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Examining Engagement of a Small-Group Discourse Network During Collaborative Argumentation

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Abstract

We examined the patterns of discourse and argumentation during implementation of the MEL and baMEL instructional scaffold activities, to see how agentic elements of instruction influence individual and collective engagement within a small group around complex Earth and space science topics. By linking discourse analysis to social network analysis we found that including elements of agency and choice in the activity distributed engagement in critical evaluation and argumentation among all participants.

Purpose & Research Question

This study investigated ***whether there were shifts in collective engagement of one student group during the implementation of MEL and baMEL activities*** used to scaffold reasoning and critical evaluation during science lessons.

Background and Theory

- Chin and Osborne (2010) suggest that argumentative discourse activities could stimulate more scientific evaluations, wherein students challenge each other's thinking through questions about the strength of evidence and how that evidence connects to a given model.
- Scientific knowledge is constructed from social discourse to compare, critique, and revise ideas (Nussbaum, 2008).
- Participating in argumentation does not automatically equate with engagement in reflective thinking and reasoning, and students may need instructional scaffolds to evaluate the quality of explanations (Nussbaum & Edwards, 2011).
- The Model Evidence Link (MEL) and build-a-MEL (baMEL), were designed to assist students in effectively coordinating evidence with scientific explanations (Chinn & Buckland, 2012; Lombardi et al., 2016; Lombardi et al., 2018).
- The baMELS are intended to offer a real-world element of individual agency and choice to the existing activity, ensuring students must not only choose two models from three options to compare, but they also must decide which lines of evidence offer relevance to their selected models.
- Scientific practices in the science classroom can be measured as epistemic operations, which can be defined as defined as discursive actions or talk moves whose function is to promote the creation and development of knowledge and understanding (Christodoulou & Osborne, 2014)

Method

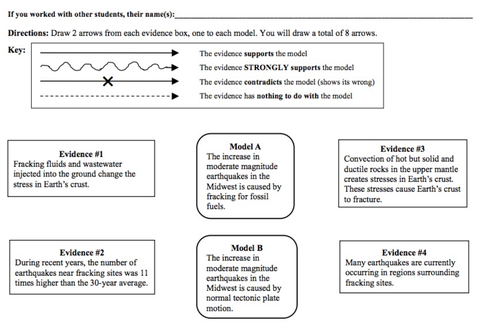

Figure 1. Sample Fracking MEL Diagram

- Participants
  - 1 teacher and 3 sixth grade students in one group embedded in a classroom.
- Analysis
  - We collected classroom observation data using both video and audio recorders to transcribe all classroom discourse and interactions.
  - We coded the scientific talk of the participant discourse and their interactions using a framework for analyzing classroom epistemic operations (Christodoulou & Osborne, 2014).
  - We then used a combined qualitative and quantitative methodology of Critical Discourse Analysis and Social Network Analysis (CDA-SNA) (Ryu & Lombardi, 2015) to link discourse codes as relational turns (network ties) in adjacency matrices for one student group using NVIVO 12 software to examine engagement patterns.
  - Sample Coding Structure:

Student Talk	From	To	Epistemic Operation
S1- It contradicted that idea – the graph clearly shows when there's an increase in fracking, the number of earthquakes also largely increased, right? From the normal? From the average 1.6 per year to 20 then 35, 64, back down to 35 but up to 109 and in recent years it's been up to 584. So you gotta find information that it was caused by fossil fuels – I'm sorry, that it was not caused by fracking, right?	1	4	justification using evidence
S2-yeah	2	4	agreement/confirming
S2-It just says it talks about tectonic plates so I would think it has nothing to really do with it	2	4	justification
S1-No, right. And I'm not saying that just because that has nothing to do with it, but what this is trying to do is to tell you how an earthquake is formed, right?	1	2	arguing/contradicting

Findings & Discussion

Our results show emerging patterns of how students shifted from one centralized student facilitating much of the knowledge construction on the first MEL activity, to more distributed collective engagement by the second baMEL (Figure 2). The findings not only show shifts in density of interactional turns during argumentation between students, but also shows fewer teacher interactions by the final baMEL suggesting increased student agency.

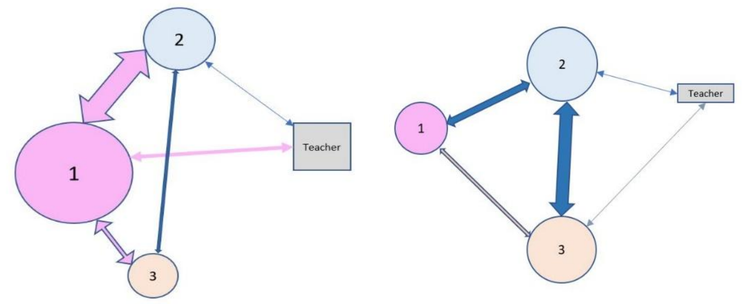

Figure 2. Group engagement for the MEL (left) and baMEL (right). The circles represent the three students in the group. Arrows represent discourse interactions and reciprocity of talk. Circle size represents degree centrality as determined by quantity of discourse interaction ties (bigger circle, more central student). Arrow width represents interaction density of argumentation epistemic operations.

- The findings provide support that the baMEL activity results in increased student agency within a group to a more shared process of knowledge construction.
- The results also show a shift towards a more even distribution of collective engagement for members of the group from the MEL to the baMEL activity. This indicates that the increase in student agency the baMEL provided, likely opened more opportunities for student argumentation and discussion when determining evaluations. Thus having increased student agency in a collective activity is beneficial for overall collective engagement.

References

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