Hylable Discussion for quantitative discussion visualization

Hylable Inc.

Challenge

The challenge we tackle is to quantify the group dynamics of small group discussions by students. The small group discussion is a common activity in recent student-centered education. It is widely recognized that capturing group dynamics is efficient for fostering students' motivation and conceptual understanding. However, it was almost impossible for a limited number of teachers, learning assistants, and students to capture what is happening quantitatively with small effort.

For students, reviewing their behavior during the discussion is a difficult task because they need to perform metacognition and discussion simultaneously. Since it requires the parallel processing of the brain[1], many students need careful help to do it. For teachers, it is physically impossible to listen to all group discussions simultaneously with two ears.

Although speech-to-text technology is rapidly improving, its performance is still quite low in noisy and natural conversation. For example, the word accuracy is around 50%, even for the top group of the speech-to-text contest[2]. Therefore, a reliable automatic transcription is not available yet.

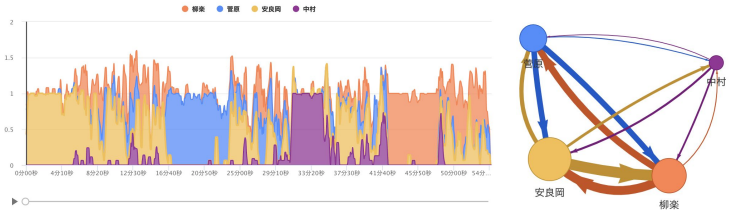
[1] Chiu, M. M., & Kuo, S. W. (2009). From Metacognition to Social Metacognition: Similarities, Differences, and Learning. Journal of Education Research, 3(4), 1-19.

[2] Barker, J., Watanabe, S., Vincent, E., & Trmal, J. (2017). The fifth 'CHiME' speech separation and recognition challenge: Dataset, task, and baselines. In Proceedings of Interspeech, 1561-1565.

Solution

We solve this problem with a non-linguistic quantitative approach. Using patented microphone array processing and visualization technologies, we can capture all utterances for each group for each student in a noisy environment. The figure below illustrates a quantified visualization provided to students and teachers via a web browser. A different student is illustrated with a different color. The left shows the temporal change of the main talker. The right shows the frequency of the turn-take occurrences, i.e., who talked after who, using the arrows.

The users can playback the recording in the left figure to review what they uttered at a particular time in the discussion. With the help of the visualization, the students can review efficiently rather than only listening to the IC recorder sound directly.



Learning Impact Outcomes

We have analyzed the discussions with more than 15,000 people in total, ranging from K-12 students, university students, new employees, to new managers. In elementary school and new employee training program, we analyzed brainstorming discussions. Each group reviewed their behavior after the first discussion without any individual feedback. In the second one, the balance of the utterance improved, i.e., the talkative students reduced talking, and the less-talkative ones increased talking. The correlation was statistically significant.

From a qualitative point of view, the students' metacognition to their behavior in discussions was also improved. Some talkative students tried to listen to and encourage others to speak up. Some less-talkative students recognized that they were just nodding, and tried to say their opinion.

The impact also occurred for teachers. In a university classroom, the professor measured the amount of talk and re-organized the group with talkative students and the one with less-talkative students. Then, the less-talkative students' amount of talk increased. The result suggests that an amount-based group organization may provide more chances to participate in the classroom to less-talkative students.

Return on Investment

The evidence-based reflection with the visualization was that the students noticed their bias in the behavior by themselves. Without Hylable Discussion, experienced teachers are required to listen to each student carefully and give feedback. It was very hard for a limited number of teachers in large classrooms.