The role of epistemic empathy in teachers' learning and responsiveness to students' experiences in science

Abstract

This study traces the learning journey on one preservice teacher, Keith, who after having expressed strong skepticism about student-centered responsive teaching at the beginning of an early teacher education course, came to value this approach and took it up in his instruction. The analysis traces the shift in Keith's views on teaching and identifies key epistemological and affective dynamics that supported his learning. Central to Keith's learning, the findings show, was his developing awareness of his own disciplinary epistemology and affect as a science learner in tandem with noticing similar epistemic and affective beginnings in K-12 student inquiry. The analysis makes salient the role of epistemic empathy—the capacity for tuning into and valuing someone's thoughts and emotions in constructing, communicating, and critiquing knowledge— in helping Keith connect with K-12 students' experiences. I show how Keith channeled his own experiences and joys in physics as a way to empathize with and appreciate students' work in the science classroom, and, in turn, reframe his views on teaching. The study contributes empirical and theoretical insights on teacher learning and offers design implications for teacher education to cultivate epistemic empathy as a resource for responsive teaching.

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1. Problem

Within science education, there is increasing interest in exposing students to science not only as a body of knowledge but most importantly as a way of thinking, acting, and talking (National Research Council, 2012). This vision for science learning requires a re-examination of the role that teachers play in the classroom. It entails centering instruction around learners' questions, curiosities, and ideas where the teacher closely attends to students' contributions and adjusts instruction accordingly, an approach often referred to as r*esponsive teaching* (Maskiewicz & Winters, 2012; Robertson, Scherr, & Hammer, 2016; Thompson et al., 2016).

Responsive teaching centers on attending to and eliciting student thinking, recognizing the "disciplinary opportunities" (Robertson et al, 2016, p. 42) within that thinking, and leveraging these opportunities to support learners' epistemic pursuits and agency. As such, responsive teachers listen closely to the meanings in students' ideas and questions and adapt their instruction accordingly (Ball, 1993; Hammer, 1997; Hammer, Goldberg, & Fargason, 2012). In these ways, responsive teaching shifts "the emphasis away from teacher as knowledge provider – and toward students as agents of their own learning" (Robertson & Richards, 2017, p. 318).

A number of studies show that by leveraging learners' varied resources, responsive teaching can engender more inclusive participation (Rosebery, Ogonowski, DiSchino, & Warren, 2010; Windschitl & Calabrese Barton, 2016) and foster rigorous disciplinary learning (Richards & Robertson, 2016; Thompson et al., 2016). However, responsive teaching is not yet the norm in science classrooms and research documents various challenges that may be in the way of teachers embracing and enacting responsive teaching. For instance, teachers may be hesitant to implement responsive teaching, worrying that it may lead into uncharted terrains and away from lesson objectives (Radoff, Robertson, Fargason, & Goldberg, 2018).

Such challenges highlight the need for continued research that examines ways to support teachers to take on responsive teaching in their instruction (Kang & Anderson, 2015). This study is a response to this need with its primary goal to examine how one preservice teacher (PT), Keith, came to value responsive teaching and took it up in his instruction after having initially expressed clear opposition to it at the beginning of an early teacher education course. The question guiding my inquiry is: *How did Keith come to develop a vision for responsive teaching during an early teacher education course and what supported his learning?* By analyzing Keith's learning, I aim to identify experiences that supported the shift in his stance towards responsive teaching, experiences that may more broadly inform the design of teacher education programs striving to foster teacher responsiveness.

2. Design

This qualitative exploratory study is situated in a course for preservice science and mathematics teachers in a teacher education program at a large public university. The course engaged PTs in various activities: analyzing K–12 student work in videos and transcripts; discussing articles on student thinking; exploring science and mathematics questions; and tutoring K-12 students with a focus on eliciting their thinking. I take a revelatory case-study approach (Yin, 2014) to examine the experiences of one PT, Keith, who at the time was a senior majoring in physics. I purposively select Keith because he initially expressed strong resistance towards responsive teaching but made a remarkable shift in his views. As such, his journey promises to illuminate rich insights about teachers' uptake of responsive teaching.

Myriad data were collected including video records of all classroom discussions, tutoring journals, reflections on videos of student inquiry, and weekly reflective slips. Using a constructivist grounded approach (Charmaz, 2006), I collaborated with another researcher to examine the data for evidence of Keith's views of science teaching and how they shifted over time. Our analysis converged around two salient dynamics in Keith's experiences as a science learner and novice science teacher that centrally shaped his teaching views: affective dynamics, related to feelings and emotions; and epistemological dynamics, related to ideas about knowledge and learning. Our analysis of affective and epistemological dynamics in Keith's learning generated working themes (Braun & Clarke, 2006) about key experiences that shaped Keith's views on learning and teaching science, highlighting *epistemic empathy* as central to Keith's learning as I discuss in the findings. While I present a more thorough and complete analysis in the full paper, here given the limited space, I illustrate the main findings using representative data excerpts and a figure (Fig1) that paint a picture of Keith's learning journey.

3. Findings

3.1 Developing a Vision for Responsive Teaching

When Keith initially joined the course, he advocated for a teacher-centered view of instruction, stressing the importance of "imparting" his knowledge to students. This view was informed by his conception of science learning as about acquiring the canonically established body of knowledge about the world. Watching videos of student inquiry from responsive classrooms at the beginning of the course, Keith expressed concerns about "leav[ing] students with the wrong ideas," noting "After all, even a thorough, engaging discussion can be detrimental if they all leave with the wrong ideas" (Video reflection—1/15).

Keith frequently used emphatic negative language in his initial posts on responsive teaching (e.g., "terrible mistakes", "detrimental", "horrible") portraying his strong apprehension. Concerned that student thinking may lead in non-canonical direction, Keith resisted the notion of letting students grapple with phenomena, insisting instead that "You need to show them the patterns" (Classroom discussion—2/2).

Nonetheless, midway through the course, Keith started to recognize the importance of students' active involvement and agency in shaping the lesson:

> lesson plans, which I have always assumed to be rigid things, must have in them a certain amount of flexibility, such that educators are able to adjust to what their students are thinking and take advantage of their inherent sense-making. (Reading reflection—3/9).

Keith continued to shift in his views on teaching, and towards the end of the course, he expressed a strikingly different view from his incoming one. He noted that he now sees his role as a teacher as about "being present", "willing to genuinely attend to a student, listen to his or her ideas, draw out their thinking, and help them develop their thoughts using what they already have, rather than going off of your own thinking", describing responsive teaching as "a very exciting position to be in" as a teacher (Tutoring Log—4/12).

3.2 Epistemic Empathy as a Driver for Responsive Teaching

How did Keith come to embrace this vision for responsive teaching? The analysis highlights that throughout the course, Keith had varied opportunities to cultivate his *epistemic empathy*—the capacity for tuning into and valuing someone's thoughts and emotions in the process of constructing, communicating, and critiquing knowledge. This empathy, I argue, prompted the shift in Keith's views on teaching and his understanding of his goals as a science teacher. I refer to Keith's empathy as *epistemic* to distinguish it from more general portrayals of empathy that

comprise, for instance, teachers' empathy with regards to familial, relational, and personal dynamics affecting students' lives (e.g., Dolby, 2012; Tettegah & Anderson, 2007; Warren, 2018). Epistemic empathy, in contrast, is specifically directed at and in service of learners' epistemic experiences—experiences aimed at the construction, communication, and refinement of knowledge (Author et al, 2018). Below, I identify two central experiences that cultivated Keith's epistemic empathy, and in turn, his uptake of responsive teaching.

3.2a Drawing on his own expanding relationship with science to connect with K-12 students. Throughout the course, Keith was encouraged to critically reflect on and interrogate his own experiences as a science learner and his motivation to pursue physics. In his final paper, Keith explained how his learning experiences in science have informed his initial views on teaching:

> Coming into this course, I held the belief that the most important factor in a student's education was how effectively the educator conveyed information: how well the instructor knew the material and could present it. This was all based off of my own personal experiences through school and college, which revolved around the notion of listening to the teacher… To me, the learning process was a transfer of information from the teacher to the student, and this is what my education has been based on for years.

As Keith reflected on his experiences, he started to notice a disconnect between K-12 and college courses: "when I got to college, and began taking genuine physics classes, much of what I learned in school did not translate well" (Reading reflection, 1/25). He added: "I don't recall ever really learning anything spectacular, or making any big revelations like I have in college"; "Understanding and intuition were merely implicit goals, second to achieving good grades."

Through this process of reflection, Keith problematized and expanded aspects of his relationship with science, including with regards to his views on and approaches to doing science (i.e., his epistemology) and the feelings and emotions he experiences within science (i.e., his affect). He became cognizant of the nascent epistemic feelings, and particularly the joys, that he derives from making sense of phenomena in science.

> the intuition I am beginning to develop in my field is of an intensely rewarding nature (addicting, some might say), and has completely overshadowed the more external rewards I once prized in high school (Reading reflection—3/26)

In turn, he started to perceive science learning as a deeply personal endeavor involving intuitions, feelings, and a drive to make sense of the world:

> I know from my own experiences that at the heart of it all lies a fundamental reasoning and sense that "clicks" on an immensely satisfying level. There is so much "sense" in physics that so many people tend to miss, and that is perhaps something that I through my efforts can bring out for more students and lead them down the path that I've come to love so dearly" (Reading reflection—4/2).

Keith's growing awareness of his own disciplinary epistemology and affect as a science learner helped him recognize the centrality of sense-making in science and the deeply satisfying feelings within it. He described his sense-making experiences in physics in a deeply affective tenor ("immensely satisfying"; "love so dearly"). This recognition motivated him to reorient his instructional efforts towards facilitating similar epistemic and affective experiences for his students. In other words, Keith started to channel his personal experiences with science, including his frustrations and joys, to connect with K-12 students in the classroom.

3.2b Interacting with K-12 students and seeing the merits in their inquiry.

Concurrent to his engagement in critical reflections on his science learning were Keith's

generative interactions with K-12 students, both in video-records of student inquiry and during tutoring. While at the beginning of the semester Keith expressed a number of concerns regarding student inquiry, interacting with students compelled Keith to question his incoming thoughts. Keith was pleasantly surprised by K-12 students' creative ways of making sense of phenomena and became intrigued by the rich ideas that they came up with and their keenness to understand. Reflecting on such interactions, Keith wrote: I know through my experiences that every single student I've worked with has some kind of productive beginnings in some way (Tutoring log, 3/26). He similarly noted, "you can almost 'see' the science in them in those moments" (Exit slip, 4/5). "Seeing the science" (Hammer & van Zee, 2006) in student inquiry, Keith started to orient to students' thinking with a fascination akin to that with which he orients to scientific phenomena, appreciating the beauty and coherence in their reasoning:

> how fascinating some students' ideas can be when left to their own reasoning. This has certainly shaped my view of "instruction", since I will be curious to see what ideas my students can come up with for reasoning about physical phenomena, and then trying to use their ideas for their advantage to shape how I respond (Exit slip, 3/1).

Keith's fascination with students' ideas inspired him to envision instruction that elicits and productively build on student thinking. Reflecting on his tutoring experiences, Keith noted:

> There are many times when, in the process of working with a student, a concept "clicks" for them, such that they can figure out many of the problems on their own by drawing from a deeper understanding. This happened two weeks or so ago, I believe, when I was working with a student... he would grin and say "I got it!" [...] and for a brief moment the student got a glimpse of some of the joys of the intuition and understanding that education brings, [...] a glimpse of the kinds of joys I myself experience in my own studies" (Tutoring log, 3/26)

In this excerpt, Keith explicitly relates his own motivations and drives as a physics learner, and in particular, the joys he derives from figuring things out, to K-12 students' experiences. Seeing nascent forms of these epistemic feelings in student inquiry, such as eagerness, enthusiasm, and tenacity to understand, motivated Keith to cultivate similar feelings in his future instruction.

In sum, as illustrated in Figure 1, when Keith initially joined the course, he advocated for a teacher-centered vision for instruction. Underlying this vision was a tacit conception of science learning as about acquiring the established body of knowledge about the world. This conception is premised on an understanding of knowledge as a "thing" to be transferred, which "calls to mind teaching as *providing* and learning as *acquiring* (Hammer, Elby, Scherr, & Redish, 2005, p. 116). In a sense, Keith felt responsible to impart scientific knowledge to students and minimize their confusion and misunderstandings. The shift in Keith's orientation to teaching was informed by a corresponding shift in how he oriented to science learning—from privileging knowledge acquisition to foregrounding meaning making and the development of personal connections with the discipline. This shift, I have argued, was facilitated through cultivating and tapping into epistemic empathy as a resource for connecting with and tuning to students' epistemic experiences. Such cultivation was not merely epistemological; rather, it comprised affective dynamics that were central to Keith's experiences in science. It entailed Keith's developing awareness of his own disciplinary feelings in science, in tandem with his growing appreciation for and curiosity about K-12 students' ideas and feelings in science.

Seeing the value and productive beginnings in K-12 students' scientific explorations, Keith came to trust that grappling with uncertainty and experiencing the feelings inherent in disciplinary engagement are productive for student learning. As such, Keith shifted from feeling

anxious about engaging students in inquiry in responsive ways towards feeling excited about the potential in students' epistemic efforts. These realizations further stabilized the shift in Keith's understandings of his goals and priorities as a teacher, from one who "transfer[s] information to the student" to one who "bring[s] out" students' thinking and emotions (Tutoring log, 2/26) and cultivates their personal connections with the discipline.

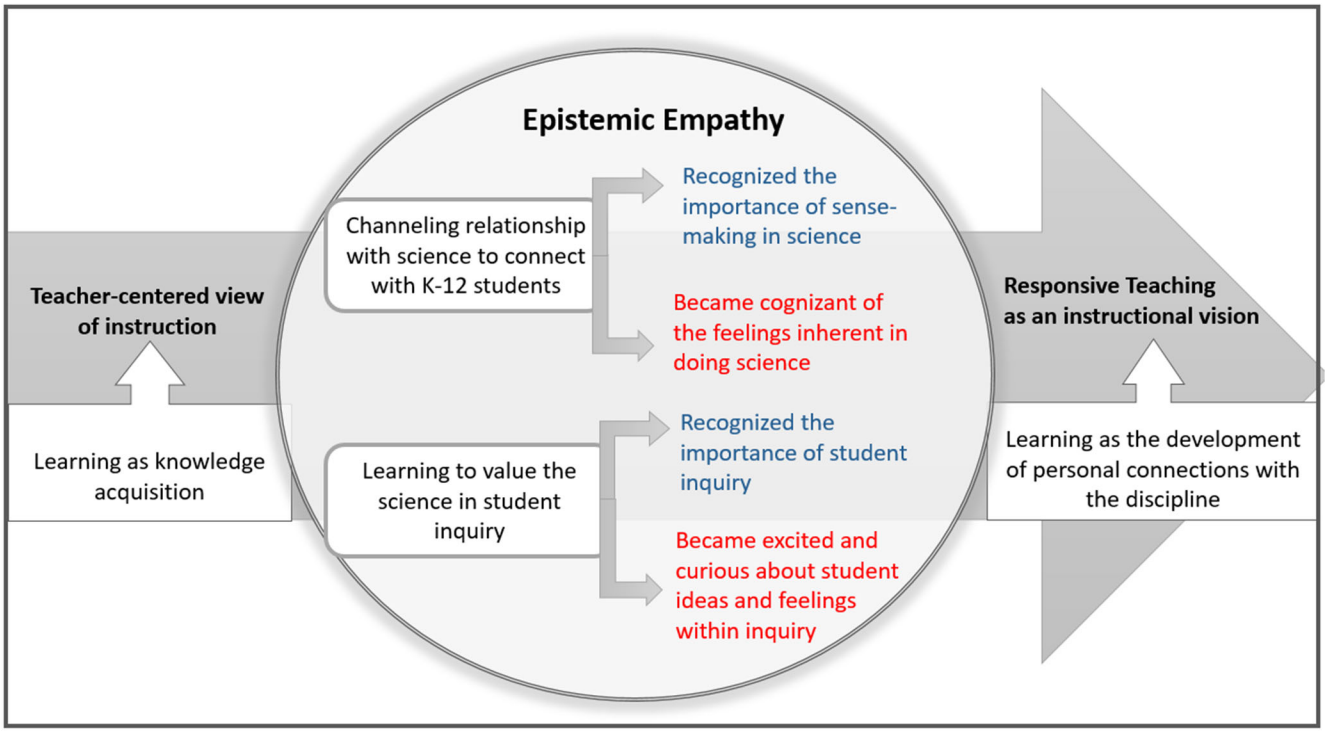

Figure 1. Epistemic empathy as a driver for the shift in Keith's views on teaching.

Contributions to Education Research and to the NARST Community

Keith's case study sheds light on an undertheorized aspect of teacher learning, that is, the importance of cultivating epistemic empathy as a resource for responsive teaching. While research documents that many teachers consider empathy as key to their teacher identity, most accounts conceptualize teacher empathy as occurring outside of, and separately from, students' *epistemic* endeavors (Author et al., 2018). Epistemic empathy, in contrast, allows teachers to tune into and appreciate their students' meaning-making experiences as they explore phenomena, and in turn positions teachers to become more responsive to students' epistemic experiences.

The findings of this study will be of interest to the NARST community as they hold implications for both teacher education and research. First, they depict the powerful ways in which one's understanding of and relationship with the discipline can be potentially recruited to cultivate epistemic empathy. The findings also show the centrality of affect in shaping one's relationship with the discipline and in turn one's epistemic empathy. Additionally, the study highlights the importance of educative experiences that target epistemic empathy as an aspect of teacher learning, including interacting with and analyzing rich instances of K-12 student work in science and inviting teachers to critically examine their own approaches to and assumptions about learning. Lastly, the findings also suggest the importance of creating opportunities within teacher education for teachers to experience science as an exciting pursuit of sense-making, opportunities that would allow teachers to cultivate their own personal and meaningful connections with the discipline and in turn better support their students to develop their own.

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