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Student agency to participate in dialogic science discussions

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ABSTRACT

Students enter learning situations (informal and formal alike) with a wealth of knowledge, skill and expertise with which to engage in new learning experiences. However, in dialogic science discussions, many students do not call on these resources to engaging in discussion, and some students rarely participate. In this paper, we introduce a hybrid model of agency as a lens to examine the enablers and barriers to students' engagement in dialogic science discussions. We operationalize this model in the analysis of students' participation patterns in whole class discussions and their narratives about experiences in these discussions. The findings show that all students enact agency in discussion, but differences lie in the extent to which students perceive that they can enact agency. We find that social structures that help to create and perpetuate differences in students' sense that they can enact their agency. We discuss the implications of these findings on what teachers can do to support equitable participation in talk in the service of equitable opportunities for learning.

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1. Introduction

Students bring a wealth of knowledge and resources with them into science classrooms. These faculties serve as a foundation for knowledge construction (Chi & Roscoe, 2002) and important resources for sensemaking about scientific concepts (Berland & Reiser, 2009; Chin & Osborne, 2010; Chin, Brown, & Bruce, 2002). When students make use of these resources in the context of collaborative argumentation discussions, they have opportunities to externalize their emergent understandings, consider alternatives, recognize misconceptions, and potentially transform them in light of new evidence or ideas. When carefully guided by teachers, this shared reasoning process through talk has the potential to "grow the mind", in addition to students' learning of scientific concepts (Resnick, Asterhan, & Clarke, 2015b).

There has been growing interest in dialog as a means through which to support student engagement in the practices of science as they learn scientific concepts (NRC, 2012; Osborne, 2010). A proliferation of studies on talk and learning across school subjects has shown that when teachers carefully guide students in the shared process of sensemaking about domain concepts, students benefit in terms of steep increases in learning, including long-term retention, domain transfer and reasoning development (Clarke, Resnick, & Rosé, 2015; Littleton & Howe, 2010; Resnick, Asterhan, & Clarke, 2015a). We refer to this particular kind of teacher-lead discussion as dialogic class discussions.

Examining discussion in terms of aggregate discourse processes and outcomes highlights that the dialogic classroom is one where there is a density of productive interactions between students. However, several studies have begun to examine the nature of individual student engagement in these kinds of discussions. These efforts have helped to show that there are significant differences in the ways in which individual students participate in class discussions, which have implications for individual learning

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(Black, 2009; Clarke, 2015; Kelly, 2007). Thus, while one of the goals of dialogic discussions may be to engage students in intermental thinking processes to support the development of intramental processes, some questions are raised when we consider that discussions of this kind may not necessarily yield equitable participation across speakers (Clarke, 2015).

Students do not enter classrooms with an absence of the ability to engage in reasoning through talk (Howe & McWilliam, 2001). However, they may differ in the soundness of their arguments, as well as the structural and discursive norms of reasoned argumentation (Chin & Osborne, 2010; Sandoval & Millwood, 2005). Appropriating these standards, however, is developmental and can be augmented through instruction (Adamson, Dyke, Jang, & Rosé, 2014; Felton & Kuhn, 2001; Herrenkohl & Guerra, 1998; Mercer, Dawes, Wegerif, & Sams, 2004). Analyzing students' narratives about participating in dialogic science discussion, Clarke (2015) showed how students perceived the whole class discussions as a distressing space, insofar as not all students were willing to enter discussions where they made their emergent thinking public. Several studies help to highlight the ways in which social structures imbue some linguistic forms and lived experiences with more or less legitimacy in the classroom, and shape student opportunities for engagement as a consequence (e.g., Gee, 1985; Nasir & Hand, 2008; Zohar, 2004). In this sense, student participation in dialogic class discussions is not simply an externalization of cognitive processes, but also comprised of the dynamic interplay between interlocutors in dialog, the social context in which learning dialogs are situated, and the institutions and histories that structure these relationships. This dynamic interplay between interlocutors, institutions and histories can have the effect of shaping the opportunity space for student participation in dialog.

In this paper, we extend such research by focusing on a particular aspect of engagement in science discussions: students' agency to participate in these discussions. We consider two primary questions with respect to students' agency in dialogic science discussions. First, what is the nature of students' *sense of agency* to participate in discussions? Second, what is the nature of students' *enacted agency* to participate in discussions? We answer these questions through the analysis of classroom discussions and student narratives about participating in these discussions. This study is situated within a longitudinal teacher professional development study on a certain form of dialogic pedagogy in science, Accountable Talk (cf. Clarke et al., 2013). This work was situated within an urban school district in the U.S. Thus we examine student agency in the context of class discussions that were in the process of evolving discursively from predominantly recitation (e.g., I-R-E (Mehan, 1979), towards dialogic pedagogy (Resnick et al., 2015a). Our goal is to better understand what it means for students to be persistently on the margins of this kind of learning dialog and to understand how more equitable student engagement could be supported in spite of the social structures that shape participation.

2. Conceptual framework

2.1. Why talk and participation matter in discussion

Does simply 'being there', in a context where rich collaborative sensemaking discussion is occurring, an adequate enough condition to produce learning? Or, are more "active" forms of participation in dialog needed? Prior research suggests that there is a minimum threshold level of engagement needed in order to benefit from discussion in terms of learning (e.g., Chi, 2009).

On the low end of the engagement threshold, that is to say the minimal level of engagement in discussion needed for learning to occur, several studies have found that students need to verbally engage with one another's ideas, e.g., negotiation for meaning through asking questions. King, Rosenshine and colleagues examined the degree to which students asked each other questions during collaborative learning and the quality of those questions in relation to learning outcomes (King, 1992, 1999; King & Rosenshine, 1993; Rosenshine, Meister, & Chapman, 1996). They found that when students ask each other questions during collaboration, groups were more effective at problem solving and individual learning outcomes increased (King, 1999; Rosenshine et al., 1996).

On the high end of the engagement threshold are forms of engagement in discussion that are more active in nature with respect to both interlocutors and ideas, and tend to yield robust learning outcomes. In particular, several studies of small group and dyadic problem solving have examined particular discursive interactions that seem to yield robust outcomes (e.g., explanations, transactive reasoning and disagreements) (Asterhan & Schwarz, 2007, 2009; Azmitia & Montgomery, 1993; Kruger, 1992; Teasley, 1997).

First, explanations are utterances (or a sequence of utterances) that function to externalize an individual's knowledge or understanding of domain concepts. In conversational interaction, an explanation becomes an ideational artifact/object for interlocutors to make sense of in relation to their problem solving goals. Research has shown that when students engage in explanation during collaborative problem solving discussions with peers, their knowledge, conceptual understanding and success in problem solving increases (Asterhan & Schwarz, 2007, 2009). Explanations have also been shown to support the development of deep shifts in conceptual understanding. Second, transactive reasoning, talk in which the reasoning of discussions (self and other) is 'interpenetrated', has been shown to support both collaborative problem solving, as well as growth in reasoning abilities (Azmitia & Montgomery, 1993; Berkowitz & Gibbs, 1983; Kruger, 1992; Teasley, 1997). Third, disagreements, which include close cousins like challenges to ideas and contradictions, have been shown to not only support learning gains and conceptual change, but have also support long-term retention of learning (Howe, 2010; Kruger, 1993; Mugny & Doise, 1978).

Collectively, studies on this kind of discursive interaction show that it is not simply the incidence of these interactions that produces benefits for learning. Rather, it is the students who use these moves during discussions that seem to benefit most in terms of learning. Studies of explanation have found that it is the explainers who have the greatest growth in conceptual understanding, when compared to listeners to those explanations (Fuchs et al., 1997; Howe et al., 2007; King, 1992; King & Rosenshine,