Using Students’ Speech to Characterize Group Collaboration Quality
Cynthia D’Angelo, Jeremy Roschelle, Harry Bratt, Elizabeth Shriberg, Colleen Richey, Andreas Tsiartas, & Nonye Alozie

ABSTRACT
Collaboration is a core teaching and learning process, as well as an important 21st-century skill that students must be able to master as they progress through school and into their careers. This project is investigating the feasibility and challenges of using the speech of small groups of students to determine the quality of each group’s collaboration. Preliminary data analysis of this early-stage project will be presented.

INTRODUCTION
Collaboration is a core teaching and learning process, as well as an important 21st-century skill that students must be able to master as they progress through school and into their careers (National Research Council [NRC], 2011). Collaboration is also an integral part of STEM learning.

Management and assessment of collaborative learning tasks is difficult in typical classrooms when teachers attempt to monitor 10-15 groups with 2-3 students in each group (Cohen, 1994). Ideally, teachers would listen to peer interactions in each group for long enough to understand how discourse is proceeding—and very few teachers can do this well for so many groups. This new project is working on building speech-based analytics for collaboration that could help teachers by identifying what is going on in groups and enabling teachers to target their interventions. We see speech-based analytics not as replacing, but rather as informing the teacher’s exploration of group dynamics, diagnosis of issues, and development of an intervention plan.

Therefore, this project is investigating the feasibility and challenges of using the speech of small groups of students to determine the quality of each group’s collaboration. We are engaging human observers to code small-group collaboration (Ih). Preliminary data analysis of this early-stage project will be presented.

METHODS
Setup in Classroom

The tasks were a collaborative variation of the cloze task. In a cloze, students fill in blanks in a sentence in order to show their comprehension of material they have recently studied. In a collaborative cloze, three students each fill in one blank in a sentence (or short explanation) to express their mutual understanding. The tasks were embedded in an online delivery system and students worked in groups of three on a laptop together. Each student was wearing an individual microphone to pick up their contribution to the discussion.

A speech activity detection system was run on each student’s audio channel and provided data on who was speaking when. Pairing this speech data with timing information from the software (e.g., which question the students are working on) enables us to analyze how much each student was speaking during each problem.

We initially compute the spectral characteristics of the speech signal at 20ms windows. We then, the spectral characteristics and dynamics are analyzed at 200ms windows and much each student was speaking during each problem.

PRELIMINARY FINDINGS
There was a weak overall trend (r=0.47) of “Good” collaboration types to have higher Entropy values (more equal participation) and “Follow the leader” or “Out in the cold” types to have lower values. This single feature looks promising for helping to classify the different cases. We will continue to explore this along with further features which look at overlapping speech, words used, prosody, etc.

NEXT STEPS
We are currently refining the coding scheme for the collaboration indicator codes (Ih). Phase one data collection is complete and that full data set will be coded for both Ih and Qa codes over the next few months.

Phase two data collection with entire classrooms of collaborating students will commence next year.

REFERENCES

This material is based upon work supported by the National Science Foundation under Grant No. #DRL-1432606. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.