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Why Teach Science? Helping Teacher Candidates Frame Instructional Decision Making From Moral and Ethical Perspectives

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Objectives or Purposes

This qualitative research project's overarching goal was to explore ways to help primary grade teacher candidates (re)kindle a conception of teaching as a moral enterprise involving ethical choices and enactment of one's values. In the context of a science methods course in an elementary teacher credential program, we explored the research question: *What happens to the commitments toward science instruction of pre-service elementary teachers when we help them view science instruction as an act of caring?* Students explored Noddings' ethic of care (1984, 1992, 2002a, 2002b, 2010), worked to clarify their own understanding of the ethical terrain underlying instructional decision-making, and grappled with their various levels of commitments to science instruction.

Researchers have repeatedly found that people pursue teaching careers for reasons associated with the moral dimension of the work (Goldstein, 2000; Lickona, 2009; Sanger & Osguthorpe, 2015). Early in their programs, candidates recognize their roles as models of moral and ethical behavior, explaining their decision to become teachers in these terms (see, for example, Authors, XXXX; Goldstein, 2000; Sanger & Osguthorpe, 2015). Interestingly, however, research shows that by the end of their programs, most candidates have not explicitly explored the values they will inevitably bring with them into their classrooms – examined or not – and how those values intersect with their professionalism, nor have they gained a sophisticated moral language that might allow them to develop further as they gain experience in the classroom. Worse, in their brief sojourns in teacher prep programs, many candidates seem to replace their own intuitive understanding of the moral nature of teaching with a narrow instrumentalist view of the work. As Sanger and Osguthorpe (2015) suggest, not only do teacher educators routinely fail to help candidates incorporate deep moral and ethical values into their professionalism, we seem actively to teach the inclination out of them.

We chose science instruction as a focus area for several reasons, including that many elementary teachers hold negative views about science (e.g. Tosun, 2000), and maintain low self-efficacy about their ability to teach science, which often results in diminished instructional time in science (Fitchett & Heafner, 2010; Marx & Harris, 2006). Centering our attention on science instruction opened the opportunity to push our students to explore the influences of such dispositions on their instructional choices, and on the ethical and moral implications of those choices, thus clearly casting professional decision-making in ethical and moral terms.

Perspectives or Theoretical Framework

While Noddings' conceptualization of an ethic of care has its roots in the philosophical tradition of existentialism (Bergman, 2004), she grounds caring in experience, and as such situates it within Dewey's natural pragmatism. Further, her recognition of the relational aspect of caring is aligned with Dewey's (1916) conception of democracy as a participatory method of living in relationship with others, as "a mode of associated living, of conjoint communicated experience" (p. 87). Mueller et al (2012) connect science instruction to ethics directly and highlights the importance of helping

teachers consider the influence of personal beliefs in their professional realms. Mueller (2009) writing that "youth must not merely travel between science classes; they should engage in the competency of how they should live in relation to others and ecosystems" (p. 1031) reframes the primary purpose of science instruction from the narrow view of science competency toward a much broader conception of science literacy underpinned by a larger goal: personal transformation and civic action. When teachers develop a view of science as connected to their students' well-being in the fullness of the manifold possibilities of their lives as individuals in society, not merely as academic performers, future workers, or other narrowly conceived ways of being, teaching science can become an act of caring as Noddings describes. Similarly, this view frames the act of taking on the responsibility of teaching science to all students, even though most will not become scientists, as an act of social justice (Barton, 2001).

Among the many possible subjects at the intersection of science and ethics, we chose to focus on issues of ecological sustainability for several reasons, including that it is increasingly seen as a critical human imperative centered on ethics (e.g. Bowers, 2001; Brundtland, 1987; Hawken, 2007; Orr, 2004, 2009; IPCC, 2007, 2014; Talloires, 1990). Further, Thayer-Bacon (1997) highlights relational aspects of the study of ecology and sustainability, as does Noddings (2010), Gruenewald (2003), and others.

Methods

Data were collected from a sample of convenience: 59 students enrolled in two sections of a semester-length elementary science methods course that was a required part of a post-baccalaureate elementary teaching credential program at a large Western state university and that had been modified to encourage students to explore connections between science instruction and an ethic of care. The classroom teaching experience of the participants was very low, although some had substitute teaching experience, a few worked as tutors, and about 20% of them were beginning their field placements as student teachers. Stated goals of the original course were to provide an overview of the K-8 state science framework, to explore critical issues surrounding the teaching of science in the public schools, and to assist candidates to develop the knowledge, skills and strategies to plan and implement high quality inquiry science curriculum based on their students' diverse learning needs. Course revision added a goal to foster exploration of the connection between science instruction in the elementary grades and an ethic of care as well as explore how science literacy relates to participatory democracy in the context of ecological sustainability. These additional goals were supported by: assigning out-of-class reading that explored the relationship between science instruction and care ethics; using targeted "quick-writes" at the beginning of instruction that focused on the relationship between science and care ethics as well as science and participatory democracy; incorporating discussions of care ethics, participatory democracy, and sustainability into class lectures and activities; modeling K-8 level inquiry-based lessons focused on sustainability; exploring sustainability, care ethics, and participatory democracy in several course assignments; and fostering class discussions centered explicitly on care ethics, teachers' ethical responsibilities related to science instruction, and the role of teacher dispositions as potential motivators to dedicate instructional time to science.

Data Sources

Data were collected from four sources. First, a survey instrument was developed to gather information regarding participants' views about science, their self-assessed level of science understanding, their comfort level teaching science to elementary grade students, their commitment to teach it, as well as to gauge their understanding of the relationship between science instruction and care ethics. The survey consisted of nine open-ended questions, two Likert-style questions, and two multiple-choice questions. The survey was administered at the time of first contact with the students in both sections of the course. Each administration took most participants about 20 minutes to complete. The survey was then administered a second time at the end of the semester in both courses. The second data source was a series of quick-writes in which students wrote ten-minute in-class responses to prompts, as well as similarly structured out-of-class brief writing assignments Third, the course instructor (Author 1) kept a teaching journal that included a descriptive account of each lesson, notes about discussions and interactions with individual students, and notes about class happenings that seemed related to care ethics, ethical responsibility, equity, sustainability, dispositions, motivation, commitment to teach science, and the like. Fourth, the course instructor recorded five brief (ten to 20 minutes) interviews with students after class, all of which were initiated by the students themselves. These interviews were centered on comments and insights expressed by the students during class. The five interviews were audio-recorded using a smart phone and later transcribed.

Analysis followed Creswell's (1998) guidelines for categorical aggregation, interpretation and generalization. Each artifact (e.g. a student quick-write, a homework assignment, a transcribed student interview) was read a minimum of four times by each researcher, with a minimum of two days between readings. Line by line coding was conducted using an unmarked copy of the text for each reading, with provisional codes applied to phrases, sentences, and segments of text that appeared to relate to connections between science, equity, sustainability, ethical responsibility to teach, and the like. These codes were developed during the reading of the artifacts themselves while simultaneously keeping information from the literature in mind, using a methodological process that Miles and Huberman (1994) describe as "partway between the a priori and inductive approach" (p. 61). After each artifact was coded four times by each researcher, the eight code lists that resulted were compared and an attempt was made to form a single internally consistent code list by revisiting each artifact once more, specifically to re-examine areas of differences. This code list was then examined to identify larger categories and to note emerging themes within these categories. Thus, each individual code was assigned to one or more category directly, without further examination of the data, and the resulting categories were then examined to identify underlying themes. In this way, codes were aggregated into categories, and categories were organized into themes. These themes were used to examine the data again in mind in order to make what Creswell (1998) refers to as "naturalistic generalizations."

Results

Our findings suggest that for many, this approach stood out as a clear illustration of how taking a moral stance and articulating an ethical position regarding educational issues might inform decision-making at the instructional level. In particular, deepening

our pre-service teachers' appreciation of the connection between science and ethics helped them consider science instruction from a perspective that for most of them appeared to be novel: science teaching as an ethical concern. Specifically, as the revised course unfolded, our teacher candidates became more aware of the role of care ethics in teaching and were able to make clear connections between an ethic of care and teaching science. For many, that awareness seemed to result in a dispositional shift, helping them to view science instruction as an ethical responsibility. This, in turn, seemed to spur many of them toward a stronger commitment to provide high quality science instruction to their future students *despite* their real or perceived lack of preparedness to do so, and *despite* the high-stakes testing that threatens to crowd it out of the school day.

Scholarly Significance

While many teachers certainly realize that educating a child can never be a morally neutral enterprise and seem to intuitively recognize the inherently moral work of teaching, teachers often present mono-cultural perspectives of what caring entails (Authors, XXXX), hold deficit views of children's parents as inadequate moral role models (Delpit, 2006; Sanger & Osguthorpe, 2015; Ullucci, 2009), and think of moral leadership in the professional setting merely as the task of fostering specific behaviors, a view that too often pushes them toward a behavioristic approach to moral instruction (Sanger & Osguthorpe, 2015; Authors, XXXX), all of which threaten to undermine the foundational reasons to engage in the work in the first place. The relevance of this work lies in its ability to counter this trend, suggesting an approach to help candidates tie foundational ideas (e.g. the purpose of education, the value of education) to curricular concerns (i.e. ideas and the world).

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