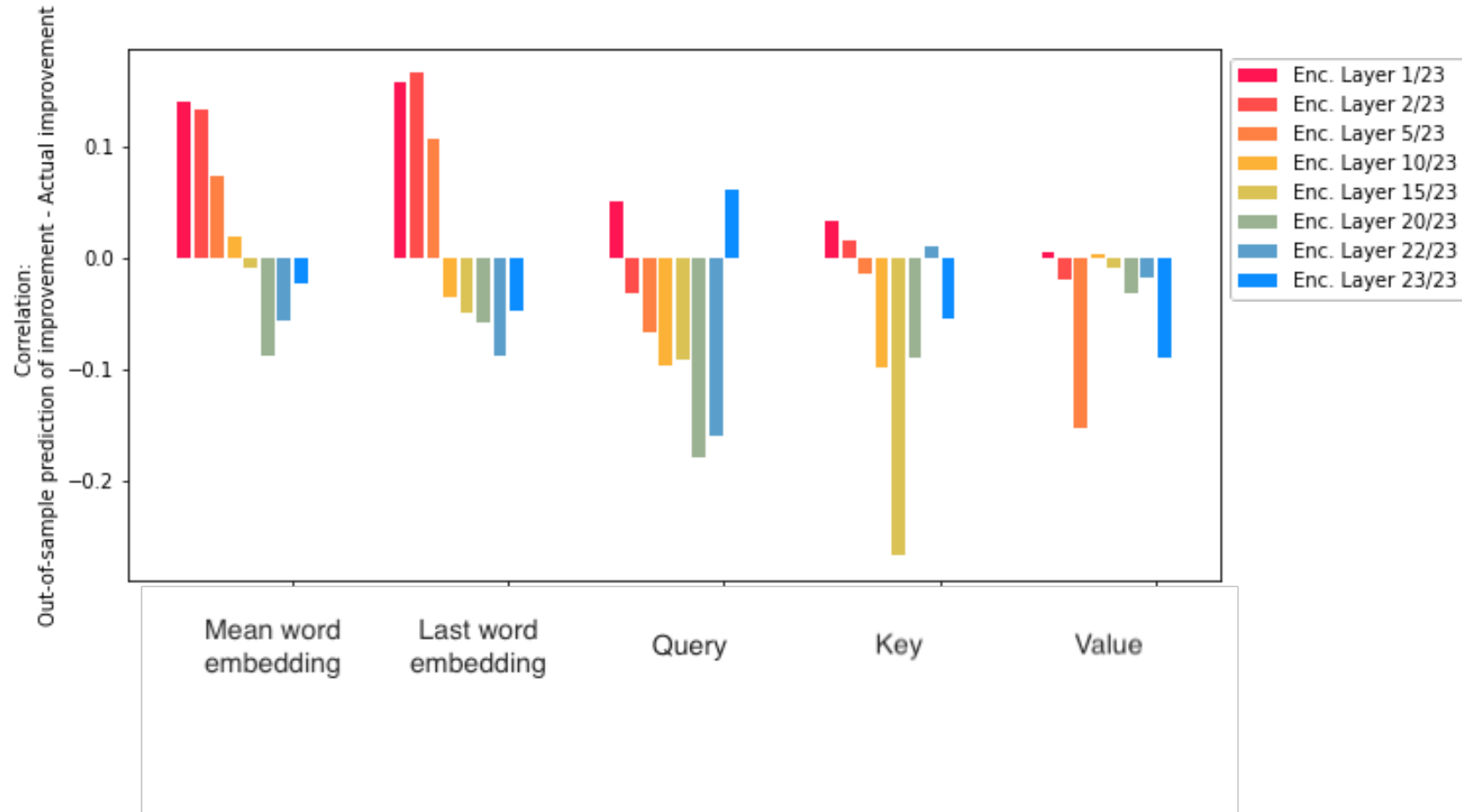
Interpretability



Origin of the prediction: early v last layers?

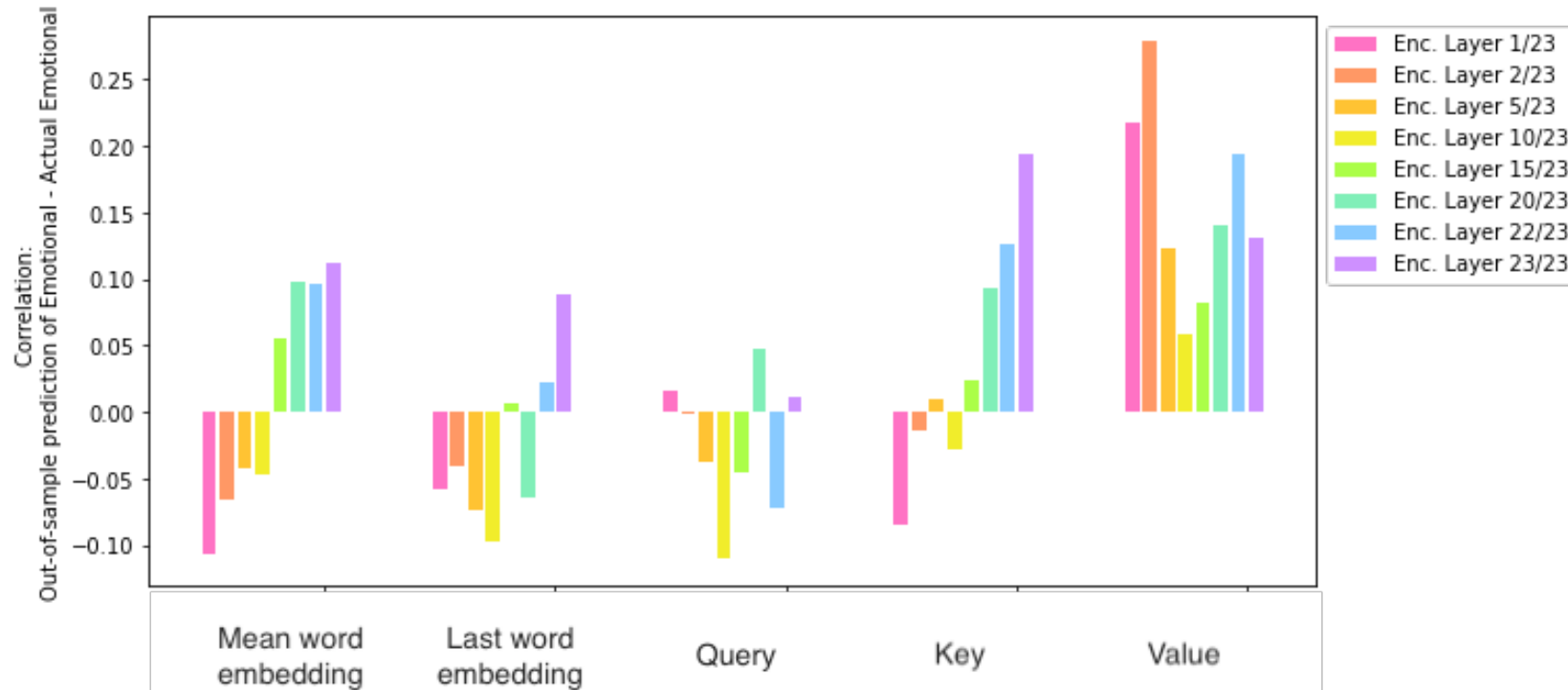
Sorting sentences by predictability of outcomes

Predictability of layers for learning outcomes



Results for different layers in terms of correlation between ground truth and out of sample k-fold predictions. The bar height is the median correlation across different regularization parameters.

Predictability of layers for class content



Results for different layers in terms of correlation between ground truth and out of sample k-fold predictions. The bar height is the median correlation across different regularization parameters.

Predictability in terms of sentences

Emotional sentences:

- *Do you like sports?*
- *The years go by fast in school, enjoy them fully*
- *At least the prime numbers*

Less emotional sentences:

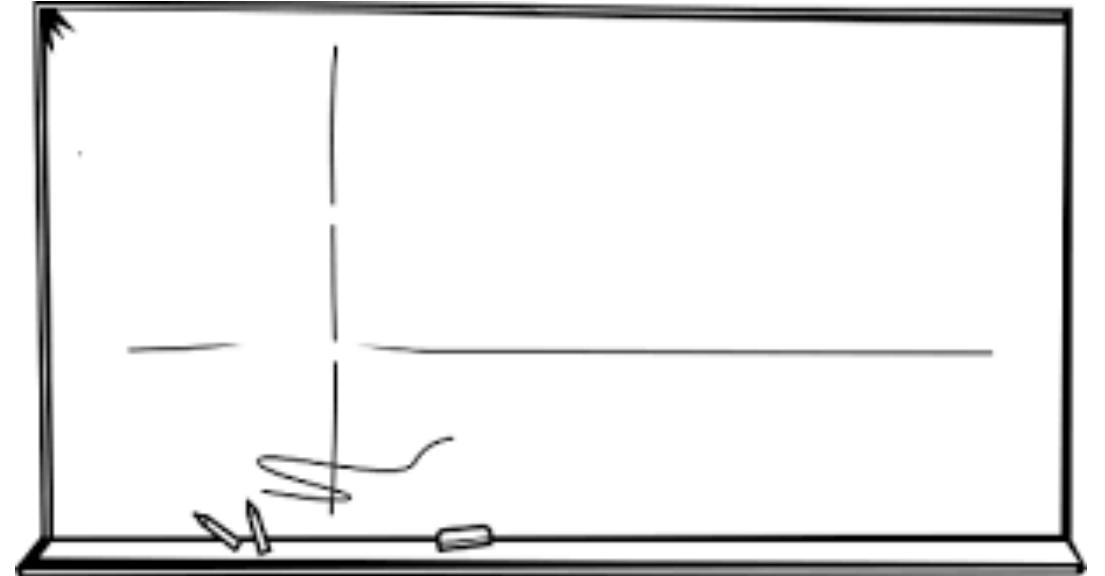
- *Can you repeat the parts of a circle*
- *Count how many elements there are*
- *We finished the exercise*

Limitations & Future avenues

No causal analysis

Limited interpretability

No audio analysis

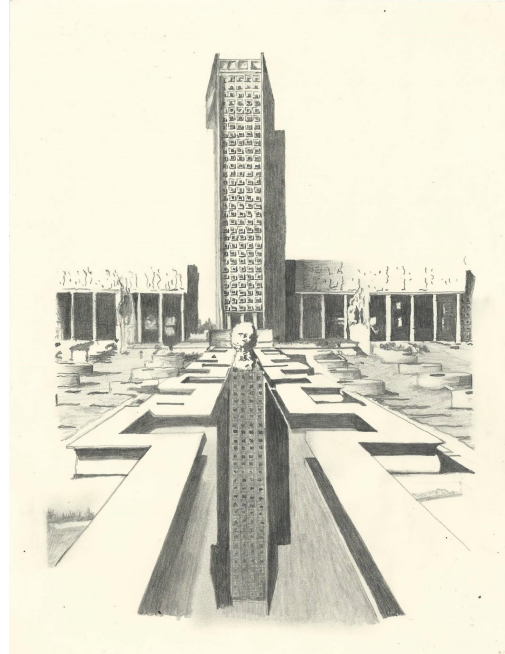


Conclusions

NLP can be used to create multidimensional representations of classroom features

These features can be used to understand how different interventions changed the classroom environment

It is possible to find traces of good teachers in classroom activities through automatized ways



Thanks! Questions?