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Article

Dissolving Dualisms: How Two Positivists Engaged With Non-Positivist Qualitative Methodology

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Abstract

This is the story of how a chemical engineer and a medical microbiologist overcame their positivist training and deeply held disciplinary attitudes to engage with non-positivist qualitative methodology. Through a series of facilitated reflections they explored what helped and hindered their transition from positivist to non-positivist inquiry. To move forward they needed to acknowledge the extent and nature of the transition they were making, find metaphors to dissolve troubling dualisms, and balance a desire to reach out to others with the need to manage the very real sense of vulnerability that came with embracing subjectivity. Their experiences suggest that pragmatism may be a useful bridging framework for the growing number of academics from the science, technology, engineering, and math (STEM) disciplines turning to qualitative methodologists for help to move beyond positivist research.

Keywords: pragmatism, STEM, non-positivist research, positivism, qualitative methodology, interdisciplinary research, Scholarship of Teaching and Learning

Quantitative methodologies, large samples, precise parameters, and the elimination of confounding variables are still the hallmarks of rigorous research in most science, technology, engineering, and mathematics (STEM) disciplines (Banchoff & Salem, 2002; Box, Hunter, & Hunter, 2005; Coppola & Jacobs, 2002). With the exception of the health sciences, in which nursing scholars have led the charge to develop qualitative methodology (Malterud, 2001; Morse, 2010; Sandelowski, 2000; Thorne, 2008), many STEM researchers either have yet to engage with non-positivist methodologies or are still at the stage of justifying their use to sceptical STEM audiences (Dittrich, John, Singer, & Tessem, 2007; Trauth, 2001). In the area of STEM education, however, the growing understanding that learning involves highly complex social interactions has led to increasing calls for research that captures the subjectivity of human experience (Regehr, 2010). Yet few people have explored the processes by which traditionally trained STEM academics can engage with non-positivist ideas to undertake meaningful qualitative research of their own. In light of this lack of guidance as to how to proceed, two STEM scholars share their story of how they overcame their deeply held disciplinary attitudes to conduct a reflective study into their transition from positivist to non-positivist qualitative inquiry.

NK and SN, who have chosen to identify themselves by their initials, are female faculty at a large research university. SN is a chemical engineer and NK is a medical microbiologist. Their academic careers have been founded on quantitative STEM research conducted within a positivist paradigm. Over the last decade, however, both have completed faculty development courses and research related to the Scholarship of Teaching and Learning (SoTL). This is an emerging scholarly field in which academics research the processes and impact of their own teaching and the experiences of their learners (Boyer, 1990; Hutchings, 2010).

Each discipline engages with SoTL using its own distinctive ways of practising and thinking (Entwistle, 2005). Academics tend to start exploring the impact of their own teaching practices through their discipline's traditional language and conventions (Huber & Morreale, 2002). However, the quantitative methodologies most familiar to STEM scholars do not fit well with the SoTL field in which replicable controlled experimental studies are rare and the focus is on subjective human experience. SoTL research relies heavily on qualitative methods, such as reflection and narrative inquiry. This means that STEM scholars undertaking SoTL research must draw on unfamiliar language, tools, and concepts to a far greater extent than those in disciplines like sociology, which share with SoTL a body of theory and a broad range of qualitative methodologies (Howery, 2002). When "focus groups, surveys and scoring rubrics are as unfamiliar to chemists as titrations, distillations and spectrograms are to sociologists" (Coppola & Jacobs, 2002, p. 206), the qualitative methods of non-positivist inquiry are strange tools indeed. STEM academics are left with the paradox that, compared with colleagues in other disciplines, they might be least familiar with qualitative research conventions, and yet have the greatest need for them when interrogating their own teaching and learning processes.

At the time of this study, SN and NK were both part of the Curriculum Scholars Development Program, a SoTL program hosted by the University of British Columbia's Centre for Teaching, Learning, and Technology. They came to realize that the gap between the epistemology, methodology, and language of SoTL and their training as STEM practitioners made SoTL research more challenging than is often presented. They set out to more fully understand these challenges. While making no claims of generalizability, their hope was that by interrogating their own journey from STEM to SoTL they might provide a starting point for discussion with other STEM scholars walking the same path.

Methodology

I, CO, am a social worker with experience in facilitation and qualitative research. It was this experience which led a mutual colleague to introduce me to SN and NK, prompting my subsequent invitation to facilitate, record, analyze, and write about their reflections. SN and NK discussed their experiences over a period of six months in four joint reflective sessions lasting approximately two hours each. I attended the reflective sessions and made written notes of my observations and audio-recordings, which were later professionally transcribed. SN and NK continued their reflections on a private blog where they posted 12 times. Reflection and blogging constitute key SoTL techniques (Gelter, 2003; Kreber, 2006; Yang, 2009) and were particularly helpful in this study because they enabled SN and NK to articulate their experience of engagement with non-positivist SoTL research methods, even as they enacted that very engagement. This provided two levels of data. SN and NK discussed challenges with using non-positivist methods and this was captured in the written data from both the interview transcripts and the blog postings. They also demonstrated, and sometimes surmounted, those challenges through their engagement in the reflective processes of the study. Their thoughts on the strategies they were using to engage in the study's processes and my written observations of those strategies became a second level of data.

I approached the study from a symbolic interactionist perspective, acknowledging my own partiality and the intersubjectivity of the research process (Blumer, 1986). I saw each of our social and disciplinary group memberships as important factors influencing how we make sense of our worlds (Shibutani, 1955). My focus, however, was on how NK and SN made meaning and how they interpreted and engaged with the epistemological and methodological questions they faced. To keep the focus on the experiences of NK and SN, I endeavoured to interrogate and limit my own influence. I declined the invitation to contribute my own reflections about non-positivist qualitative inquiry until the conclusion of the study, and I encouraged SN and NK to make all decisions as to how the study should proceed.

With no "insider" knowledge of either SoTL or STEM, I began as a "curious inquirer" (Thorne, 2008). I started the first session using a semi-structured interview approach. This session, however, quickly became a free-flowing conversation between SN and NK, who thereafter took over the process of prompting each other to reflect more deeply, to explain themselves more fully, and to be curious about where their differences lay. Aware that joint interviews can tend toward a consensual construction of the truth that obscures individual experience (Seale, Charteris-Black, Dumelow, Locock, & Ziebland, 2008), I sometimes intervened to invite exploration and clarification of differences in perspective. I kept a journal, not as data but to reflect on my role, assumptions, and analysis. My disciplinary positioning as a social worker made me attuned to the change processes and emotional aspects of SN and NK's journey, and I was especially careful to interrogate the extent to which my perceptions of these processes and aspects were grounded in SN and NK's experiences.

I used a qualitative description approach to data analysis (Sandelowski, 2000). Qualitative description is a means of naturalistic inquiry (Lincoln & Guba, 1985) that produces a description of the main features of an event or phenomenon. It allowed me to stay close to the words and experiential knowledge expressed by SN and NK because it

> is not highly interpretive in the sense that a researcher deliberately chooses to describe an event *in terms of* a conceptual, philosophical, or other highly abstract framework or system. The description in qualitative descriptive studies entails the presentation of the facts of the case in everyday language (Sandelowski, 2000, p. 336)

First, I organized the data into broad groupings capturing recurring ideas like "culture," "emotions," and "complexity." I then examined the relationships between and within groupings, paying particular attention to chronology. I identified seven themes relating to SN and NK's engagement with SoTL. My goal was for these themes to provide an accurate accounting of the discussions and the meanings given to these discussions (Maxwell, 1992) by SN and NK. SN and NK reflected together in a series of private discussions on the initial thematic analysis. We then met for a final session, also audio-recorded and transcribed, in which SN and NK discussed the themes they felt most closely described their experience and might be most useful to other STEM academics engaging with SoTL. Some themes relating to the nature of the differences between STEM and SoTL have previously been discussed (Kelly, Nesbit, & Oliver, 2012). In this article we focus on others that pertain to the processes facilitating SN and NK's increasing comfort with non-positivist qualitative research.

Recognizing the Extent of the Shift

The first of these helpful processes was recognizing the full extent of the intellectual shift in which NK and SN engaged. They had begun with the belief that doing SoTL research would be a relatively simple matter of learning new skills, becoming versed in new qualitative methodologies, and exploring new literature. They were confident in their capacity to perform these tasks and excited about the interdisciplinary collaboration and intellectual challenge necessitated by SoTL's requirement to work "at the borders of disciplinary imagination" (Huber & Morreale, 2002, p. 2). Indeed, the SoTL literature itself supported the idea that engaging with this new approach to research was a manageable cognitive task that could be achieved with the guidance of mentors (Hubball, Clarke, & Poole, 2010), adequate faculty development resources (Donnelli, Dailey-Hebert, & Mandernach, 2010), and an appropriate reward system (Walker, Baepler, & Cohen, 2008). SN and NK had had little discussion of the need for, and implications of, a new epistemology.

NK and SN's efforts to rationalize this as a simple process, however, were undermined by their tendency to describe the intellectual culture of SoTL as something far removed from their usual way of thinking. They repeatedly implied the magnitude of the transition they felt they needed to make by "othering" non-STEM culture. They stereotyped non-STEM researchers as inductive thinkers who were naturally comfortable with uncertainty and had little need for prediction. They even described STEM and non-STEM scholars as being physiologically different, due to what they characterized as "the physical fact of constructivism, the dendritic structures that grow in your brain as you think" (SN). Many of NK and SN's comments about SoTL were prefaced with "I don't know but" and other declarations of ignorance and uncertainty. These appeared not to reflect their lack of substantive knowledge of SoTL research approaches, but rather their experience of the difficulty of incorporating these approaches into their ways of viewing the world.

SN and NK's conclusions about the nature of the gap between STEM and SoTL are described in more detail elsewhere (Kelly et al., 2012). Their attempts to define their transition from STEM to SoTL reflected their increasing recognition that they were undertaking a significant transition. They started out thinking that they were simply moving "from a quantitative to a qualitative perspective" (NK). This was the title of their blog, in which their first post was comprised of definitions of quantitative and qualitative methodologies. Yet they quickly concluded that the process could not be so neatly defined. Some sciences employ qualitative methods and the arts and humanities work with numbers. The distinction between disciplines that measure and those that use narrative is not absolute. Their journey was not a matter of simply adopting a new

methodological stance. The discussion broadened to consider whether they were moving from positivist to constructivist epistemologies:

> We talked about how qualitative and quantitative research methods can overlap and augment and complement one another . . . does that mean we're talking about epistemological beliefs, how . . . people construct those beliefs—it's not that we're either one or the other, that they're mutually exclusive beliefs, it's that we're on a continuum, or maybe that's also not the right way to describe it? (SN)

It broadened further as SN and NK questioned whether they were moving from the culture of one intellectual discipline to another:

> I see this as a . . . more social sciences way of approaching something . . . it's a more humanities way of approaching thinking as opposed to a scientific way of thinking. So quantitative and qualitative are just two terms and there's also humanities and science. (NK)

Even these disciplinary distinctions did not fully reflect their feeling that they were moving toward a new way of viewing the world that extended beyond their professional identities as STEM academics. They were moving from a perspective that emphasizes cause and effect thinking, deduction, and the quest for proof and certainty to a "world view that has a deep understanding of complexity and messiness" (SN). In place of STEM's "imperative of proof," they found themselves needing an "imperative of understanding" (Regehr, 2010) that elevates contextualized description over generalization and causal explanation. They needed an inductive and abductive approach to inquiry rather than a deductive approach. Fully engaging with SoTL research into the shifting and idiosyncratic domain of teaching and learning experiences only seemed possible once they adopted a worldview that emphasized complexity, uncertainty, and subjectivity.

The repercussions of adopting this new worldview were not limited to academic life. They both started reading novels as they came to a new appreciation of narrative. They described their STEM colleagues responding to narrative with "it's nice to hear your story. But you know really, I don't want to hear it. I just want to get to the bullet points" (SN). As they came to a new understanding of the value of narrative in conveying complex ideas and emotions, they could let go of the reductionist urge to "get to the point." As NK commented, "this is offering me a way to not only embrace something new within my job but my job's offering me a way to embrace a new way of looking at the world" (NK). Fully acknowledging the extent of the distance between their traditional way of thinking and the non-positivist perspective inherent to SoTL research was an important first step in clarifying why the journey seemed so hard. It allowed both SN and NK to accept that the process would take time, and enabled them to engage with it differently.

Acknowledging the Emotional Impact

The process of engaging with SoTL research had an emotional impact. It was exciting and frustrating, liberating and alienating. SN and NK described their insights into their growth as reflective scholars with words like "epiphany" and "revelation." They both talked spontaneously of the joy of embracing a new way of looking at the world:

> The joy that I'm experiencing is that I feel that it's like looking at Google Earth and only looking at your street for thirty years and then, all of a sudden, toggling out and thinking

> "wow here's another way of telling that" and "oh I can see this is where what I've been thinking about fits, but it fits in within this whole other way of the world working." (SN)

It was liberating to let go of the idea of securing the one "correct" answer and to see knowledge as an ongoing, incomplete, and creative process of meaning-making:

> The joy that I'm having in beginning to try and understand my anxieties in this is that . . . it's allowing me to have uncertainty, to accept that I can't wrap it all up, so I'm not looking to fit it in to everything, I'm looking for a place where I can say: I am transitioning and it is ok that I feel anxious transitioning. (NK)

Nevertheless, entering into the qualitative research world also elicited anxiety and frustration. It involved temporarily relinquishing the familiar position of academic expert. This troubled their very identity as academics because "you accept that you are ignorant, you have to . . . you must and so there is a discomfort in that, and how you sort of define yourself, if you're not an expert what the hell are you?" (SN). The process was frequently characterized as a "struggle," in which reverting to more deterministic reasoning was felt to be a failing:

> I acknowledge the value of this other perspective . . . I admire it greatly, I can see that I lack understanding in it and yet I just haven't been able to go there, I really don't think I've been able to go there, I think when I get confused about something I revert to my cause and effect way. (SN)

Both SN and NK expressed feeling caught between a positivist STEM and a non-positivist SoTL approach to research. It seemed that engaging with one implied rejecting the other: "I feel that all the time like either I'm belittling one way of thinking or the other" (SN). Both saw themselves as naturally predisposed to the complex thinking and interdisciplinarity inherent to SoTL. They had both taken non-traditional routes into the sciences, detouring through interests in philosophy, history, and salmon fishing. They characterized themselves as "lone wolves" within their disciplines, tending to challenge disciplinary norms and to be somewhat more open to alternative approaches than their STEM colleagues. Despite this openness, they frequently displayed ambivalence toward non-positivist qualitative approaches. They mocked themselves for being "hokey" (SN) and engaging in the "navel-gazing" (NK) of reflection, and they voiced scepticism about the value of their narrative. While they acknowledged the importance of storytelling, they told few stories and appeared most comfortable theorizing and debating because "we were just trained entirely that all our intellectualism is in our head" (NK).

Acknowledging the emotional dimension of the transition helped because as NK said, "we're trying to say there is a normalcy in this and, it's sort of like grieving, when people say 'it's normal that you're angry first and then . . .' because then it gives you relief." This acknowledgement put NK and SN in a position to pay attention to their emotional needs and reduced their frustration at not quickly mastering what they had initially characterized as the simple intellectual exercise of adding qualitative methods to their research repertoire.

Finding the Right Metaphor

Both SN and NK made a significant move forward toward embracing non-positivist qualitative research when they found metaphors that enabled them to incorporate their understanding of SoTL research into a familiar conceptual framework, tap into personal goals, and access pre-existing strategies for managing transition and uncertainty. While they used different metaphors,

the effect was the same. NK's metaphor was drawn from personal experiences outside academia, while SN's was firmly rooted in her academic discipline.

The right metaphor for NK was one of crossing cultures. Engaging with SoTL research entailed moving from the culture of science to a complexity-based humanities culture. Although this metaphor reproduced a dualistic understanding of science and the humanities, it also provided a means to reconcile the two. It meant that NK did not need to disavow a culture of science, but rather to become sufficiently fluent in the humanities culture to function effectively within it. It meant learning a new language and coming to understand the customs and practices of a different intellectual community. This was a familiar experience for NK who, several years previously, had emigrated from Ireland to Canada: "I left behind everything I knew about one culture, put everything I owned into two suitcases, hopped on a plane . . . like a complete new beginning" (NK). She had retained her Irish identity even as she learnt to operate within Canadian culture and developed a new identity as an Irish-Canadian. The process of identity development and the emotions evoked were similar to those experienced in her "journey" to SoTL, bringing great opportunity, exciting intellectual growth, and considerable discomfort:

> Now I'm moved into another language that embraces different ways of thinking, like it embraces the thing of uncertainty, it doesn't look for proof and so it's allowing me to reason about knowledge in different ways and so for me that's what I'm calling an acculturation . . . like if I had stayed in Ireland there were thoughts I would never have had because I wasn't exposed to certain things. (NK)

Both moves had been complicated by a lack of acknowledgement of the differences between the cultures between which she was transitioning:

> Around culture shifts there's anxiety because there's an unawareness that that's what you're doing. A lot of this would come for myself when I came from Ireland to North America because they both look the same and they both speak English and you're not aware. And so there's anxiety that comes from an awareness that you don't know the rules of the game you've landed in and I think the anxiety becomes because you didn't realize you were changing games, you didn't realize you were moving into a different environment. (NK)

NK described herself as being at a stage in her personal and professional development where she wanted to be challenged to think in new ways. Envisaging engagement with SoTL as travelling into a new culture allowed her to experience the kind of radical change she sought. Most importantly, it enabled her to draw on the same strategies she had employed during her previous experience of cultural transition. The process demanded patience and time:

> If you accept that it's an acculturation then it isn't learning a bag of tricks, then it isn't somebody just sitting down and doing it, then it isn't procrastination or whatever else you want to say because acculturation by its process means that when you join another culture you have to sort of learn from it, it's iterative, you have to sort of listen, learn, practice, give back, listen, learn. You never leave behind the other but you're continually learning. (NK)

In contrast, SN imagined SoTL research fitting into the conceptual framework of the science culture in which she was already engaged. Having studied the ideas of complexity science as they relate to sustainability engineering, she envisaged SoTL as an additional subsystem of knowledge within the complex framework of nested intellectual systems described by complexity scientists

(Kay, 2008). Basic science, engineering science, and qualitative SoTL research were just three of many systems of knowledge necessary to understand a complex world:

> If I can understand complexity as it relates to bio-physical systems, ecology and so on, then I'll be able to understand complexity as it applies to human systems . . . I'm coming to the same conclusion if you want as the humanities research people would, but not by embracing the culture of the humanities, rather from just expanding my understanding of the culture of science. (SN)

Complexity science and the perspective of the social sciences and humanities "just naturally come together and it's at this level of complexity" (SN). This metaphor allowed SN to connect engagement with SoTL research to her broader personal and professional goals. In contrast to NK's quest for change, she was at a point in her career when she sought to consolidate her learning in the complex science field. SN's metaphor enabled her to reframe unfamiliar SoTL approaches as familiar:

> There's a remarkable similarity in the methodologies really . . . they're collaborative, they're situational, they're only good for the particular and there's a lot of flexibility but over time you gain almost intuitive knowledge about how to apply it. (SN)

SN could navigate SoTL by drawing on language and strategies used in engineering to manage overlapping human and ecological systems: collaborating, goal-setting, accepting the idiosyncrasies of systems, and working with "fuzzy boundaries" and uncertainty. Once she had attached SoTL to a familiar cognitive framework, it became far more manageable:

> How do you start managing an ecosystem? . . . they were describing the same process with respect to curriculum, to managing human systems. That was amazing to me and there are similar analogies throughout both processes in terms of how you, if you want to control, I don't even like to use the word manage, but in some way monitor, so that you know positive things are happening and have interventions at hand that will . . . sort of shift the system in a positive direction. (SN)

For both SN and NK, the chosen metaphors were expansive and integrative, enabling them to reconcile their familiar ways of thinking with the unfamiliar conventions of non-positivist qualitative research.

Connecting Safely

SN and NK described all their important insights as being prompted by interaction with others. Whether it was discussing insights with colleagues, listening to invited speakers, or engaging with the thoughts of others through books and media, social interaction was a significant part of the journey to make sense of and adapt to this new research perspective. Connections with others provided much needed methodological expertise and interpretation of SoTL language and culture. The metaphors adopted by SN and NK help explain their openness to collaborative learning. Acculturation comes from immersion into the new culture and through interaction with others within the new culture who can take the role of "trans-contextual mentor and boundary-crossing guide" (Walker & Nocon, 2007, p. 189). In complexity science, experts in one subsystem need to collaborate with others to reach an understanding of the workings of the system at a larger scale (Kay, 2008). For this reason SN and NK both saw connection with mentors and a community of practice (Wenger, 2000) as essential to their development as SoTL researchers.

Connecting with others was not only important for the generation of new ideas and transmission of expertise. For NK and SN, it enabled them to "peel the layers of the onion" (NK) of their own thinking, to reflect deeply, and to integrate their new understandings. The blog and reflective sessions demonstrated this process, as new insights came from challenging each other's ideas:

> It's not about winning, it's about understanding and it's about if you take oppositional positions you will go deeper . . . because you'll defend your position and in defending your position you will try to understand your position more and so both of you learn . . . the end goal is not to win but to delve deeper. (NK)

The blog and reflection sessions enabled them to examine and revise their ideas. They provided:

> [A] fantastic venue for critical analysis because I like the fact that you come back and say "that wasn't what I was saying, so there's an ability to state something, have somebody examine it and interpret it and for you to realize that it didn't come across in the way you felt it or thought it and so now you have to respond to the other so you have to explain yourself more. (NK)

The idea that they were connecting to a broader social and intellectual movement also appeared helpful. Both SN and NK talked of participating in a cultural change, from determinism to complexity, which would accelerate and expand over the coming decades. This motivated them to engage with non-positivist research processes and to describe the challenges in doing so, in order to inform those who might follow.

The process of connecting with others was balanced by a need to manage the vulnerability engendered by engagement with an academic realm that was unfamiliar and emphasized subjective experience. The attention paid in SoTL to personal reflection, narrative, and bringing teaching challenges "out of the closet" to become "community property" (Shulman, 2011, p. 2) was threatening to STEM academics trained to be invisible and objective. Storytelling involved an unfamiliar and uncomfortable level of self-exposure; by definition it demanded personal involvement, public scrutiny, and little control over the meaning made by the audience. SN and NK struggled to tell stories about the challenges they faced and often retreated to the more familiar intellectual mode of theorizing and debate. Their STEM training had ill prepared them for personal narrative:

> It was beaten into us from graduate students when you had to write a paper you would always use the third person, you were never allowed to use the first person in writing about science, so science is not about the personal at all, in fact you must get rid of it. (NK)

Both NK and SN found strategies to safely make themselves more visible. They chose to reflect on their emergent ideas with people with whom they shared trust, common experiences, and a sense of intellectual parity. They were explicit that their goal with each other was not to engage in the rhetoric of adversarial academic discourse. Even so, there were times when they chose to defer spontaneous discussion of certain topics to their blog. In doing so, they gave themselves the time and space they needed to formulate their ideas on challenging issues.

The blog became a focal point for the tension between their wish to engage with others and their wish to protect their privacy and manage their vulnerability. They discussed running both a public and a private blog to manage this tension and deferred requests from others to join the blog because it was, in NK's words:

> [A] place I can openly vulnerably and honestly struggle with something I'm genuinely struggling with, with somebody who I've established a trusting and intellectually equal relationship and so the struggle is . . . like any other relationship there has to be trust and there has to be a place that you can be vulnerable in because that's how you both grow. (NK)

At times there appeared to be tension between the urge to seek the advice of others and to listen to their intuitive knowledge and trust their own experience. Several times they discussed seeking information from a cross-cultural expert who might give them information about the process of crossing cultures. This embodied their orientation toward collaborative learning, but also suggests a strategy of managing vulnerability by seeking certainty in an expert's answer. This strategy had the potential to distract from their expertise and inhibit the highly situational lessons to be learned from engaging with SoTL practice.

Discussion: A Pragmatist Middle Ground?

Having achieved a level of comfort with the methods and claims of the non-positivist qualitative research represented by this study, NK and SN now wish to more explicitly address the question of how they locate themselves epistemologically. Positivism occupies such a hegemonic position that its paradigmatic features are largely taken for granted by those operating within it (Guba & Lincoln, 1994). There had been little need for NK and SN to interrogate epistemology in their STEM work. It is only now that they have actively engaged with, and reflected on, non-positivist qualitative research that they feel ready to define in a meaningful way where they stand in their approach to knowledge. For this reason their epistemological position has to date been identified only as "non-positivist." However, in ongoing post-study discussions SN and NK have talked of an intuitive attraction to pragmatist ideas and it was my observation that despite having no knowledge of pragmatist epistemology during the study, their conduct throughout was highly congruent with a pragmatic approach.

During the study, the term *epistemology* was one of several trigger words that tended to derail discussion. SN used the term to convey her understanding of different approaches to knowledge and learning, while NK found it problematic because it implied a shared understanding about their approach to knowledge that she felt had not yet been established. "Epistemology? Episiotomy!" (NK) became the cry to signify a desire to avoid the use of linguistic shorthand to describe issues that needed more thorough exploration and discussion. SN and NK's introduction to SoTL methodologies included some discussion of constructivism, but they found this unhelpful because the ideas fit so poorly with their STEM ways of thinking (Kelly et al., 2012).

This meant that NK and SN began the study with no clearly defined epistemological commitment to replace the positivism they found so ill-suited to SoTL inquiry. Yet the qualitative literature is replete with warnings that "no inquirer . . . ought to go about the business of inquiry without being clear about just what paradigm informs and guides his or her approach" (Guba & Lincoln, 1994, p. 116). Qualitative scholars have long paid attention to epistemological paradigms on the basis that they dictate the ways in which data should be managed, research relationships conducted, and truth and credibility defined (Guba & Lincoln, 2005). Without a clear understanding of these issues, it is easy for researchers to get stuck in a methodological "quagmire" (O'Connor, 2001). Lacking an epistemological framework and pre-existing plan to address these design issues, SN and NK were faced with resolving them as they arose during the study. They found themselves negotiating, far later than is typical in much non-positivist qualitative research, how an emerging commitment to perspectival knowledge affected issues like

the accuracy of data transcription and analysis, the management of conflicting views, and "voicing" the research.

It is for this reason that pragmatism might be a useful epistemological perspective for positivists transitioning to non-positivist research. Pragmatism is a philosophical tradition founded in the 1870s by Charles Sanders Peirce (Ketner, 1992) and developed in the ideas of John Dewey (1920/2004), William James (1907), and Herbert Mead (1934). While a full description of its many different forms can be found elsewhere (see Haack & Lane, 2006), its utility lies in the paradox that although it is itself a philosophical position, it is not one that requires researchers to sign up to a particular ontological and epistemological commitment before engaging in inquiry. This is because it is only in the context of action that abstract ideas about what is real and true assume meaning (Ketner, 1992).

Pragmatists start with their research question and adopt whatever perspectives and tools appear most helpful to tackle it. Questions of truth and strategies of inquiry are negotiated with respect to their practical consequences and their "workability" (Dewey, 1929) in resolving practical problems. Researchers cannot avoid engaging with philosophical issues, but pragmatism allows them to do so on a "need to know" basis. For SN and NK, engaging with non-positivist thinking has been a process that has taken time, active reflection, and experiential learning over the course of the study. They shifted epistemological ground as they found positivism's idea of one correct answer increasingly problematic. However, they did not name this as an epistemological shift or engage in abstract philosophical debate as to the meaning of their new understanding. It was only when it had a practical impact on the study, for instance when deciding how to manage differing perspectives, that they had to take the next step to interrogate the implications of their new position. James (1907/1995) said, "the pragmatic method is primarily a method of settling the metaphysical disputes that otherwise might be interminable" (p. 18). This means that researchers who have yet to fully engage with philosophical systems can get on with the business of non-positivist qualitative research because "the test of ideas, of thinking generally, is found in the consequences of the acts to which the ideas lead, that is in the new arrangement of things which are brought into existence" (Dewey, 1929, p. 136). By narrowing the question from "what is true?" to "what is true for this study, this question, and this situation?" the transition from positivism can be taken one very practical step at a time.

In pragmatist philosophy the world is complex, shifting, and all truths are partial and fallible because they are refracted through language, context (including disciplinary context), and individual meaning-making (Ketner, 1992). This means that researchers must negotiate the shared understandings on which joint action is built, attending to the ways in which their "lines of action" (Blumer, 1986) intersect. A guiding pragmatic question is "to what extent are two people (or two research fields) satisfied that they understand each other, and to what extent can they demonstrate the success of that shared meaning by working together on common projects?" (Morgan, 2007, p. 67). These shared understandings, however, are not merely the product of negotiation but must be tested empirically or "scientifically" (Mead, 1917). Pragmatist inquiry proceeds via an abductive cycle in which the researcher makes inductive inferences that are built on previous knowledge and then tested for correspondence to the way things "really" work. The inferences are judged by the extent to which they are supported by existing evidence, fit with well-founded supporting beliefs, and predict future lines of action (Haack, 2000). Although they did not name them as such at the time, SN and NK expressed pragmatist principles not only in their reflections about how to engage with qualitative research but also in their design decisions during the study. These decisions were consistently based on the desire to be useful to other STEM scholars engaging with SoTL, to honour complexity while remaining faithful to a sense of what was "real," and to maintain their collaborative working relationship.

Pragmatism has the potential to dissolve many of the dualisms (positivism and constructivism; deduction and induction; theory and practice) common to qualitative research discourse. Peirce himself saw pragmatism as a means to synthesize science and philosophy (Rorty, 1966). It enables communication amongst researchers of different paradigms because "it offers an immediate and useful middle position philosophically and methodologically; it offers a practical and outcome-oriented method of inquiry that is based on action and leads, iteratively, to further action" (Johnson & Onwuegbuzie, 2004, p. 17). It removes the need to engage in discussion of the relative merits of unfamiliar epistemological and ontological positions as a precondition of inquiry. It provides criteria for research design decisions that honour complexity and the need to capture ever-changing, ambiguous constructed realities, while maintaining a commitment to the empirical testing and practical application typical of STEM disciplines. It supports both qualitative methodology and the quantitative methods more familiar to STEM scholars (Onwuegbuzie & Leech, 2005; Tashakkori & Teddlie, 2003). In our study it may represent a natural bridging framework for the transition into non-positivist research.

Conclusion: Dissolving Dualisms

As a growing number of STEM scholars find reasons to embrace non-positivist qualitative methodology, the experiences of SN and NK suggest that they face no easy task. Challenging disciplinary norms and deeply engrained ways of seeing the world is an uncomfortable process that takes time. For NK and SN, acknowledging the extent and nature of the transition, with its attendant social and emotional dimensions, proved helpful. They needed to connect with others, who served as collaborators, sounding boards, mentors, and guides. Balanced with this, however, was the need to manage the very real sense of vulnerability that came with stepping out from behind the STEM researcher's bench and speaking in the first person from their own subjective experiences.

It was when they each found a way to link their new knowledge of qualitative research to a familiar conceptual framework and reconcile STEM and SoTL perspectives that they were able to move forward. SN and NK found metaphors that allowed them to acknowledge the value and limitations of each approach, and that did not require them to choose one over another. A traditional positivist approach remained the preferred means to address certain discrete problems. It organized amorphous knowledge into manageable frameworks. Its precise measurements and controlled experiments had the potential to produce counter-intuitive results, challenge received wisdom, and inspire creativity. STEM provided the language and predictive certainty often needed for discourse and action. However, non-positivist approaches were more applicable for research into some of the more complex aspects of human experience:

> The normal way I've come to understand the world is nested within a much larger way of understanding the world that is necessarily messy. There are times when I can dig into this grab bag if the problem is sufficiently contained, but there are also times when I can't really use this toolset and there's another set of tools that you have to become familiar with. (SN)

NK and SN were able first to sidestep and then to dissolve the philosophical and methodological dualisms that troubled them by focusing on complexity and useful, collaborative action. As they did so, they articulated ideas and made research design decisions that were highly congruent with a pragmatist perspective. This allowed them to move iteratively between the familiar STEM approach and a different way of thinking. Once they found they could operate in the world of non-positivist qualitative research without losing their STEM identities, two self-identified positivists became more able to incorporate non-positivist qualitative methodology into their research repertoire.

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