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ABSTRACT

In this paper, we report findings from the second year of a three-year research and professional development program designed to help elementary school teachers engage in dialogic teaching to support the development of students' argument literacy. We define argument literacy as the ability to comprehend and formulate arguments through speaking, listening, reading, and writing. The professional development program was focused on promoting teachers' use of a specific type of talk called 'inquiry dialogue' to achieve the goal of developing students' argument literacy. We used a single-group pretest-posttest design to assess the impact of the professional development on teachers' epistemological beliefs and their enactment of inquiry dialogue in text-based discussions. Our analyses of videotaped discussions at the beginning and end of the year showed that there were substantial improvements in teachers' facilitation of inquiry dialogue and in the quality of students' argumentation during discussions. Contrary to expectations, however, there were no changes in teachers' epistemology; teachers' beliefs about knowledge and knowledge justification remained at a relativist stage throughout the course of the program, suggesting that teachers continued to view all opinions as equally valid and regard arguments and the use of reasons and evidence as idiosyncratic.

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Classroom dialogue; dialogic; teacher development

In this paper, we report our efforts to help elementary school teachers change their discourse practices toward a more dialogic pedagogy in language arts classrooms. The study is part of a larger project, the long-term goal of which is a comprehensive professional development program in dialogic teaching to enable teachers to conduct classroom discussions about text to promote students' argument literacy. We define argument literacy as the ability to comprehend and formulate arguments through speaking, listening, reading, and writing (cf. Graff 2003). Argument literacy is considered to be a fundamental life

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skill for productive participation in contemporary society and is a core objective of the Common Core State Standards (National Governors Association Center for Best Practices & The Council of Chief State School Officers 2010) recently introduced in the United States. In the first year of the project, we worked collaboratively with teachers to design the professional development program. In the second year, reported here, we implemented the program and examined evidence of growth in teachers' discourse practices and their beliefs about knowledge.

We frame this paper and our professional development in terms of Alexander's (2006, 2008) notion of dialogic teaching. Following Alexander, dialogic teaching is a general pedagogical approach that capitalizes on the power of talk to foster students' thinking, learning, and problem solving. It requires teachers to have a broad repertoire of discourse practices and to be able to strategically use different types of discourse to address specific instructional goals for their students. Although these discourse practices include traditional kinds of talk, such as recitation and exposition, dialogic teaching privileges discussion and dialogue. According to Alexander (2008), discussion and dialogue have the greatest cognitive potential and are 'the forms of talk which are most in line with prevailing thinking on children's learning' (103). In addition to the strategic use of talk, Alexander identified four other principles of dialogic teaching:

- *collective*: teachers and students collaborate with each other to build knowledge and understanding;
- *reciprocal*: teachers and students share responsibilities for the flow of discussion and consider alternative perspectives;
- *supportive*: students voice their ideas freely within a constructive community and help each other to reach a common understanding;
- *cumulative*: teachers and students build on each other's ideas and chain them into a coherent line of inquiry.

To these, we add another principle from Mercer and colleagues (Mercer and Dawes, 2008; Mercer, Dawes, and Staarman, 2009): dialogic teaching is *metacognitive*. It involves having teachers and students reflect on their talk to increase their knowledge and skill in how to use talk to achieve their learning objectives (see also Burbules 1993; Splitter and Sharp 1996).

We use these principles of dialogic teaching to guide our professional development work with teachers and their students. In particular, we rely on a specific type of talk called 'inquiry dialogue' to achieve the goal of developing students' argument literacy. Inquiry dialogue is one of six normative dialogue types identified by Walton (1998) and we believe it is the best type of dialogue for supporting collaborative and rigorous argumentation. Inquiry dialogue is aimed at collectively finding the most reasonable answer to contestable, 'big' questions.

When engaging in inquiry dialogue in a classroom, discussion participants search for the most reasonable answer to the big questions and, if agreement is not possible, they work to clarify the basis and criteria for their disagreement. The teacher's role is to support collaborative and rigorous inquiry around the big questions. Teachers' contributions during inquiry dialogue shift from telling students what to think to helping them advance their thinking towards answering the big question. In other words, teachers are

'procedurally strong, but substantively self-effacing' (Splitter and Sharp 1996, 306). Instead of steering students towards the right answers, teachers work on 'strengthening the procedures of inquiry' (Splitter and Sharp 1996, 301). They encourage norms of reasoned discourse and model and support the use of talk to improve the quality of argumentation. On occasion, the discourse may shift from inquiry to other types of dialogue. For example, the talk might shift to information-seeking dialogue when the inquiry stalls and participants need to seek knowledge or expert opinion from outside the group, or to persuasion dialogue when one of the participants tries to persuade another of the merits of a position to resolve conflicting opinions (Gregory 2007). Teachers may even resort to exposition when they want to explain the different parts of an argument or reasoning moves to students. However, inquiry dialogue is the overarching normative framework and these other dialogue types are used only in service of the larger goal of collectively searching for the most reasonable answer (Gregory 2007).

The use of inquiry dialogue to foster argument literacy is consistent with sociocultural views of language and learning (Mercer and Littleton 2007; Vygotsky 1968; Wells 1999). According to sociocultural theory, learning is a process of internalization of cultural tools, or ways of speaking, acting, and thinking (Vygotsky 1968). Students need to encounter and use these tools to develop their mental capacities. Using language to interact with others also offers unique opportunities for a social mode of thinking or 'interthinking' (Mercer and Littleton 2007). Exchanging ideas through discourse gives students a means for combining their intellectual resources to collectively make sense of their experiences and to solve problems. During inquiry dialogue, participants interact with each other's ideas, adding detail to given reasons, qualifying general statements, or finding flaws in each other's arguments (Kennedy 2013; Lipman, Sharp, and Oscanyon 1980). The multiplicity of perspectives generated in search of the most reasonable answer to the big question enables students to test their ideas against those of others, providing a self-correcting mechanism that helps improve the quality of argumentation.

The benefits of discussions that display features of inquiry dialogue have been examined in several studies. Although still tentative, research suggests that such discussions help support the development of students' higher-order thinking skills, including argument literacy (Applebee, Langer, Nystrand, and Gamoran 2003; Murphy, Soter, Wilkinson, Hennessey, and Alexander 2009; Reznitskaya et al. 2009; Wegerif, Mercer, and Dawes 1999; Wells 1999). For example, Kuhn and Crowell (2011) showed that students' ability to generate arguments that contained more than one perspective improved as a result of their participation in discussions of controversial questions with peers. Similarly, Reznitskaya et al. (2009), in a review of several quasi-experimental studies, concluded that students who participated in collaborative inquiry into contestable questions raised by texts wrote essays that contained a greater number of argument components, including supporting reasons, counterarguments, and rebuttals, compared to students in control classrooms.

Despite the apparent benefits of such discussion practices, research shows that they are largely absent from today's classrooms (Alexander 2008; Applebee et al. 2003; Nystrand, Wu, Gamoran, Zeiser, and Long 2003; Smith, Hardman, Wall, and Mroz 2004). Observational studies of classroom instruction indicate that teachers tend to dominate classroom interaction, avoid contestable issues, and use talk largely to maintain control and assess students' knowledge (Alexander 2005; Nystrand et al. 2003; Smith et al. 2004; Walsh

2002). Moreover, learning to modify such interactional patterns and implement more dialogic practices presents a serious challenge for teachers (Alvermann and Hayes 1989; Juzwik, Sherry, Caughlan, Heintz, and Borsheim-Black 2012; Nguyen, Anderson, Waggoner, and Rowel 2007). For instance, in a carefully planned study designed to improve classroom discussions, researchers worked with five high school teachers for six months and engaged them in repeated cycles of videotaped observations, reflection on the videos, and planning conferences (Alvermann and Hayes 1989). At the end of the study, regrettably, the authors concluded that teacher participants 'exhibited a marked stability in their patterns of verbal exchanges' (331). The researchers noted that the lack of progress might have resulted from conflicts between the recommended practices and the teachers' 'experiences, beliefs, and intuitions' (332).

In conceptualizing the present study, we argue that the difficulties teachers experience in learning to implement dialogic practices might be explained, in part, by conflicts between these practices and teachers' epistemological beliefs. Many scholars have endorsed, at least theoretically, the link between classroom instruction and teacher epistemology (Brownlee and Berthelsen 2006; Hofer 2001; Richardson and Placier 2001; Windschitl 2002), although only a few studies have confirmed the connection (e.g. Johnston, Woodside-Jiron, and Day 2001; Stipek, Givvin, Salmon, and MacGyvers 2001). In one study, Johnston, Woodside-Jiron, and Day (2001) analyzed the lessons of two fourth-grade teachers who held contrasting beliefs about knowledge and knowing. They observed dramatic differences in the teachers' instruction, including differences in power relations and interactions with students. The teacher who believed in a single truth and unquestionable authority relied solely on traditional recitation, whereas the teacher with a 'constructed knower' (Johnston et al. 2001, 225) epistemology shared authority with students and engaged in research and discussion activities during which students explored and critiqued each other's ideas.

Models of epistemological development suggest that people progress from a simple view of knowledge as static and known by authorities to a more nuanced understanding of knowledge as socially constructed through reasoning (for reviews, see Hofer 2001; Schraw 2001). Kuhn (1991) proposed three stages of epistemological development: absolutist, multiplist, and evaluatist. Absolutists view knowledge as fixed, certain, and existing independently of human cognition. Multiplists, or relativists, view knowledge as entirely subjective, deny the role of reason and expertise, and consider all opinions to be equally valid. At the most advanced stage, evaluatists view knowledge as 'the product of a continuing process of examination, comparison, evaluation, and judgment of different, sometimes competing, explanations and perspectives' (Kuhn 1991, 202).

Following Bakhtin (1984) and others (e.g. Kuhn and Udell 2003; Weinstock 2006; Windschitl 2002), we suggest that absolutist and multiplist epistemologies are incompatible with dialogic practices that aim to foster argumentation. In the words of Bakhtin (1984), 'both relativism and dogmatism equally exclude all argumentation, all authentic dialogue, by making it either unnecessary … or impossible' (69). That is, absolutists would see no need for engaging in inquiry dialogue to co-construct new understandings and critique each other's perspectives because they believe that knowledge is simple, certain, and known by authority figures. Likewise, multiplists would fail to appreciate the value of inquiry dialogue because they view knowledge as entirely relative and idiosyncratic. We argue that teachers who subscribe to a more evaluatist epistemology are more likely to

recognize the importance of rational evaluation of different points of view and more likely to successfully facilitate inquiry dialogue.

Weinstock (2006) made similar claims regarding the incongruity of absolutism and relativism with skilled argumentation. He proposed an evaluatist epistemology as a normative framework for engaging in argument aimed at establishing well-reasoned conclusions. His claim is supported by evidence from several studies that examined the relationship between people's epistemological beliefs and their argumentation skills (e.g. Kuhn 1991; Nussbaum, Sinatra, and Poliquin 2008; Weinstock 2005; Weinstock, Neuman, and Glassner 2006). Results of these studies showed that people's levels of epistemological development predicted the quality of their argumentation, including their skills in constructing and evaluating arguments.

In summary, the use of inquiry dialogue as a means of promoting students' argument literacy is a practice that has considerable theoretical support and emerging empirical evidence for its effectiveness. Yet, facilitating inquiry dialogue is not an easy task for teachers and may require substantial shifts in their beliefs and practices. We designed our professional development program to help foster teachers' conceptual and procedural knowledge in how to conduct inquiry dialogue to promote students' argument literacy.

Design considerations

Two strands of research informed the design of our professional development program. The first strand is work on principles of effective professional development. There is an emerging consensus that effective professional development needs to focus on students and what they need to know and be able to do, be grounded in the daily lives of teachers, be intensive and sustained, involve the collective participation of teachers, and provide both conceptual and procedural knowledge about teaching and learning (Hawley and Valli 1999; Wei, Darling-Hammond, Andree, Richardson, and Orphanos 2009; Yoon, Duncan, Lee, Scarloss, and Shapley 2007). Professional development programs that incorporate these principles have been shown to increase teacher's use of recommended practices (Desimone, Porter, Garet, Yoon, and Birman 2002; Garet, Porter, Desimone, Birman, and Yoon 2001; Ingvarson, Meiers, and Beavis 2005) and to improve student outcomes (e.g. Powell, Diamond, Burchinal, and Koehler 2010).

The second strand of research is prior professional development efforts aimed specifically at enhancing teachers' discourse practices (e.g. Goldenberg and Gallimore 1991; Juzwik et al. 2012; Kucan 2009; Lefstein and Snell 2014; Michaels and O'Connor 2015). This strand of research is relatively inchoate but some features common to more successful professional development efforts can be gleaned from the research (see Reznitskaya and Wilkinson 2015). Features of more successful programs include:

- reflection on discourse practices through analysis of transcripts and video;
- co-inquiry into practice;
- a repertoire of discursive moves;
- co-planning of lessons;
- a dialogic approach to professional development.

It is reasonably well known that teacher reflection on discourse practices is necessary but not sufficient to promote change in such practices (e.g. Alvermann and Hayes 1989; Lefstein and Snell 2014). Combining teacher reflection with other features, such as deliberate opportunities for co-inquiry, seems to produce more positive results (Heintz, Borsheim, Caughlan, Juzwik, and Sherry 2010; Juzwik et al. 2012; Kucan 2007, 2009). Arming teachers with a repertoire of discursive moves to enhance their discourse practices appears to be particularly beneficial (Beck, McKeown, Sandora, Kucan, and Worthy 1996; McKeown and Beck 2004; Michaels and O'Connor 2015). Ideally, all features should be incorporated into professional development aimed at changing teachers' discourse practices. Indeed, integrating reflection, co-inquiry, and attention to discursive moves into a comprehensive program that incorporates the general principles known to characterize effective professional development seems to yield more sustained shifts in teachers' practices (e.g. Adler, Rougle, Kaiser, and Caughlan 2004; Hennessy, Mercer, and Warwick 2011; Saunders and Goldenberg 1996; Saunders, Goldenberg, and Hamann 1992).

Present study

Guided by these considerations, we conducted the larger project as a design study (Collins, Joseph, and Bielaczyc 2004) over three years at public schools in two US states, Ohio and New Jersey. Each year constituted a new iteration of the professional development program. Each year, we worked collaboratively with a new group of teachers to identify and organize instructional content and activities that supported teachers' use of dialogic teaching to promote students' argument literacy. We collected data from teachers and students to assess the effectiveness of the program and to inform its revisions. Professional development activities were similar at both sites with small variations in materials and delivery to accommodate specific needs of participating teachers. Data used to inform revisions of the program came from professional development meetings, focus-group interviews, and coaching sessions with participating teachers.

The purpose of the study reported here was to assess the impact of the second iteration of the professional development program on teachers' epistemological beliefs and their enactment of inquiry dialogue in text-based discussions. The research questions were:

1. Is there change in teachers' epistemological beliefs following the professional development?
2. Is there change in teachers' enactment of inquiry dialogue in text-based discussions following the professional development?

Method

Participants

Participants were 13 fifth-grade language arts teachers and their students. Six of the teachers taught in two elementary schools in a large suburban school district in Ohio with 19% minority enrollment and 8% of students designated as low income (eligible for free or reduced lunch). Four taught in one school (two of the teachers shared a classroom, each teaching 50% of the time) and two in the other. Seven of the teachers taught in six

elementary schools in four urban school districts in New Jersey. Minority enrollment in the New Jersey schools averaged 71% and the percentage of students designated as low income averaged 47%. Two of the seven teachers taught in the same school. All teachers in the study were female and European-American. Their teaching experience ranged from 2 to 26 years. On a questionnaire given to teachers prior to participating in the professional development, most indicated that class discussions 'in which students exchanged views and ideas' were an integral part of their instruction.

Design and procedure

We used a single-group pretest-posttest design. In September/October 2013, we videotaped two discussions in each classroom to establish baseline information about typical practices. Teachers conducted discussions using texts we selected. A different pair of texts was used at pretest and posttest, with the order in which the pairs were used counterbalanced by teacher within site. Teachers were asked to conduct the discussions with their students as they would normally. We collected information about teachers' background and experience using a questionnaire adapted from that used by Applebee, Langer, Nystrand, and Gamoran (2003). We also assessed teachers' epistemological beliefs using the *Reflective Judgment Interview* (King and Kitchener 1994), counterbalancing the order of administration of the forms at pretest and posttest by teacher within site. We audio recorded these interviews.

We implemented the professional development from October 2013 through May 2014. The activities included two workshop days, seven study group meetings, and four to six individual coaching sessions per teacher. We also conducted three semi-structured focus-group interviews with teachers during the study group meetings in November and February, as well as at a half-day workshop in May devoted to teachers' summative assessment of the program. The purpose of these focus-group interviews was to ask teachers what they found valuable (or not) in learning about dialogic teaching, discussion, and argumentation. We video and audio recorded the focus-group interviews and analyzed them to inform revisions of the program.

In April/May 2014, we again videotaped two discussions in each classroom using the researcher-selected texts. For these posttest discussions, teachers were asked to discuss texts as they had learned in the professional development program. We again interviewed each teacher about their epistemological beliefs using the alternate form of the *Reflective Judgment Interview* and we audio recorded the interviews.

Professional development

We began the program with two workshop days (6 hours per day), one in October and one in November, separated by a one- to two-week interval. The interval provided teachers the opportunity to try discussions with their students and reflect on them at the second meeting. In the workshops, we introduced teachers to dialogic teaching, inquiry dialogue, argument literacy, and an assessment tool designed to measure the quality of teacher facilitation and student argumentation called the *Argumentation Rating Tool* (*ART*) (Reznitskaya, Wilkinson, Oyler, Bourdage, and Sykes 2016). We also gave teachers multiple opportunities to engage in inquiry dialogue, view models of discussion featuring inquiry

dialogue, and co-plan discussions. Thereafter, we asked teachers to conduct discussion in their language arts classes approximately once per week throughout the school year. Teachers were free to use their own texts but often discussed a common text so they could co-plan discussions and engage in follow-up co-inquiry and reflection. We audio and video recorded the workshops, and we videotaped teachers' classroom discussions once per month.

Following the workshops, we met with teachers in study groups every two weeks (four meetings), then every month (three meetings). Each meeting was held after school and lasted approximately two hours. In these meetings, (1) we typically shared a video and transcript of a discussion just conducted by one of the teachers and prompted reflection on the video, (2) we focused on one of the standards of argumentation evaluated in the *ART* and the moves to facilitate inquiry dialogue that addressed the standard, and (3) we co-planned a discussion. All study group meetings were audio and video recorded.

Beginning in November, an expert discourse coach met with teachers in their classrooms for individual coaching. The coaching typically involved viewing and analyzing the most recent videoed discussion using the *ART*, followed by reflection and goal setting for the next discussion. It also included an in-class demonstration of inquiry dialogue. We offered coaching approximately once per month and each session lasted 30–40 minutes. All sessions were audio recorded.

Materials

For the pretest and posttest classroom discussions that we videotaped in each teacher's classroom, we used four texts organized into pairs. Each pair had one literary and one informational text. Pair A comprised *Thank You, M'am* (Hughes 1996; 1346 words) and *The Right to Fight* (Modigliani 2013; 711 words). Pair B comprised *Don't Be an Uncle Max* (Adler 1995, 1794 words) and *Too Risky for Kids* (Modigliani 2011; 662 words).

To assess teachers' epistemology before and after the professional development, we used the *Reflective Judgment Interview* (King and Kitchener 1994). During the interview, teachers were presented with problem-scenarios that had no simple solutions, such as the safety of chemical food additives or the objectivity of news reporting. Teachers answered a series of questions about the problems, prompting them to reflect on the nature, source, certainty, and justification of their judgments (e.g. *Can you ever know for sure that your position is correct? How or why not? How is it possible that experts in the field disagree about this subject?*). The psychometric quality of the measure is supported by numerous validity and reliability studies (Wood 1997). Scores on the measure correlate highly with measures of verbal ability and critical thinking and are sensitive to expected changes across ages and educational levels (King and Kitchener 1994). There are two forms each comprising two problem-scenarios.

To examine changes in the quality of discussions, we used the *ART* (Reznitskaya et al. 2016). The *ART* is an observational rating scale designed to examine the quality of teacher facilitation and student argumentation in elementary language arts classrooms. It consists of 11 pairs of items that describe teacher and student behaviors using a 6-point Likert scale. The pairs of items are grouped in relation to four standards of argumentation: (1) consideration of multiple perspectives, (2) clarity of language and structure of

STANDARD #2. CLEAR: WE ARE CLEAR IN THE LANGUAGE AND STRUCTURE OF OUR ARGUMENTS				
MOVE		ADVANCING 6 5	DEVELOPING 4 3	NOT YET 2 1
5. CONNECTING IDEAS	Teacher	The teacher **clarifies the group's reasoning** by making visible the connections among students' ideas. The teacher prompts students to relate their ideas to what's been said by others **in specific ways.** He attributes student ideas and questions to specific speakers. This happens whenever students fail to build on or challenge each other's arguments. • *Which part are you agreeing with?* • *What is the difference between what you are saying and what Quincy said?* • *How does this relate to what William said?* • *Martin, do you want to respond to Kim?* • *Kelly, you said you are disagreeing with Jon's point. How are you disagreeing?* • *I don't see how your example supports Keisha's position – can you explain more?* • *How is this example relevant to what Marina said earlier about…?*	The teacher allows students to give redundant answers that make the points already made by others. The requests for connections are often **overly general.** The teacher **misses opportunities** to connect students' ideas. • *Anything else?* • *Does anyone have something to add?* • *Does anyone agree or disagree?*	The teacher **does not** relate student answers to each other. • *OK, the next question on p. 12 is, "Why did Morgan run away from home?" Who can give us the answer?*
	Students	Student **responses are interrelated** and connected to the ideas of others. The responses are 'chained together' as **students react to each others' positions and justifications**, building on or challenging each other's reasoning. • *As Jack said before…* • *I disagree about one thing in what Brad just said…* • *Jamilla's point might be true, but I have a different example….* • *What Omar said changes everything for me. Now, I think …*	Students **occasionally** relate their answers to the contributions of other group members. Often, these connections involve the sharing of similar opinions and personal experiences. Thus, the degree of simple agreement and repetition may be high. • *Colleen's story reminds me of one time when I got lost in the mall.*	Students simply state their answers in a sequential fashion, essentially disregarding the input of others. Their answers do not relate to contributions already made in the discussion.

Figure 1. An example of a teacher–student item pair from the Argumentation Rating Tool.

arguments, (3) acceptability of premises, and (4) validity of inferences (cf., Toulmin 1958; Walton 1996). Figure 1 illustrates one pair of ART items that address the standard of clarity. Raters record their notes on the entire discussion, or pre-selected segment of the discussion, then complete their ratings. Studies of the psychometric properties of the *ART* show evidence of high reliability, criterion-related validity, and sensitivity to experimental manipulations of talk (Reznitskaya et al. 2016).

Data analysis

To examine changes in teachers' epistemology, we transcribed and scored the pretest and posttest *Reflective Judgment Interviews*, following the scoring manual provided by King and Kitchener (1994). King and Kitchener classify interviewee responses into pre-reflective, quasi-reflective, and reflective judgments. These three levels correspond to the absolutist, multiplist, and evaluatist levels proposed by Kuhn (1991), respectively. One rater from each site scored the responses of teachers (de-identified) from the other site to minimize bias associated with knowledge of the teachers and timing of the interviews. On a random sample of 20% (6) of the interviews, inter-rater agreement within one point on the 7-point scale was 94% (correlations between raters were not meaningful because of limited variability in the ratings). Two scores were derived from the *Reflective Judgment Interviews*: a Nature of Knowledge score, derived from teachers' responses to three questions; and a Nature of Justification score, derived from teachers' responses to another four questions.

To examine changes in the quality of discussions, we scored videos of the pretest and posttest discussions using the *ART*. We sampled the middle 14 minutes of each video, reasoning that argumentation would be most evident during the middle stages

of inquiry dialogue (Gregory 2007). Two raters from each site independently viewed and scored the clips (de-identified) from the other site to minimize bias associated with knowledge of the teachers and timing of the video recordings. Across the 22 items, agreement between raters within one point on the 6-point scale ranged from 71% to 100% and intraclass correlations ranged from .59 to .96 (two-way mixed, absolute agreement, average-measures intraclass correlation). Three scores were derived from the ART: a Teacher Facilitation score, derived from the 11 items that describe teacher interactions; a Student Argumentation score, derived from the 11 items that describe student interactions; and a Total score, derived from all 22 items. For Teacher Facilitation, the Pearson correlations between raters were .91 and .93 for the two sites; for Student Argumentation, the correlations between raters were .93 and .95. For the Total score, the correlations were .93 and .95.

Findings

We first report results concerning the quality of teachers' discussions. Table 1 shows results of our ratings of pretest and posttest discussions for each site using the *ART*. To obtain these results, we calculated the mean of the two raters' scores at each site for each item; then calculated the mean Teacher Facilitation, Student Argumentation, and Total scores for each of the two discussions at pretest and posttest; then averaged the mean scores for the two discussions. Results were very similar at the two sites, with teachers and students making an average improvement of about two points on the 6-point Likert scale. Dependent samples t-tests, using an alpha of .01 to minimize family-wise Type-I error, showed the differences were statistically significant at the Ohio site (Teacher Facilitation, $t(5) = 38.09$, $p = .00$; Student Argumentation, $t(5) = 20.28$, $p = .00$; Total, $t(5) = 26.62$, $p = .00$) and the New Jersey site (Teacher Facilitation, $t(6) = 10.19$, $p = .00$; Student Argumentation, $t(6) = 13.28$, $p = .00$; Total, $t(6) = 11.83$, $p = .00$).

To illustrate the nature of the change following the professional development, we provide excerpts from transcripts of discussions conducted by the same teacher at the beginning and end of the school year. All teachers showed gains in their facilitation of inquiry dialogue and in the quality of students' argumentation, but we chose this teacher's discussions because they were among those that showed the largest growth from pretest to posttest as measured by ratings on the ART. The discussions took place in a fifth grade class from a school in New Jersey with 100% minority and 85% economically disadvantaged students. The school's academic performance 'lagged significantly' compared to other

Table 1. Means (standard deviations) of ratings on the ART for Teacher Facilitation, Student Argumentation, and Total scores, before and after professional development.

	Ohio		New Jersey	
Measure	Pretest	Posttest	Pretest	Posttest
Teacher Facilitation	2.90 (0.28)	4.78 (0.32)*	2.35 (0.52)	4.63 (0.44)*
Student Argumentation	2.81 (0.24)	4.95 (0.34)*	2.25 (0.43)	4.64 (0.40)*
Total score	2.85 (0.25)	4.87 (0.33)*	2.30 (0.47)	4.63 (0.41)*

*Pretest-posttest significant difference, $p < .01$.

schools in the state. Students in this class were either African American or Hispanic. In this excerpt from the beginning of the year, the teacher and students[1] took part in a whole-class discussion of *Don't Be an Uncle Max*, a short story about a somewhat unconventional uncle who sends his favorite niece unusual gifts, not the least of which is an empty box ostensibly full of snow from Alaska.

Teacher:	So why did he send her snow from Alaska? And, I'm also looking for you to make some inferences about Uncle Max. What can we infer that is not in this text? Um, Dante.
Dante:	He sent snow in a box because he can't keep a steady job, while you're broke.
Teacher:	Oh, so he didn't have a lot of money, you're saying? So he just put the snow in. Yes, that's probably part of why he did it, but he also did it for another reason, I think, which is maybe why she likes him. Do you think she likes him?
Class:	Yes!
Teacher:	I am wondering why? So, Nadia?
Nadia:	The note that was sent with the snow said it was packed with my love, for her.
Teacher:	And, did he really pack love in the box?
Class:	No.
Teacher:	So what is that? It's not a metaphor really. So what is it, when he says I packed love in the box? What kind of literary device is that?
Amaya:	I wasn't going to, I have a different comment.
Teacher:	Okay, we'll come back to you. Anybody know? Dante.
Dante:	Metaphor?
Teacher:	It's not quite a metaphor, right, because the love really stands for … love. But, can you actually put love in a box?
Class:	No.
Teacher:	So what do you think?
Tanika:	Idiom?
Teacher:	Mmm, that's interesting. I don't think it's exactly an idiom but I could see how you could make that conclusion. What do you think?
Jamir:	Hyperbole?
Teacher:	Yeah, it's hyperbole. That's what I was thinking. It's a big exaggeration, he's not really packing love in the box. It's also very descriptive language, it's very figurative. He's making you understand how the uncle feels about her, what's her name, Joanne, Jo, without saying it. You can make inferences about their relationship. What does Jo do with the love? Does she go 'Oh, that's stupid'?
Class:	No.
Dion:	She says in the last paragraph in the last page, 'Uncle Max also sent me lots of love. Sometimes I really need that. I taped the box closed again so none of the love will fall out.'
Teacher:	Excellent, excellent. So what was the other big thing that Max sent to her that maybe not everyone would understand or appreciate? Andre.
Andre:	A blue jay.
Teacher:	He sent her a bird? It was really a bird? Was it? Was it a bird that made a lot of noise at night when she went to sleep?
Class	No.
Andre:	It was a trained bird.
Teacher:	It was a what?
Andre:	A trained bird.
Teacher:	It wasn't a trained bird. Dante?

Note that in this excerpt the teacher held the floor most of the time and controlled the flow of discussion. The pattern of discourse was largely that of recitation where the teacher nominated students, asked questions, evaluated the answers, and generally steered the discussion towards pre-determined conclusions. Students' responses were brief and all were directed to the teacher.

By contrast, the following excerpt from a discussion toward the end of the year showed a markedly different pattern. In this excerpt, the teacher and students were using a 'fishbowl,' with half the students in the discussion and the other half observing. The discussion was based on a short story, *Thank You M'am*,, about a youth who attempts to steal the purse of an elderly woman as she is walking home at night. The elderly woman foils the theft and drags him to her home but does not call the police. The students and the teacher

were considering the question of whether the elderly lady should have reported the youth to the police.

Zalen: I want to agree with everybody who say no because, like, when Andre said she grabbed him by the neck and, she call the police, the boy could tell everything that she did … that the old lady did to him, like beat him up or something. Mia.
Mia: I say she should never have called the cops because in the text it said that his age was around 15 or 16, and, they said it in the text. And I say she should never have called the cops because he was too young to go to jail. And like, I think Kala said … yeah, like Kala said it would have been her fault because she grabbed him by the neck and he didn't really grab her purse, but he tried to.
Dante: Zalen, can you repeat that again?
Zalen: I said that, um like Andre said that, the lady had grabbed him by the neck down the street, he could've just told the police that, could have told the police everything that the lady did to him.
Sam: Yeah, but he was the one who stole the pocketbook … So if she calls the cops … She didn't really call the cops… But he stole her pocketbook.
Tanika: I want to change my mind … I want to change my mind, I say yes, she should have called the police because, if, if you're walking down the street at eleven o'clock and … No, you can't just turn the corner and then grab onto a lady's purse by accident. [points to Zalen]
Teacher: [Laughs]
Zalen: I want to go back to what Sam said and I want to disagree with you [looking at Sam] because, he didn't actually steal the purse, he tried to, he grabbed onto the purse. [points to Amaya]
Amaya: I want to disagree with Tanika because, if the lady would have called the cops, why would she have bring him to her house and give him the 10 dollars? Nadia.
Jamir Huh?
Nadia: I agree with/
Teacher: [Interrupts] Wait, just let me stop for just a second. I think there's a little confusion about that. If the lady had … She said if the lady had called the cops why would she bring him to her house and give him 10 dollars.
Jamir: She didn't call the cops.
Amaya: [quietly] Exactly what I was sayin'
Teacher: Thank you.
Nadia: I agree with Tanika because um, he didn't really finish grabbing her pocketbook and he didn't really stole it and, and you don't know if he could do that again.

In this excerpt, the students largely controlled the flow of discussion. There were consecutive peer-to-peer exchanges uninterrupted by the teacher. The students engaged in critical and collaborative inquiry in relation to the big question; they managed turn taking, evaluated each other's answers, and explored alternative perspectives together. The teacher stepped in only when necessary to clarify a misunderstanding. The students connected their ideas to those of others in the group, and gave long, elaborated responses using reasons and evidence from the text to support their claims. There was an openness and respect for differences of opinion. One of the students, Tanika, changed her position in response to other's arguments, a move some regard as a key indicator of an exploratory or inquiry orientation (Wegerif 2008). Elsewhere in the discussion, not shown in this excerpt, other students also changed their minds.

Despite the marked gains in the quality of teachers' facilitation and students' argumentation over the year, shown in Table 1, we were unsuccessful in helping teachers make shifts towards a more advanced, evaluatist epistemology. Table 2 shows scores of teachers' responses to the *Reflective Judgment Interview*. Results show no changes in teachers'

Table 2. Means (standard deviations) of scores on the reflective judgment interview, before and after professional development.

	Ohio		New Jersey	
Dimension	Pretest	Posttest	Pretest	Posttest
Nature of Knowledge	4.03 (0.16)	4.08 (0.55)	4.43 (0.45)	4.44 (0.24)
Nature of Justification	3.93 (0.19)	4.14 (0.85)	4.75 (0.65)	4.65 (0.40)

epistemology before and after the professional development, either at the Ohio site (Nature of Knowledge, $t(5) = 0.33$, $p = .76$); Justification of Knowledge, $t(5) = 0.68$, $p = .53$) or at the New Jersey site (Nature of Knowledge, $t(5) = 0.06$, $p = .96$); Justification of Knowledge, $t(5) = 0.37$, $p = .73$). For the most part, teachers obtained scores of 4 and 5 on the 7-point scale. King and Kitchener (1994) characterize levels 4 and 5 as 'quasi-reflective thinking' (similar to a multiplist or relativist view of knowledge described by Kuhn 1991). These results indicate that most teachers held to a view of knowledge as subjective; even though they believed conclusions should be justified by giving reasons, they regarded arguments and use of reasons and evidence as idiosyncratic (in other words, there is no way of evaluating contrasting positions).

Discussion

The purpose of this study was to assess the impact of a professional development program on teachers' epistemological beliefs and their enactment of inquiry dialogue during text-based discussions. As indicated earlier, teachers' discourse practices are notoriously resistant to change (Alvermann and Hayes 1989; Juzwik et al. 2012; Nguyen et al. 2007). Building on principles of effective professional development and prior efforts to enhance teachers' discourse practices, we sought to help teachers make the transition from teacher-dominated classroom practice to a more dialogic pedagogy and to advance their beliefs towards a more evaluatist epistemology that acknowledges the importance of rational evaluation of different points of view.

Analysis of the videoed discussions at the beginning and end of the year showed that teachers made substantial shifts in their discourse practices toward a more dialogic pedagogy. Following participation in a combination of workshops, study group meetings, and individual coaching sessions totaling approximately 30 hours, teachers evidenced considerable improvements in their ability to facilitate inquiry dialogue and in the quality of argumentation among students during the discussions. Comments from teachers over the year suggest that they struggled with various conceptual and practical aspects covered in the professional development (e.g. making moves to facilitate inquiry dialogue, understanding argument and the criteria for evaluating arguments, choosing texts for students, formulating big questions). Nonetheless, when given texts at the end of the year, they were readily able to formulate big questions, launch discussions, and facilitate inquiry dialogue without guidance from the researchers.

The fact that we achieved these results in the absence of any meaningful change in teachers' beliefs about knowledge and knowledge justification remains a puzzle. This finding is inconsistent with prevailing theory that assumes a relationship between teachers' practices and their epistemology (Brownlee and Berthelsen 2006; Hofer 2001; Richardson and Placier 2001; Windschitl 2002) and with at least some prior studies (e.g. Johnston et al. 2001; Stipek et al. 2001). It is possible that teachers would have made even greater improvements in their practices if they had revised their views of knowledge and knowledge justification; however, the changes they made were substantial.

There are several possible explanations for the apparent discrepancy between teachers' beliefs and practices. One explanation is that our measure of epistemology was insensitive to shifts in teachers' beliefs as they made the transition from teacher-dominated classroom practice to a more dialogic pedagogy. Recent research and theorizing suggests that

teachers' epistemological beliefs are domain-specific, situated, and multi-dimensional (Buehl, Alexander, and Murphy 2002; Chinn, Buckland, and Samarapungavan 2011; Cobb 2002). Hence, teachers may have demonstrated a more evaluative epistemology when conducting inquiry dialogue, manifest in their discourse, but not when asked to articulate their beliefs about abstract issues removed from the classroom context. Another explanation is that the professional development was simply insufficient to contribute to meaningful shifts in teachers' beliefs. If this were the case, we would expect teachers to revert to more traditional discourse practices following conclusion of the professional development; unfortunately, we do not have the data to test this explanation. Another possibility is that, although teachers' epistemological beliefs can influence their classroom instruction (Brownlee and Berthelsen 2006; Chan and Elliott 2004; Kang and Wallace 2005), the relationship between beliefs and practices is more complex than we hypothesized. It may be that changes in practice precede changes in beliefs or that the relationship is reciprocal. Yet another explanation, of course, is that the theory is flawed. Perhaps a multiplist view of knowledge—the view held by most of the teachers in our study—serves teachers sufficiently well in their classroom practice, at least well enough for them to be able to facilitate inquiry dialogue to the degree demonstrated in the present study. More research is needed to clarify the nature of the relationship between teachers' beliefs and their discourse practices.

To conclude, despite the apparent inconsistencies between teachers' beliefs and their practices revealed in this study, our results show that teachers were able to demonstrate marked changes in their discourse practices following the professional development. These findings align with those from other research involving comprehensive professional development programs aimed at changing teachers' discourse practices (Adler et al. 2004; Hennessy et al. 2011; Saunders and Goldenberg 1996; Saunders et al. 1992). They hold promise for future professional development efforts aimed at supporting teachers' adoption of more dialogic pedagogy.

One part of the study not discussed in this paper involved collecting data on teachers' perceptions of the professional development during the program. These data were collected to inform revisions of the program for the larger project. Informed by analyses of these data, as well as prior work on professional development and dialogic teaching, we are developing a set of design principles to guide future iterations of our program. As we have mentioned, research on professional development in dialogic pedagogy is not well developed, and it remains to be seen whether our current instantiation of these design principles is sufficient to support teachers in making sustained shifts in their discourse practices to promote argument literacy. Although our results are promising, considerable research remains to be done to identify and test strategies to help practitioners acquire the theoretical, epistemological, and procedural knowledge needed to successfully implement dialogic teaching. Our hope is that these principles will contribute to the design of effective programs that can support teachers' adoption of new discourse practices and, eventually, enable teachers to use classroom dialogue effectively to promote the development of students' higher-order thinking and argument literacy.

Note

1. All student names are pseudonyms.

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