

# A Case for Sustainability Pedagogical Content Knowledge in Multicultural Teacher Education



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If education is going to offer a remedy for rather than exasperate the problem of the ecological and cultural crisis we currently face, teacher learning must be at the forefront of the discussion. Current efforts to educate for sustainability rely upon teachers who are knowledgeable, skilled, and committed agents for change. The same is true for efforts to provide equitable education for students from culturally, linguistically, ethnically, and racially diverse populations. But how do we prepare preser-

vice teachers to assume these roles? This article draws upon literature in the fields of sustainability education, multicultural education, and teacher learning to advance the discussion of how to equip preservice teachers to educate for sustainability.

Using a generalized framework based in research on discipline-specific pedagogical content knowledge (Shulman, 1986), a vision for sustainability pedagogical content knowledge is proposed. The framework describes the subject matter knowledge, orientations, curricular knowledge, and instructional strategies needed for teachers to enact sustainability education in diverse school environments. It draws upon a wealth of resources from the fields of environmental education, place-based education, and eco-justice education (Bowers, 2009; Capra, 2005; Lowenstein, Martusewicz, & Voelker, 2010; Martusewicz, Edmudson, &

Lupinacci, 2011; Orr, 2004). Sustainability pedagogical content knowledge advances a vision of teaching and learning that parallels Gay's (2010) summary of culturally responsive pedagogy in that it also develops "social consciousness and critique, . . . community building and personal connections; individual self-worth and abilities; and an ethic of caring" (p.45).

Implementation of the framework is optimized by teacher education programs that develop coherence through integration of coursework and field-based experiences. Similar teacher education pedagogies are called for in the research on multicultural teacher education. Lowenstein (2009) describes the use of field experiences and reflection as components of "parallel practice" in multicultural teacher education. If one assumes the truth of the adage "We

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can't teach what we don't know," developing teacher knowledge of diversity and sustainability is an imperative for rethinking education to promote human and planetary health for generations to come.

### Defining Sustainability

Sustainability is a complex construct with roots in both the concern for intergenerational equity held by numerous ancient cultures and the balance of resource use and regeneration within the field of ecology (Nolet, 2009, p. 413). Today, the term is used in a broader context often referring to "a balance among various human systems that influence and are influenced by the natural environment" (Nolet, 2009, 413).

This conception of sustainability is attributed to the 1987 Brundtland Report, the international policy document that first presented environmental impacts, economic development, and social justice as interconnected systems (Nolet, 2009). "Ultimately, sustainability represents an ideal that will be achieved when human-caused environmental degradation has been reversed and overconsumption and gross economic injustices that deprive future generations of the ability to meet their needs are eliminated" (Nolet, 2009, p. 413).

### Sustainability Education

In the past twenty years, reforms in education have been widely promoted as having the potential to elevate sustainability to a global, national, community, and personal goal. At the 1992 Earth Summit, the United Nations advanced sustainability by providing specific goals and strategies for education. These policies were further articulated in the United Nations call for a Decade for Sustainable Development from 2005 to 2014 (McKeown, 2012; Nolet, 2009; Shallcross & Robinson, 2007). The resolution outlined the following characteristics of education for sustainable development: interdisciplinary and holistic, values-driven, critical thinking and problem solving, multi-method, participatory decision-making, and locally relevant (Nolet, 2009).

Orr's (2004) writings have likewise been influential in the rethinking of education to focus on issues of sustainability. He wrote,

The crisis we face is first and foremost one of mind, perception, and values: hence, it is a challenge to those institutions presuming to shape minds, perceptions and values. It is an educational challenge. More of the same kind of education can

only make things worse. This is not an argument against education but rather an argument for the kind of education that prepares people for lives and livelihoods suited to a planet with a biosphere that operates by the laws of ecology and thermodynamics. (p. 27)

His vision of education requires a change in the content and pedagogy of the cur-

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riculum as well as the functions and architecture of educational institutions and the purposes of learning itself (Orr, 2004).

### Challenges to Sustainability Education and Multicultural Education

Bowers (2009) sets forth the major challenges to reforms in education that seek to advance the transitions to an ecologically sustainable culture. These include the marginalized status of environmental education, the failure of the majority of the American public to recognize the impact of the environmental crisis on their own lives, political and public support for a consumer-driven lifestyle, and the lack of attention paid to "the cultural roots of the ecological crisis" by educators at all levels (Bowers, 2009, p. 2). Teacher educators, in particular, have been cited as nonresponsive to the problems of sustainability impacting local environments across the globe (Bowers, 2009; Greenwood, 2010; Nolet 2009).

Shallcross and Robinson (2007) point to the rarity of sustainability in the official teacher education curricula and the requirements of teacher licensure as providing substantial barriers. Greenwood (2010) argues further that the regulatory mandates and bureaucratic stranglehold on teacher education render "deep thinking and substantive change very difficult" (p. 143). He does, however, recognize the opportunities for grassroots change to influence local policy. Greenwood (2010) concludes that such changes begin with individual faculty and course-level revisions and can influence larger program and state level policy changes through the efforts of professional networks.

Cochran-Smith, Davis, and Fries

(2004) cite similar patterns of resistance to substantive reform in their review of the research on multicultural teacher education. Despite the addition of multicultural content to state and national standards for the preparation of teachers and a growth in conceptual research that proposes a new paradigm for multicultural teacher education, empirical

studies continue to reveal a "business as usual" approach in most teacher education programs. Additionally, the current political landscape creates competing reform agendas in teacher education by confounding equal accountability on high-stakes testing with equal access to high-quality learning opportunities and by devaluing all but the most narrowly defined research on teaching and learning (Cochran-Smith, 2003; Cochran-Smith et al., 2004).

### Reorienting Teacher Education for Sustainability

McKeown (2012) summarizes the past twenty years of efforts to reorient teacher education to address sustainability as follows:

This means weaving knowledge, skills, perspectives, values and issues related to sustainability into existing curriculum and educational programs. Reorienting teacher education is important to ensure that sustainability is taught as part of a primary and secondary education. Teachers touch the lives of millions of learners in specific ways. Teachers help shape learners' worldviews, economic potentials and attitudes towards others in the community. Teachers also help form an individual's participation in community decision-making and interaction with the environment. More than 70 million teachers in the world (UNESCO, 2010) have enormous potential to bring about major changes in society and to create a more sustainable future. (p. 38)

The International Network of Teacher Education Institutions has led the way in teacher education reform to address sustainability. The network meets biennially and includes representation from more than 65 countries. It produced the guide-

lines and recommendations for teacher education program to address sustainability published by UNESCO in 2005. Member institutions pledge to focus programs, practices and policies on education for sustainability. They have conducted research, published academic journals, and provided professional development opportunities. Their innovative efforts have increased awareness of sustainability education in mainstream teacher education (McKeown, 2012; Shallcross & Robinson, 2007).

The State of Washington has provided the best American example of policy change to address sustainability in teacher education (Greenwood, 2010; McKeown, 2012; Nolet, 2009). That state revised its standards for teacher education programs so that “teacher education programs statewide must now demonstrate that their teacher candidates understand the ‘contextual and community centered’ nature of learning so that ‘all students are prepared to be responsible citizens for an environmentally sustainable, globally interconnected, and diverse society’” (Greenwood, 2010, p. 150). It also instituted a specialty teaching endorsement in Environmental and Sustainability Education; “further legitimizing environment and sustainability as vital educational themes within teacher education” (Greenwood, 2010, p. 150). Policy level reforms such as these require corresponding changes in the content and pedagogy of teacher education programs.

### Teacher Learning for Sustainability Education

Hammerness, Darling-Hammond, Grossman, Rust, and Shulman (2005) set forth widely accepted guidelines for the design of teacher education programs in their contribution to *Preparing Teachers for a Changing World: What Teachers Should Learn and Be Able to Do*. Hammerness et al. (2005) identify (1) the content, (2) the learning process, and (3) the learning context as significant elements in teacher learning across disciplines. To prepare preservice teachers to educate for sustainability, teacher education programs must utilize best practices related to field experiences and case studies. Preservice teachers “cannot be expected to simply conjure up images of enacted sustainability, they need to interact with tangible examples that support integration of sustainability into their own developing knowledge of practice” (Nolet, 2009, p. 432).

Most importantly, however, preservice

teachers need the “big picture” of sustainability content; a conceptual framework that “enables them to begin to recognize how all the individual ideas and theories fit together and relate to one another” (Hammerness et al., 2005, p. 397). The following articulation of a sustainability pedagogical content knowledge provides teacher educators with a framework for integrating teacher learning for sustainability education into the curriculum.

### Pedagogical Content Knowledge

#### Background

Shulman (1986) laid the foundation for over twenty-five years of educational research related to pedagogical content knowledge (PCK). Shulman characterized the lack of research on teacher content knowledge as “the missing paradigm” and questioned the assumption that most teachers begin with expertise in the content that they are teaching. He posed the questions, “How does a teacher prepare to teach something never previously learned? How does learning for teaching occur?” (Shulman, 1986, p. 8). Shulman’s response to these questions shed light on the content-intensive nature of teaching (Loewenberg Ball, Thames, & Phelps, 2008). He called for a “coherent theoretical framework” and identified “three categories of content knowledge: (a) subject matter content knowledge, (b) pedagogical content knowledge, and (c) curricular knowledge” (Shulman, 1986, p. 9).

Thus, he began to specify the distinction between disciplinary content knowledge and content knowledge for teaching (Loewenberg Ball et al., 2008). Although the ideas he represented were not new, Shulman (1986) first defined the term pedagogical content knowledge as:

The most regularly taught topics in one’s subject area, the most useful forms of representations of those ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations—in a word, ways of representing and formulating the subject that make it comprehensible to others. Pedagogical content knowledge also includes an understanding of what makes the learning of specific topics easy or difficult; the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons. (pp. 9-10)

Since Shulman’s introduction, there has been abundant and widespread interest in the study of PCK. Thousands of

scholarly works have referred to the notion of PCK in relation to subjects ranging from science and mathematics to music and physical education and regarding teaching students at all levels from preschool to graduate studies (Loewenberg Ball et al., 2008). In sum, these authors have presented numerous conceptions of PCK and models that define its components (Barrett & Green, 2002; Park & Oliver, 2007). All of the models recognize context knowledge as well as the domains of content knowledge and pedagogical knowledge (Gess-Newsome, 1999). The National Council for Accreditation in Teacher Education’s (2002) definition of PCK reflects each of these components

[PCK is the] interaction of the subject matter and effective teaching strategies to help students learn the subject matter. It requires a thorough understanding of the content to teach it in multiple ways, drawing on the cultural backgrounds and prior knowledge and experiences of students. (p. 55)

#### A Framework for Pedagogical Content Knowledge

Grossman, Schoenfeld, and Lee (2005) presented a framework for PCK based on a series of six inquiry-oriented questions. The questions guide teachers in an investigation of the content knowledge, teacher orientations, student understanding, curriculum, assessment, and instructional strategies related to a specific subject. Grossman et al. (2005) did not intend for teacher educators “to provide definite answers to these questions” but, rather, “to help prospective teachers begin to generate productive answers to these questions and to provide them with the intellectual tools to continue to inquire into these questions over their careers” (pgs. 207-208). The six questions posed were general and it was anticipated that responses would vary when applied to specific subject matter. The use of Grossman et al.’s framework to synthesize the research that defines the knowledge base and best practices in sustainability education provides a model of interdisciplinary teacher learning for integration into multicultural teacher education programs.

### Sustainability Pedagogical Content Knowledge

#### Knowledge of Sustainability

In addition to familiarity with the definitions of sustainability discussed earlier, teacher knowledge of sustainability should

have the “core concepts that describes the patterns and processes by which nature sustains life” (Capra, 2005, p. 23) as a foundation. By applying systems thinking to observations of ecosystems, Capra (2005) argues that these “principles of sustainability” are interrelated in a singular natural design that creates and nurtures communities. Teachers must understand that sustainability is dependent upon relationships.

Individuals make contributions to and are affected by other members of the larger “network.” Networks exist in relation to other networks in a “nested system.” Due to “interdependence”, the health of the individual is dependent upon that of the whole. The value of “diversity”, “cycles,” and “flows” to the health of a system must likewise be understood. “Development”, or change and learning, is a natural occurrence in all systems. The key to successful development is the achievement of a “dynamic balance.” This refers to “finding the optimal values for the system’s variables” (Capra, 2005, p. 28).

Nolet’s (2009) nine themes of “sustainability literacy” provide a more in-depth description of the knowledgebase and agency

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needed by teachers. He draws upon Orr’s original conception of “ecological literacy” to define sustainability literacy as “as the ability and disposition to engage in thinking, problem solving, decision making, and actions associated with achieving sustainability” (Nolet, 2009, p. 421). The summary of each of the nine themes included below represents Nolet’s (2009) claim that each “includes some specific knowledge or skills component, and each also clearly includes a component that likely would be characterized as disposition or belief” (p. 428).

*Stewardship.* A human connection to and care for the natural and physical world which would result in management and preservation of resources for the next generation.

*Respect for limits.* An understanding of the harm to the environment, biodiversity, and life caused by overconsumption and a call to prevent waste and preserve resources.

*Systems thinking and interdependence.* Consideration of the links within and between ecological, economic, political, and social systems and implementation of strategies to bring about equilibrium in the face of change.

*Economic restructuring.* An awareness of the fact that current economic models promote growth at the expense of natural resources, ecosystems, and human communities. Support for new ways of thinking including movement toward a “green economy.”

*Social justice and fair distribution.* An acknowledgement of equity and social justice as equal in importance to protection of the environment. Promotion of social, political, and economic reform that provides greater opportunity and decision-making for all stakeholders.

*Intergenerational perspective.* A long-term view of the impact of one’s actions and decisions made to ensure health of environment and society for future generations. Nature as model and teacher. A recognition of our potential to learn from the composition and cycles of nature and advocacy for innovations that reflect the design of the natural world.

*Global citizenship.* An understanding of

the interdependence of the globe’s environmental, political, economic, and social systems resulting in civic consciousness and engagement that crosses local and national boundaries.

*Importance of local place.* An appreciation of and efforts to protect the natural, economic, political, and social systems where one lives.

Nolet (2009) recognizes that these themes do not provide an exhaustive list of elements that could contribute to sustainability literacy and promotes a holistic approach to conceptualizing it as a construct. Nevertheless, these themes provide an ample set of interdisciplinary content knowledge as a starting point for the development of sustainability PCK.

### **Orientations to Sustainability**

Nelson (2010) posed the question: “What are the roles and responsibilities of schools in addressing the ecological crisis?” (p. 3). For an individual teacher

to respond in affirmation of this question, one must first believe in the significance of sustainability as a subject to be taught in school and embrace an alternate purpose of education. Several authors offer compelling responses to inform the development of the orientations that support sustainability PCK (Bowers, 2009; Lowenstein et al., 2010; Martusewicz et al., 2011; Orr, 2004; Stone, 2010).

Orr (2004) suggests six principles that frame a “rethinking” of education to address the ecological crisis: (1) all education, including that what is taught and not taught, is environmental education; (2) the goal of education is the mastery of one’s person rather than the master of subject matter; (3) knowledge must be used responsibly; (4) true knowledge is dependent on knowing the effects that the knowledge has on people and communities; (5) examples teach more than words; and (6) the process of learning is more important than the content learned.

Martusewicz, Edmunson, and Lupinacci’s (2011) work seeks to “inspire a vision for responsible teaching toward healthy and viable communities for the twenty-first century” (p.8). Teachers must first recognize that a crisis in the way people think and behave towards each other and the environment—a cultural crisis—is at the root of the ecological crisis. Then, awareness that we currently educate students to reproduce this cultural crisis must be developed. Finally, Martusewicz et al. (2011) propose a new goal for education: “we must begin to educate ourselves and our students about what it means to live differently on the Earth” (p. 8).

### **Knowledge of Students’ Understanding of Sustainability**

To educate for sustainability teachers must not only address their own assumptions, they must also understand the deeply-held beliefs of their students. Bowers (2009) focuses on the influence of language, particularly the narrow construct of the term “environment,” as a marginalizing factor. He proposes the use of a more inclusive term “commons” which represents the interdependency of the cultural and natural environment. He advocates for a shift from “environmental education” to “commons education” as it “bring into focus relationships, processes, and possibilities” (p. 14). Ultimately, education should help “students become aware of how abstract words, based on cultural assumptions that have been taken-for-granted over hundreds and even thousands of years,

can limit their awareness of the activities and relationships that sustain the cultural commons” (p. 32).

Martusewicz et al. (2011) draw upon this discussion of metaphors to identify the powerful discourses, or complex meanings created by the intersection of a group of root metaphors of modern Western cultures. These “discourses of modernity” include individualism, mechanism, progress, rationalism, commodification, consumerism, anthropocentrism, androcentrism, and ethnocentrism. Preservice teachers must understand the meaning of these concepts and how they become taken-for-granted views of the world and the practices by which we live.

Orr (2004) cites “biophobia,” an aversion to nature, as increasingly common among students who live in urban and suburban settings and whose time and activities are dominated by technology. Biophobia is problematic for several reasons: (1) it places a heavier burden for caring for and preserving nature on a smaller segment of the population; (2) it limits the range of experiences and joy in life; (3) it is a source of domination and exploitation; and (4) it violates the ancient commitment to stewardship of the Earth (Orr, 2004). To oppose the biophobia epidemic, Orr (2004) proposes that “a will to reshape education in a way that fosters innate biophilia and the analytical abilities and practical skills necessary for a world that takes life seriously” (p. 148) is required.

### **Knowledge of Sustainability Curriculum**

The Center for Ecoliteracy publications and web site provide an excellent starting point to review materials and exemplar projects of sustainability education (Capra, 2005; Nolet, 2009; Stone, 2010). For example, the *Smart by Nature* curriculum identifies a set of core competencies that demonstrate “learning to think in terms of relationships, connectedness, and context” (Stone, 2010, p. 40). *The Story of Stuff* project illuminates the ecological and cultural impact of our economic system and patterns of consumption.

Additional projects that provide resources aimed at both increasing awareness and changing practices include the Earth Charter, the Edible Schoolyard, and the Bioneers (Stone, 2010). Martusewicz et al. (2011) conclude each chapter of their book, *EcoJustice Education: Toward Diverse, Democratic, and Sustainable Communities*, with a list of resources for teachers ranging from suggested readings to community organizations. Preser-

vice teachers must be familiarized with these resources and guided in reflection on how they can be incorporated into the adopted curriculum of their states and local districts.

### **Knowledge of Assessment of Sustainability Learning**

Clearly the knowledge, dispositions, and practices desired as a result of sustainability education are not commiserate with the dominant forms of assessment currently used in public schools; namely standardized, selected-response tests. Ultimately, assessment of sustainability learning would involve more than a measurement of knowledge of sustainability concepts gained. Rather, it would require a long-term demonstration of applied understanding of knowledge of sustainability in multiple contexts (Nolet, 2009). However, shorter-term forms of assessment including projects and portfolios could be effectively used to measure student learning of sustainability concepts and enactment of related practices.

### **Knowledge of Instructional Strategies for Sustainability**

Again, Martusewicz et al. (2011) provide a wealth of examples for teachers. They include a section titled “What Schools and Teachers Can Do” in each of their chapters. These suggestions range from lessons on introducing students to sustainability vocabulary to research projects that explore the practices of well-known corporations. They also provide numerous examples of schools and communities who are successfully educating to promote sustainability.

Instructional strategies identified in the research on place-based education are likewise relevant to educating for sustainability. Gruenwald (2003) proposes a pedagogy of place as an integral component of his framework for place-based education. In his words, “places are fundamentally pedagogical because they are contexts for human perception and for participation with the phenomenal, ecological, and cultural world” (p. 645). He draws upon three educational traditions—natural history, cultural journalism, and action research—to identify a multidisciplinary approach to teaching and learning centered on place.

Lowenstein, Voelker, and Martusewicz (2010) contend that implementation of ecojustice and place-based instructional strategies require a shift in teachers’ per-

ceptions of their role “role vis-à-vis their students, the academic subject(s) they teach, and the action-space of teaching” (p. 105). In this new role, teachers guide inquiry, work in partnership with students and community leaders, and become more comfortable with complexity and uncertainty. They often have to negotiate the tension caused by requirements of the State and school district and those of ecojustice content and teaching strategies (Loewenstein et al., 2010).

## **Sustainability Pedagogical Content Knowledge in Multicultural Teacher Education**

The argument for developing preservice teachers’ sustainability PCK can be summed up in a series of simple, related statements. It is quite evident that “teachers need to know the subject matter they teach” (Grossman et al., 2005, p. 205). Yet, knowing a subject matter is not enough for teaching. Rather, what seems most important is knowledge of the subject matter for teaching—PCK (Loewenberg Ball, Thames, & Phelps, 2008). And, since most individuals do not enter teacher education programs with knowledge of sustainability, it is imperative that they develop sustainability PCK as part of their preservice teacher preparation.

The model of sustainability PCK and the argument for implementation parallels that made by researchers who advocate for the preparation of preservice teachers for multicultural education (Cochran-Smith, 2003; Gay, 2002; Lowenstein, 2009; Villegas and Lucas, 2002). In her review of the literature, Lowenstein (2009) described a knowledge base for multicultural education and the corresponding culturally responsive teaching practices.

Gay’s (2002) model for preparing teachers for culturally responsive teaching includes the development of knowledge and pedagogical skills, the ability to implement and design culturally relevant curricula, and the use of appropriate instructional strategies. The development of a sociocultural consciousness, understanding of students from diverse backgrounds, and a view of themselves as advocates for change to make schools more equitable are additional aspects included in the model presented by Villegas and Lucas (2002).

Cochran-Smith (2003) provides a framework for analyzing the multiple meanings of multicultural teacher education by posing a series of eight questions and examining the external forces and

larger contexts within which they are embedded. The questions are as follows: the diversity question, the ideology question, the knowledge question, the teacher learning question, the practice question, the outcomes question, the recruitment/selection question, and the coherence question. These inquiries are similar to those that contribute to the framework for pedagogical content knowledge and result in similar calls for reform of teacher education program design and pedagogy.

Grossman et al. (2005) postulate that the development of PCK is commonly housed in methods courses within teacher education programs due to its subject-specific nature. The interdisciplinary teacher learning required for the development of sustainability PCK, however, calls for a multi-faceted approach to preservice teacher instruction and experience. Both the literature on sustainability education (Bowers, 2009; Greenwood & Greenwood, 2010; Gruenewald, 2003; Lowenstein et al., 2010; Stone, 2010) and on PCK (Barrett & Green, 2002; Bullough, 2001; Nilsson, 2008; Park & Oliver, 2007; Shulman, 1986) cited in this discussion advocate a process approach to teacher education; one that combines subject matter preparation, contextual learning, reflective practice, and clinical practice.

Lowenstein's (2009) proposal for the construction of a pedagogy of multicultural teacher education shares several of the teacher education practices identified above. In addition to her call for a reconceptualization of preservice teacher knowledge of diversity by teacher educators, she advocates for greater use of field-based experiences and reflective practice. In weaving sustainability PCK into the fabric of multicultural teacher education, teacher educators promote parallel practices to increase teacher learning and transform student understanding about the environmental and social challenges facing our, their, and future generations.

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