

Epistemic Terrains and Epistemic Potential: A Review of "How I Should Know? Preservice Teachers' Images of Knowing (By Heart) in Mathematics and Science"

Abstract

A book review of Kathleen T. Nolan's *How Should I Know? Preservice Teachers' Images of Knowing (by heart) in Mathematics and Science* (238 pp.). Rotterdam: Sense Publishers.

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Since the dawning of the *interpretive turn* in mathematics and science education, many have developed a new sensitivity to *experience* within the practices of our disciplines. Many researchers and scholars, seeking a space beyond the traditions to ground their inquiries, have become to tackle "the fundamental questions of how and where knowledge is produced and by whom, and of what counts as knowledge" (Weedon, 1987, p. 7). Kathleen Nolan, similarly, in her book *How Should I Know? Preservice Teachers' Images of Knowing (by heart) in Mathematics and Science*, opens up another epistemic terrain for discussion on knowers and the known. From the practical trenches of an educator's work with preservice teachers, she calls into question many of our familiar categories of meaning and explanation in order to explore a nonfoundational epistemology in science and mathematics.

What distinguishes *How Should I Know?* from other recent efforts to engage with preservice teachers' knowing in mathematics and science is the way in which Nolan situates it squarely within the contemporary epistemological context. In doing so, the book draws on new forms of social to offer a grounding, as well as empirical evidence for a view of knowledge as a production, created and experienced by cognitive agents within social practices. *How Should I Know?* provides important insights relating to how and why an individual preservice teacher participates differently between subject disciplines and how that differential participation influences knowledge production. The result is a more expansive conception of knowing, and with it, a more fruitful view of subjectivity.

Conceptualizing knowledge production more expansively is important if we are to enhance pedagogical effectiveness in our schools. The harsh reality is that, by the time they arrive at teacher education courses, many preservice teachers are already disaffected with science and mathematics and have not learnt to interact successfully with the content of the formal curricula. Their visions of teaching are often narrowly confined to transmission approaches that tend to locate authority directly with the text and with the teacher. *How Should I Know?* is a creative initiative that brings these issues to the fore.

The mode of representation is through the construction of the text as a parody on physical science textbooks on the topic of light. More particularly, each chapter is produced through an experimental form of writing that works both within and beyond dominant textual forms. Each chapter uses a number of textual strategies such as differences in font size, inclusion of quotations from colleagues, scholars, reflections from the eight participants and the author on their individual experiences, along with poetry, prose, comedy, journal entries and excerpts pertaining to the scientific explanation of light. The intent is that, in using a "kaleidoscopic text", the presentation will highlight "the unfolding stories of struggles, questions, and rewards, presented as the word not the afterword" (p. 36). What the multilayered approach is able to do is capture the dynamic between structure and agency by showing us how science and mathematics are, for these elementary preservice teachers, places that allocate them with minimal epistemic authority. This finding is profoundly troubling; yet the detail of the analysis is worth taking seriously.

Exploring How People Come to Know

In the investigation, Nolan is focused on what it is that structures a concrete experience in mathematics and in science, whilst taking care to avoid the foregrounding of "concrete experience as the final arbiter" (Lather, 2006, p. 44). The research, based on a narrative inquiry that is "continually unfolding" (Clandinin & Connelly, 2000, p. 166), has a number of important theoretical guideposts. For example, highly influential have been critical theory, feminist theory, Bernstein's sociology of knowledge; sociocultural theory, and to some lesser extent, psychoanalytic theory. This theoretical underpinning allows Nolan to canvass a number of issues such as the politics of knowledge, the construction of subjectivity and agency, the nature and function of participants' reflections, the characteristics of effective teaching, and the promise of critical thinking.

Like a Foucauldian analysis, *How Should I Know?* does not promise total vision. Rather, it questions taken-for-granted meanings, values, and interrelations. It assists us in finding out where meanings and values are legitimated, as in Sylvia's view: "It's that mystique of science and how I had always been taught science: the teacher knows the answer" (p. 51). The stories demonstrate whose knowledge is privileged, and how those investments are sustained. For example, problematizing the assumption that potential knowers are equally distributed across the epistemic terrain, Helen observes: "The guys in our school were like 'oh, the girls can't do physics, the girls can't do math' (p. 129). Elsie tells us: "I loved our female math teacher but I always felt like she was teaching to the

male students in the class. Her favorites were always the males" (p. 129). Knowledge production, in these stories, works unevenly across gendered lines, generating presumptions of whose knowledge will be dismissed, discounted and disbelieved. Roberta explains: "We're taught to use our experience as knowledge and yet it's disqualified if it doesn't fit in" (p. 52).

In Foucault's terms, dividing practices are tremendously powerful. Places of knowing do not operate on a level playing field, as Helen notes: "I didn't understand anything in grade ten [math]. I thought 'Oh, I'm just bad at math', and then I gave up" (p. 123). Who might count as a knower is always already partially scripted and contained within hierarchies of power that work to endorse a female preservice teacher's epistemic status. As Evelyn observes: "There is a lot of support for not doing good at science...If I told people I didn't understand chemistry, they'd say: 'Yeah, well, you know...'" (p. 162-163). Politics grounds the struggle over a teacher's sense of self as a knower. Crucially, preservice teachers come to think of themselves in ways that have been shaped for them and begin to act accordingly.

Similarly, what it means to know mathematics and science is generated within specific spaces that induce teachers into a particular pedagogical pattern. Ursula tells us: "[I]t was an X or a check mark there was no discussion it was just a right or a wrong thing" (p. 51). Later Ursula notes: "They gave you a handout; you memorized it quick the night before and you go spit that out and forget it the next day" (p. 76). Evelyn tells us that in her class: "We labelled diagrams that were photocopied out of the textbooks" (p. 74). In Helen's experience as a student, links between knowledge and power worked to produce uneven possibilities of being a knower in mathematics and science. She noted: "He'd come to class, He'd write something on the board that didn't make any sense. He wouldn't explain it. He wouldn't answer questions. Then he'd leave the class..." (p. 123). Experiences like these in which positions of authority and expertise are differentially located, influence the kinds of teachers the preservice teachers might become.

Concluding Thoughts

How Should I Know? is directed towards understanding and potentially eradicating the injustices that determine "outsider" status within science and mathematics. It offers an analysis that is much richer than mere description. By exposing the conditions which operate to make divisions between people, the book reveals that the effects of power are experienced not only by those marginalized by social class, ethnicity and so forth, but for these female preservice teachers in their everyday school practices. By unpacking what seems "natural" and by locating the effects of constitutive power, *How Should I Know?* prompts us into thinking differently about women in science and mathematics. The stories offered do not support a naïve experientialism, but rather sketch out how systemic constraints become lived as individual dilemmas.

Importantly, the analyses point to the transformative potential of gendered epistemologies. They provide a means to explore the possibilities that emerge for elementary preservice teachers, with a view towards more tangible results and more equitable forms of organization. Raising questions about differential power and privilege and paying close attention to the way in which both human practices and systems shape the knowledge of those learning to teach, might be a valuable first step.

References

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