Chapter 47
Analysis of Discourse Practices in Elementary Science Classrooms using Argument-Based Inquiry during Whole-Class Dialogue

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ABSTRACT

This chapter discusses an analysis of discourse practices found in eight different elementary science classrooms that have implemented the Science Writing Heuristic (SWH) approach to argument-based inquiry. The analysis for this study involved examining a segment of whole-class talk that began after a small group presented its claim and evidence and ended when the discussion moved on to a new topic, or when a different group presented. The framework for the analysis of this whole-class dialogue developed through an iterative process that was first informed by previous analysis, review and modification of other instruments, and notable anomalies of difference from this data set. Each classroom was then rated using the Reform Teaching Observation Protocol (RTOP), which provided a score for the extent to which the teacher was engaged with reform-based science teaching practices. Our analysis shows that elements of whole-class dialogue in argument-based inquiry classrooms were different across varying levels of RTOP implementation. Overall, low level RTOP implementation (little evidence of reformed-based practice) had a question and answer format during whole class talk that rarely included discourse around scientific reasoning and justification. Higher levels of RTOP implementation were more likely to be focused on student use of scientific evidence to anchor and develop a scientific understanding of "big ideas" in science. These findings are discussed in relation to teacher professional development in argument-based inquiry, science literacy, and the teacher's and students' grasp of science practice.

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INTRODUCTION

For quite some time now, reform documents have set the benchmarks for science literacy by stressing the importance of using inquiry-based approaches in the science classroom (AAAS, 1993; NRC, 1996, 2012). Yet, what drives and supports an inquiry-based approach in the classroom is still up for discussion and currently being thoroughly examined through research. Kuhn (1991) gives one good idea of what it means to actually be engaged in scientific inquiry, stating "Scientific inquiry is fundamentally a knowledge building process in which explanations are presented to the community so they can be critiqued, debated, and revised" (1991, p. 4). Deriving Kuhn's definition of scientific inquiry leads us to understand that to engage in argument-based inquiry means to use evidence in support of one's claim, which can help to focus and drive dialogues of critique and consensus (Duschl & Osborne, 2002; Osborne, Erduran, & Simon, 2004). Dialogue "is about a shared inquiry, a way of thinking and reflecting together. It is not something you do to another person. It is something you do with people" (Isaacs, 1999, p. 9) and dialogic conversation can be a way to generate knowledge (Alexopoulou & Driver, 1997; Ford, 2008; Kelly & Green, 1998; Schein, 1993). While the research community recognizes the value of dialogic communication in inquiry-based learning approaches, research that examines communication patterns found in classrooms using argument-based inquiry is still needed. This chapter will explore the talk patterns within whole-class dialogue in fifteen elementary classrooms that utilize argument-based inquiry. The two research questions guiding this study are:

1. What are the key factors that contribute to whole-class discussion found in classrooms using argument-based inquiry, and
2. How do these key factors develop across levels of implementation of argument-based inquiry?

ARGUMENTATION IN PRACTICE

Argumentation is conversational dialogue. This can be reasoned through by exploring the meanings of the words dialogue and argumentation. The word dialogue is from two Greek roots: dia and logos. This roughly translates to be "meaning flowing through" (Isaacs, 1993, p. 25). Conversation, which begins all dialogues, means "to turn together" (Isaacs, 1993, p. 35). Argumentation then is a conversational dialogue where meanings can flow through and turn together within those engaged. Argumentation "initiates change, it transforms the significance of material, it enables reflection and action, it brings divergent voices together in interaction..." (Mork, 2005, p. 18; referencing Costello & Mitchell, 1995). It is worth noting the difference in argumentation versus argument. Argumentation by many researchers is considered a discourse process (e.g. Jimenez-Aleixandre & Erduran, 2008; Osborne, et al., 2004) while argument is centering around producing or influencing a particular outcome (Cavagnetto, 2010; Toulmin, 1958). In this study, we focus on argumentation.

Scientific argumentation is about evaluating and critiquing the construction of scientific claims, evidence, and explanation (Duschl, Schweingruber, & Shouse, 2007). Once reasoned through by being constructed and deconstructed, knowledge is claimed because it carries with it tentative, but stable, evidence that is deemed trustworthy by the community of science (Gross, 1990). In actual practice, scientists engage in the process of argumentation to understand "why" (Duschl, 1990) their ideas matter. As these scientists engage in argumentation, they modify their ideas by making or critiquing claims supported with evidence (NRC, 2012). The net effect of their engagement further strengthens their understanding within their domain of study.