SCHOOL SCIENCE AND MATHEMATICS

# Research to Practice Article

## *Professional Pedagogical Vision as a Way of Thinking about Reflection on Practice*

**Based on the published SSM Journal Research Manuscript:**
**The Transparent and the Invisible in Professional Pedagogical Vision for Science Teaching**

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### Overview of the Study

This study investigated differences between expert teachers' (ETs) and teacher candidates' (TCs) professional pedagogical vision for science teaching. McDonald (2016) draws on Goodwin's (1994) idea of professional vision as a "socially organized ways of seeing and understanding events that are answerable to the distinctive interests of a particular social group" (p. 606). Participants were recruited from two different contexts: 1) the expert teachers from the Invisible College of Inquiry Science Study (ICISS), a professional learning community of science educators including practicing science teachers and university faculty in science education; and 2) teacher candidates from SCIED 412: Secondary Science Teaching II, the second course in a two-course sequence on teaching science at a large mid-Atlantic university's teacher education program. The participants included 6 practicing teachers (from 7 to 15 years experience) and 17 teacher candidates.

### Research Topic

This study examined the ways ETs and TCs analyzed a 33-minute science lesson video from the publicly available *Third International Mathematics and Science Study* (1999). They were asked to highlight sections of the lesson they felt represented "inquiry science teaching" and to provide reasoning for why they thought the instance was an example of inquiry science teaching. The ETs and the TCs each participated in a three-hour focus group meeting. Both meetings were recorded and transcribed.

Complex forms of teaching, such as inquiry science teaching, are difficult for both ETs and TCs to learn. Teacher educators can help teachers develop these practices through mediating TCs' analysis of examples of practices. ETs and TCs having a shared language and shared conceptualization of inquiry science teaching supports teacher learning in preservice teacher education, mentor and teacher candidate relationships, and professional development for practicing teachers.

### Discussion of Findings

McDonald (2016) found distinct differences in TCs' and ETs' professional pedagogical vision, in particular across four categories: actor focus, questions, grain size and enactment. In terms of *actor focus*, TCs attended to the activity of the teacher or the teachers' response to the students' activity, while the ETs attended to the activity of the students. With regard to *questions*, ETs were much more nuanced in their view of how questions were used and also when the use of questions indicated inquiry teaching. ETs considered questions that indicated inquiry as those both generated by and answered by students, while TCs saw all questions, from teachers and students, as equally valuable and leading to generic goals of student thinking. Attention given to the *grain-size* was the third difference found between ETs and TCs in terms of their understanding of inquiry science teaching. While the ETs attended to the small-scale individual interactions, they put significant emphasis on large-scale patterns in instructions, such as multiple lessons when considering if the lesson was inquiry; TCs did not mention any practices or activities larger than individual interactions between teacher and students. Finally, ETs were able to recognize the important distinction between the planning and the enactment of the inquiry. TCs saw the lesson and the how the teacher enacted it as the same, thus ignoring the critical role of the teachers' framing (Wickman, 2002) of

the activity for the students. ETs paid particular attention to teacher's use of framing questions to orient students in different ways to classroom activity. Overall then, there are significant differences in the way ETs and TCs see and interpret classroom activity that are generally consistent within the two groups.

**Implications for Practice**

This study indicates that when considering their own professional growth, teachers should be aware of the possibility of differences between colleagues in the way that they see and interpret classroom activity. For those who work in a Professional Learning Community, or other way of working with colleagues on professional growth, discussions about practice can be complicated by these differences in professional pedagogical vision. Teacher educators also need to be aware of these cultural "blind spots" that TCs bring with them to beginning teaching and need to guide and shape their interpretations through intensive, repeated and detailed analysis of examples of practice. McDonald (2016) suggests that a shift to evidence and explanations in analysis of classroom exemplars may help TCs to focus on students and their ideas, where TCs are asked to specifically indicate what activity in the classroom they are using as the basis for their judgments.

It is also worth considering using a shared set of tools to guide planning and enactment of science teaching. For example, McDonald (2016) suggests using the Big Idea Tool (Windschitl, et. al, 2012), which supports planning using a model-based inquiry approach to teaching science; and also a science content storyline (McDonald & Kelly, 2007; Roth & Garnier, 2006), which is a way of conceptualizing the relationship between lessons in a unit in terms of the development of an explanation or model of a scientific phenomenon. We would like to extend McDonald's (2016) suggestions and implications for other educators including classroom teachers, mentor teachers and as well as supervisors.

Practicing classroom teachers may find the Big Idea Tool and content storyline useful in their planning as well, but the primary suggestion is to be as explicit as they can about their own practices and articulate what they are trying to do with their teaching practices, in particular what the purposes are of their practices. Creating teacher critical friend groups in their own schools and examining each other's practices may help to start that conversation, which can be extended to school or district levels.

Mentor teachers and supervisors can help TCs better articulate their practices with specifics about the instructional choices they are making. This research showed how difficult it is for novices to see and talk about the teaching practices that are transparent to the experts; thus mentor teachers and supervisors should make their own practices visible to their mentees through detailed and explicit conversations grounded in examples of practice. Some teacher educators (eg. Lampert, Franke, Kazemi, Ghousseini, Turrou, Beasley, & Crowe, 2013) in teacher education classrooms use rehearsals as a pedagogy to prepare TCs to learn to interact productively in less complex environments for a short instructional time, where teacher educators can intervene in the instruction and talk to TCs about what happened in the moment. Similar to the rehearsals, mentor teachers and supervisors can use teacher timeouts (TTO) (Lewis, Gibbons, Hintz, & Kazemi, 2015) in the actual classrooms where they can stop the instruction when needed to have a conversation about teaching in the moment. This way, the entire lesson becomes a rehearsal context and can lead to discussions with mentees in the moment to help them articulate the practices and even co-develop and revise the practices.

**Other Resources in This Area**

We suggest educators look at Grossman and McDonald's (2008) work to see how they articulate teacher educators' practices they describe as pedagogies of enactment: representations of practice, decomposition of practice, and approximations of practice. We also suggest educators look at the work of Windschitl and colleagues (2012) at the University of Washington around ambitious science teaching practices. The group also has practical tools (Big Idea Tool, Discourse tools, RSSTs) and support systems for the educators to engage in ambitious science teaching practices. The following link includes their website for the tools: (http://ambitiousscienceteaching.org).

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