

# Visualizing Discussion by the Use of the Conversation Chain Model

Sabina Karkin, Elizabeth S. Charles, Janet L. Kolodner  
Interactive & Intelligent Computing, Georgia Institute of Technology, 801 Atlantic Drive, Atlanta,  
GA 30332-0280  
Email: gtg741a@mail.gatech.edu, echarles@cc.gatech.edu, jlk@cc.gatech.edu

**Abstract:** Identifying how students acquire an understanding of a particular subject in a classroom involves studying verbal interaction. In middle school science classrooms, we can analyze this interaction through videos and transcripts; however, it is still difficult to track and measure the development of students' scientific reasoning skills without visualizing this change. The *conversation chain model* offers this visualization by illustrating questions and responses elicited during poster sessions, portraying their interpretation and quality of the discussion.

Sense-making discussions are a large part of science classrooms as they allow students to articulate to their peers their experimental results and what they learned and concurrently allow peers to engage in question-asking aimed towards understanding the experiment. Studying students' understanding of science concepts and tracking this development in this type of environment requires keeping track of who is eliciting and participating in discussion, what types of questions are raised, and what types of responses are given. These occurrences can be identified through analysis of video and transcript data. We wanted to use that data to study ways students come to understand the meaning of questions raised during discussion and their evolving abilities to respond to them (Charles, Karkin, Kramer, Kolodner, 2006), and also how this shapes the overall discourse. We needed a visual representation of the interaction to allow us to map this out. The visual representation allows us to see the degree of each individual student's participation overtime, quality of presentations, degree of teacher involvement, and the changing quality of discourse. The *conversation chain model* we developed affords this.

We are studying discourse situated in an inquiry-based approach to science learning *Learning by Design* (LBD; e.g., Kolodner, Camp, Crismond, Fasse, Gray, Holbrook, Puntembakar, Ryan, 2003). Included in LBD's practices is a public activity called a poster session in which student groups present their individual procedure and results and discuss their implications. As in a cognitive apprenticeship (Collins, Brown & Newman, 1989), early on the teacher models the kinds of questions students might ask of each other. Gradually, the students take on question-asking roles. They seem to get better at asking good questions, understanding the questions of others, providing meaningful responses, and participating in clarification and sense-making dialogs. The particular teacher we were observing used what we called cueing questions. We saw kids appropriate her questions and we wanted to track this, specifically the participatory and cultural resources of the poster session activity (the role of the teacher versus the roles of the students) and the types of interactions that occurred (student-student and student-teacher). Figure 1 below shows an example.

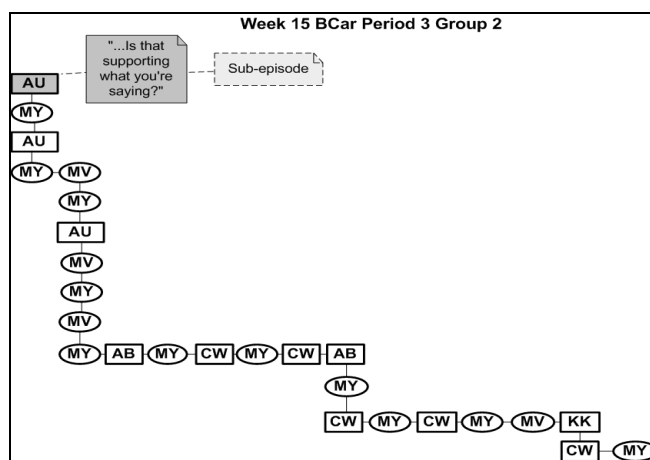


Figure 1. Conversation chain model illustrating discourse.

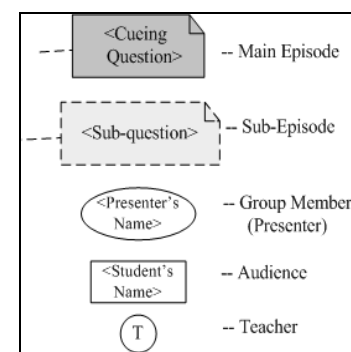


Figure 2. Components of the model.

The full set of components of the conversation chain model include main episodes composed of cueing questions (e.g., What is your recommendation?) and sub-episodes with sub-questions related to the main question but incomplete by themselves (such as a simple “Why”). Comments made by presenters, audience, and teacher are each denoted by a different shape (see Figure 2) where each piece represents a turn in the discourse. Responses are represented by vertical or horizontal chains, depending on whether the next utterance is normal turn-taking without elaboration (noted vertically) or adding/expanding/constructing shared meaning (noted horizontally). A vertical chain signifies a more unproductive discussion, as students do not build on each other’s comments and do not have a shared goal. A horizontal chain, on the contrary, denotes a richer and more productive discussion that involves students’ elaborating on each other’s comments as they try to achieve a mutual goal by participating in grounding (Clark & Brennan, 1991). Thus, the longer the horizontal chain, the greater the sophistication of the discourse.

Data represented vertically include shut-down responses that do not allow for further elaboration; clarification questions that allow only for limited responses; and directive comments made towards a particular student regarding his/her current state. Data represented horizontally include responses that rephrase what was said for confirmation; agreeing responses that encourage others to make additional comments or continue; responses that elaborate on previous comments, providing further explanation/reasoning; conclusions drawn from previous comments; statements that repair perceived miscommunications in the conversation (Schegloff, 1991); and questions challenging previous statements by asking “Why?” and “How do you know?”

The example in Figure 1 describes an episode from week 15, period 3, group 2 where students engage in a discussion about evidence support. MC has just asked “What is your rule of thumb?” A rule of thumb is a principle that specifies the conditions under which some behavior might happen. We have seen that students begin by understanding this question as requesting for factual and procedural information and later understand it as requesting for scientific explanations that generalize their findings. In this sub-episode, AU (a student) asks “Is that supporting what you’re saying?” The conversation first develops vertically, with AU, MY, and MV voicing confusion and providing clarification (MY, MV: “Which one?”) and negative comments (MY: “Excuse me, I did this work”). It evolves into a horizontal chain after MY questions the significance of the argument, which is over an insignificant variance of mere millimeters in the reading of velocity. AB elaborates on MY’s comment and provides an explanation for it, which results in elaboration of hypotheses by others. The conversation becomes vertical again for a short time at the point where MY voices confusion (“Which one?”) and again becomes horizontal when they continue to build on each others’ comments (MV: “It probably should be because it pushes it up.” KK: “It’s going up. He just tells it what it does.”). Note that this discussion includes no teacher involvement, which implies that the students are able to elicit and maintain a meaningful and productive discussion by themselves.

The conversation chain model provides a way to visualize the classroom progress as a whole and study the parts that create that whole. The approach allowed us to make comparisons between classes across different periods, helping us identify question-asking and answering practices of students (Charles, Karkin, Kramer, Kolodner, 2006).

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