Understanding Professional Vision in Inquiry Science Teaching

Abstract: To understand inquiry science teaching, we must understand how practicing and prospective teachers *see* the activity of teaching. This study examines how practicing and prospective teachers highlight and code classroom activity in an effort to understand the nature of professional pedagogical vision (Goodwin, 1994). Results indicate that differences exist in terms of: actor focus, questions, grain-size and enactment.

Problem

Describing inquiry science teaching as an activity in real classrooms is lost somewhere between high level standards describing broad criteria and particular idealized examples of inquiry often used to exemplify the standards. In science education two fields are typically drawn upon to provide implications for science teaching – learning sciences and science studies. One provides implications of how students learn, while the other provides implications about the epistemological underpinnings of science as a discipline and social practice. As an activity, teaching has largely been ignored as having independent theoretical value, while theories of phenomenon related to teaching, primarily learning theories, have been misconstrued as theories of teaching. Learning theories typically make predictions about learning outcomes based on treatments and presuppose a theory of teaching (Kerr, 1981). A theoretical base for science teaching and learning thus lacks a key third leg – the theoretical understanding of classroom science teaching as an activity. To advance the field in terms of understanding enactment of classroom inquiry science teaching there is a need for a theory of teaching grounded in practice.

The development of inquiry fostering curricula and technology, even supported with professional development is not adequate to reform science teaching without a clearly articulated theory of classroom inquiry science teaching to guide teachers and professional development leaders. For a theory of teaching to impact science pedagogy teachers need to be able to *see* this theory in practice. This requires the ability to examine classroom practice as an expert does, because expert and novice teachers literally *see* science classrooms in quite different ways. Simply watching exemplary science teaching does not mean that prospective teachers can understand or even attend to what is relevant in the activity. If prospective teachers cannot attend to the key aspects of the outer manifestation of classroom inquiry science teaching, then they cannot understand the true principles of construction. The difference between how professionals and novices see classrooms can be described in terms of professional vision, specifically three aspects of professional practice: coding, highlighting and articulation of representations (Goodwin, 1994). This study investigates the questions: How do expert and novice teachers *see* (code and highlight) science teaching differently; and how can these differences begin to define cultural categories that comprise professional vision for classroom inquiry science teaching?

Design and Analysis

This study of professional pedagogical vision occurred in the context of the Invisible College of Inquiry Science Study (ICISS), a professional learning community consisting of practicing science teachers, prospective science teachers, doctoral students, masters students and university faculty in science education. This particular study included 6 practicing and 17 prospective teachers. All 23 participants were asked to individually view a 33 minute science lesson and mark sections of the lesson they felt represented "inquiry science teaching" using Studiocode® video analysis software. Each participant was asked to write an articulation of why they labeled instances as they did. Finally, there were two 1.5 hour conversation between participants about what constitutes inquiry science teaching using the participants' video analysis as a scaffold. The discussions between participants were recorded and transcribed for analysis. The Studiocode® documents were analyzed using simple descriptive statistics to determine the how much of the lesson was coded as inquiry, how many instances, how long each instance was, etc. Teachers were able to mark time in and time out for each instance and were asked to be as careful as possible to mark the instance that they were selecting. The content of the coded instances (i.e. what was going on in the lesson at the time) was not coded for analysis in this study. The only data from the video analysis documents used were the number of instances and their length. The remainder of the data analyzed for this study, which included documents submitted by students and transcripts of the discussion of the videos, were coded based on Miles & Huberman (1984). The initial coding was developed around two of Goodwin's (1994) components of professional vision: coding and highlighting.

Findings

On average the prospective teacher highlighted 23.5% of the lesson as inquiry. This is in sharp contrast to practicing teachers who, with one exception, did not see any examples in the sample lesson of inquiry science teaching. The one practicing teacher who did code five instances of inquiry marked just over 4% of the lesson as inquiry. Prospective teachers averaged 8.78 instances of inquiry within the 33-minute lesson. This indicates there are substantive differences between prospective and practicing teachers view of inquiry pedagogy. Analysis of the qualitative data provides detail about the difference between experts and novices pedagogical vision. Differences between participants' analysis of classroom practice occurred in four areas: actor focus, questions, grain-size and enactment.

Actor Focus - Both groups talked about the activities in the classroom. However, they differed in terms of which actor they indicated was primary in the instances they highlighted. The prospective teachers talked almost exclusively about the activity of the teacher, while the practicing teachers talked almost exclusively about the activity of the students. This focus on self as teacher in prospective teachers is not unusual, and beginning teachers tend to move from self focused to student focused over time (Richardson, 1990).

Questions - Expert and novice teachers differed in how they viewed questions and the relationship between questions and inquiry. Both groups paid particular attention to the questions asked during the lesson and linked them to inquiry science pedagogy. The prospective teachers tended to equate the existence of questions in the classroom with an inquiry lesson and believed student questions were particularly strong examples of inquiry when the teacher did not answer them directly. The expert teachers were much more nuanced in their view of how questions were used and when the use of questions led to sections of the lesson being categorized as inquiry or not. Practicing teachers were looking for questions to be both generated by *and* answered by students.

Grain-size - A third difference that emerged between prospective and practicing teachers was in the "grain-size" they perceived for inquiry science pedagogy. While both groups attended to the activities and specific individual interactions between teacher and students, the practicing teachers not only went beyond those interactions, but were looking beyond the single lesson to multiple lessons (which had not been provided for analysis), units or even classroom culture. There was no indication of this larger grain-size notion of inquiry within the analysis of any of the prospective teachers.

Enactment - The final difference between practicing and prospective teachers was in their ability to differentiate between the plan and the enactment. Almost all the expert teachers (5 of 6) indicated the lesson could have been, or was intended as inquiry even though they indicated the lesson contained no inquiry. Practicing teachers indicated that what made the lesson inquiry or not was based on the enactment of the activity by the teacher not the activity itself. This separation between plan and enactment was not expressed by any of the prospective teachers.

Contribution

This study indicates there are significant differences between prospective and practicing teachers in terms of their professional pedagogical vision. Expert teachers focused on the discourse in more nuanced ways and relied more heavily on the big picture of enactment to determine if teaching was inquiry or not. Prospective teachers tended to focus on the organization of the classroom activity (e.g. whole group vs. small group) and whether question were part of the discourse. They were less concerned with the nature of the questions. These differences may make it difficult for prospective teachers to even *see* what is going on in a science classroom, much less understand the implications for inquiry science pedagogy. Prospective teachers not only missed the underlying principles of the lessons construction, they did not attend to the relevant aspects of the outer manifestation of the phenomenon. As a field we need to understand expert teachers' professional vision well enough, and be able to articulate it clearly enough, to allow prospective teachers to *see* classroom science teaching. It is critical to a theory of teaching and for the reform of science pedagogy.

References

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