Designing an Intervention to Foster Teachers’ Contingent Responsiveness during Science Discussions

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Abstract: A teacher’s capacity to perceive multiple dimensions of the classroom and to make instructional decisions on the fly is defined as ‘Contingent Responsiveness’. Little is known about how teachers manage the demanding work of moment-to-moment interaction during class discussions and how to prepare science teachers for this challenge. This poster presents the theoretical framework and tentative design features of a professional development (PD) program to foster contingent responsiveness in science teachers.

Introduction
The role of talk in science education has long been established – an essential part of learning science is learning how to engage in scientific discourse (Lemke, 1990). Leading a productive science discussion is challenging - teachers have to respond to the dynamic flow of student talk in the moment, orchestrate different voices towards a collective understanding, support the emergence of new ideas, as well as attend to the complex social relationships among members of the class. Such capacity to attend to multiple dimensions of the classroom situation and the ability to make instructional decisions on the fly in response to student ideas is defined as ‘contingent responsiveness’. Despite the breadth of research on dialogic teaching, little is known about how teachers manage the demanding work of moment-to-moment interaction and decision-making on the fly in classroom discourse and how to prepare science teachers for such a challenge. In this study, I co-design a professional development program with teachers in Pakistan to foster contingent responsiveness during dialogic science discussions.

Theoretical framework
Acquiring a repertoire of techniques such as talk moves can help to scaffold a productive dialogue (Kazak et al., 2015). However, research consistently found that whilst teachers are capable of using strategies to elicit student ideas, and to increase students’ participation, they often find it difficult in helping students to expand and move their thinking forward (Coffey et al., 2011). Therefore, leading a dialogic science discussion is not simply a superficial elicitation of student ideas, but a sustained interaction for a specific educational goal. Corno(2008) asserted that that teaching responsively is not only technical, but also intellectual as teachers have to simultaneously judge which ideas and questions will be most productive to pursue; attend to the intersection between students’ everyday ideas and disciplinary ideas, and channel discussion toward an understanding of disciplinary core (Harris et al., 2012). Nonetheless, what is required of contingent responsiveness is not merely an intellectual exercise with unlimited time for teachers to craft a response, it demands thinking on their feet in a fluctuating array of interactions. The overwhelming pace of a real classroom is illustrated in a one-minute 28-second clip of Professor Deborah Loewenberg Ball, who counted 20 micro-moments when she had to decide how to react (Barshay, 2018). Therefore, responsiveness is not only technical and intellectual, but also improvisational given the fast pace found in a real classroom, which echoes with Sawyer's (2004) metaphor of teaching as an improvisational live performance.

Research aim and method
Given its multifaceted nature and the difficulty in fostering contingent responsiveness, this study aims to understand how science teachers develop such capacity and to design an effective intervention. Using design-based research (DBR) approach, I co-design and iteratively refine a PD program with teachers in Pakistan to foster contingent responsiveness during dialogic science discussions.

Tentative design
The technical, intellectual and improvisational nature of contingent responsiveness is embedded in the design of the intervention. For example, a mixed reality simulator (Mursion: https://www.mursion.com/) is used to address the improvisational nature of contingent responsiveness by approximating the dynamic nature of a classroom and enabling teachers to rehearse teaching in a contextualized environment (Dieker et al., 2014). The talk moves toolkit (Michaels & O’Connor, 2012) addresses the technical nature whilst collaborative inquiry attends to the intellectual nature by promoting conceptual change in teachers, such as the purposes of talk in science.
following conjecture map (Sandoval, 2014) describes the interaction between the design features, mediating process and the intervention outcomes. This poster aims to stimulate a productive discussion around the notion of contingent responsiveness as well as the design features of the intervention.

![Diagram of the Design to Foster Contingent Responsiveness in Science Teachers](image)

Figure 1. Initial Conjecture Map of the Design to Foster Contingent Responsiveness in Science Teachers.

References


Michaels, & O’Connor. (2012). *Talk science primer*. TERC.

