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Principles and Principals: Leveraging K-12 Principal Training and Evaluation Standards to Support Environmental, Ecological, and Sustainability Education

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Abstract

Ecoliteracy is the pedagogical grouping of environmental science, ecology and sustainability studies. This paper is a policy analysis of how principal training and evaluation standards may support a principal's building-level efforts to establish and sustain an ecoliteracy mission and curriculum in US public K-12 schools. A comparative case study of leadership standards in Texas and Michigan was conducted to support the argument that school administrator training and evaluation standards in both states can lend formal, codified support to a sufficiently determined school leader's efforts to center the school's mission on ecoliteracy. The limitations of this support are also discussed.

Keywords: leadership preparation standards, environmental education, ecoliteracy; leadership evaluation, Texas, Michigan

In contemporary American public school settings, it is the principal that has the greatest role in setting the culture, tone and direction of the school. This is particularly true in those settings that employ a site-based management approach. The principal's imprimatur is apparent in the school's day-to-day operations, as well as its short-term initiatives and longer-terms strategic plans. While individual teachers or a cohort of teachers might adopt a particular educational plan or approach, their efforts gain or lose traction contingent upon the principal's endorsement and continued support. In the face of environmental change and attendant societal strife (Hutchinson, 1998), a principal might make environmental science and sustainability studies the school's central mission and curriculum. The advantage of doing so captures substantial teachable moments in science, cultural studies and civics. However, no template exists for such an implementation. As a result, the principal either has to improvise, or look to organizational policy and procedures for support.

Limited research has been conducted concerning school leaders and environmental education within school organizational structures. However, some literature exists concerning social justice in educational settings. For example, Murakami and Törsen (2015) conducted a comparative study of educational policies in Texas and Sweden as applied to democratic principles, i.e. teaching students to function in a democratic society. Murakami and Törsen specified the responsibilities and actions required by principals to promote democratic principles. Their comparison of Texas and Sweden outlined commonalities and differences between the two settings. Their work focused on the preparation and professional practice of principals in the context of teaching for democracy.

Why Environmental Education?

We assert that, like democratic practice, environmental education is a desirable mission and pedagogy for a principal to implement in a public school setting. We anticipate that soon in the United States, scientific study of the environment, especially in K-12 settings, will come under even greater governmental and sectarian scrutiny and attack. As environmental stewardship falls further out of favor among the public, children's inherent interest in nature (e.g., Louv, 2005), and the attendant teachable moments, may be lost. (On the other hand, increases in the frequency and severity of environmental crises may prompt a governmental/popular response more in favor of environmental education.) Whatever happens, the preservation and recapture of these learning opportunities requires from educators either passive resistance (i.e., subversion) or codification. Choosing an "environmental" school mission is one way for a school leader to pursue the option of codification. But what scaffolds that choice? We argue that it is logical to examine the overlap of environmental education with principal training and evaluation processes.

Purpose and Method of this Study

We are interested in the school leader's role in environmental education. We are particularly interested in how training and evaluation impacts the school leader's ability to implement a building-wide environmental education curriculum. Murakami and Törsen studied democratic principles through comparative analysis of Texas and Sweden. We too are situating our question in Texas, but like Murakami and Törsen, we see benefit in examining school leader preparation & evaluation in more than one state setting.

This study is not an empirical investigation of promulgated policy. No public K-12 settings in Texas or Michigan have declared an "environmental" mission. No schools in either state connect principal standards to any form of environmental or Earth science education. It is our intention here to analyze ways that such educational missions can be connected to established organizational policy. Educational policy in the U.S. over the last two decades has placed strong emphasis on school accountability. In our analysis of hypothetical policy, we explore ways to connect a school's environmental-education mission to school leader accountability. Comparing the preparation of new administrators and the evaluation of in-service administrators provides multiple perspectives on how ecoliteracy can be supported by state policies. This is not an apples-and-oranges comparison; the alignment of Texas evaluation standards with Michigan preparation standards allows us to make a thorough and meaningful parallel comparison, from training to practice. We begin our analysis with a description of the principles of "environmental" education. We then discuss the school principal certification and evaluation processes in Michigan and Texas. We continue this discussion by examining the commonalities and contrasts between these two U.S. states. Finally, we analyze the overlap between environmental education principles and principal leadership standards, and how the latter scaffolds the former.

The current training and evaluation processes in the states of Michigan and Texas provide logical examples of how a principal is *de facto* endorsed to focus his/her school on environmental education. Our analysis addresses two research questions. First, do school

administrator preparation evaluation standards support a mission of environmental education in a public school setting? Second, what are the challenges and limitations of this approach? In order to answer these questions, it is necessary to understand what is meant by “environmental education.”

Principles of environmental, ecological and sustainability education

Environmental and sustainability education are defined in myriad ways and in multiple contexts (e.g. Fiani & Rohrer, 2012; Miller & Spoolman, 2012; Orr, 1994; Rincones-Delgado & Bustillos-Durán, 2011). The problem with the term “environmental education” is that it is frequently used in a generic sense to encompass scientific study, educational policy and sustainability. The US Environmental Protection Agency states that

[E]nvironmental education increases public awareness and knowledge about environmental issues or problems. In doing so, it provides the public with the necessary skills to make informed decisions and take responsible action’ (US EPA, 2016).

“Ecological education” also appears frequently in discussions of environmental and sustainability education. This concept is more focused on Earth systems such as the atmosphere, biosphere and hydrosphere, and their interactions with each other and with humans (Hautecoeur, 2002). The United Nations World Commission on Environment and Development (UNWCED) addressed sustainability in the context of sustainable development, defined as economic and social systems and “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (UNWCED, 1987).

Developing an integrated understanding of environment, ecology and sustainability can be difficult for specialists and non-specialists alike. A convenient integration is provided by the concept of “ecoliteracy” as defined by Feig (2004):

The basic information and social practices need to survive in a world where the interconnections between humans and their planetary environment, and the physical processes of the planet, are not mere constructs relegated to a science classroom, but form a reality that shapes, guides and constrains human activity and human survival (p. 13)

This definition of ecoliteracy presents a pedagogical synergy between sustainable human activity, technical scientific knowledge and human culture. The latter cannot be excluded in considerations of human-Earth interactions. Ecoliteracy can be further unpacked to reveal its four fundamental principles (Feig, 2004): 1) environmental stewardship; 2) environmental justice; 3) systems-based thinking; and 4) deep time. The first two principles address environmental sustainability education through consideration of human-environment interactions. The third principle addresses the technical and scientific understanding of Earth processes, e.g. plate tectonics or weather. (These are examples of content knowledge.) The last principle addresses mental and personal understanding of the Earth. Deep time describes the

ability—and willingness—to think in the long-term time frames (i.e., 10⁹ years) in which Earth processes operate.

The pedagogy of ecoliteracy is translated into a curriculum of ecoliteracy by cultivating a school environment where a traditional, scientific understanding of “the environment” is combined with the teaching of environmental justice, environmental stewardship and other ways of knowing beyond Western, Eurocentric means (Semken, 2005). Integral to this combination is the deep-time perspective of the geologic time scale (Walker & Geissman, 2009), which is fundamental to Earth science. Of course, the pedagogy and curriculum of ecoliteracy are substantially different from current environmental education, as detailed in the U.S.’s Next Generation Science Standards (NGSS Lead States, 2013); or those of Michigan (Ziker 2014) or Texas (Porter-Magee, Wright & Horn, 2013).

Principles and Principals: Examples of Ecoliterate Schools

Some examples exist that describe the principal’s primary role in advancing ecoliterate curricula and teaching missions. One example of a school adopting an environmental mission described by Williams and Taylor (1999) is that of building the public Environmental Middle School (EMS) in Portland, Oregon, in 1995. This was in response to demand by parents for alternatives to standardized public school education. EMS was established during a time of budget cutbacks in the city school district. The school’s mission was to integrate ecology into education to make school more meaningful for learners (Williams & Taylor, 1999). EMS was established in an existing building housing another, existing school, and had to share resources and space. EMS was required to adhere to district hiring and staffing policies, meaning that the teachers there may or may not have been those most trained and qualified to teach an environmental curriculum. In terms of curriculum, instruction was largely field based, with students conducting investigations on the city park they adopted and helping to restore native plants while studying the local ecosystems. It is worth noting that the school met or exceeded the standards of academic accomplishment and accountability that existed at that time in Portland (Williams & Taylor, 1999).

An example of one principal’s efforts towards building level ecoliteracy is the Edible Schoolyard in Berkeley, California. This on-site teaching garden started as a community-building initiative that grew to be the keystone of the school curriculum, with each subject rooted in ecology. In 1996, a member of the local community approached the new principal at Martin Luther King, Jr., school to establish the garden. It was the principal’s buy-in that was key to the success of the garden (Waters, 1999). For example, at a start-of-the-year teacher in-service, some faculty summarized the troubled school’s problems by saying, ‘our school need[s] a revolution’ (Comnes, 1999). In response, the principal, Neil Waters, established the “Revolutionary Committee”, with a fluid and open membership. Waters gave the committee authority to identify and address problems. This included changing from 45-minute periods to block-schedule 95-minute periods, establishing an eight-level voting process for staff decisions, and reaching out to community members for help in establishing the teaching garden. In growing, harvesting, cooking and serving the crops at their school, students gained knowledge and appreciation of Earth processes associated with agriculture (Jackson, 1999).

Arguably, the principals in these examples had substantial autonomy. What about settings in which this would not be the case? What support might principals in such settings have for implementing ecoliteracy education?

Theoretical Frameworks Applicable to Ecoliterate School Leadership

The theories of leadership and administrative theory that are highly congruent with building-level ecoliteracy efforts are 1) advocacy leadership (Anderson, 2009); 2) blended instructional and transformative leadership (e.g., Hallinger, 2003); and 3) Webster's (2004) four-stage model of sustainable school development, as further explored by Scott in 2013.

Advocacy leadership is a direct challenge to constant and catastrophic school reform efforts that drive and perpetuate social inequity and inequality. Anderson (2009) identifies the focus of school leadership as efficiency (i.e., efficient use of resources and efficient accountability of outcomes). Anderson argues that in advocacy leadership, the principal is not and cannot be apolitical, because current reform efforts benefit some entities (e.g., business interests) and damage others (e.g., students and communities). The principal, then, must be at the forefront of social and community justice. In the wake of constant reform efforts, principals must develop their own agendas. We see this as directly applicable to the principal who would address social, community, and planetary issues via a school mission of ecoliteracy.

Hallinger (2003) discusses the historical development of instructional and transformational leadership practices. We recognize that these are not theories per se; Hallinger frames them as conceptualizations, which we find useful in the discussion of building-level ecoliteracy. The transformational school leader is focused on management and teaching of the curriculum. Principals set school tone in something of a cult of personality, deeply involved in day-to-day operations with measurable goals for the institution and its personnel. Transformational leadership does not itself abandon these characteristics. Rather, it is more reactionary to the micromanagement of schools from levels above and outside of the building. This practice is less focused on the principal as the individual source of governance (versus setting a tone). School vision is articulated with participation from staff, who work together to define the goals of the school, rather than meeting goals imposed from outside. We see transformational leadership as reliant on living networks (Capra, 2001) within the educational system. Such cultural and interpersonal networks operate in parallel to networks of Earth processes, which themselves are part of the package of ecoliteracy. This parallel operation then forms part of the theoretical foundations for this study.

These two leadership practices are integrated in our framework, because the principal must approach ecoliteracy from a strategic intention of advocacy leadership. The principal sets the tone, manages the resources, facilitates activities (instructional), but does not prescribe or micromanage the curriculum or community relationships—allowing them to grow organically (transformational).

Scott (2013) describes a school's "institutional journey towards being more sustainable" (p. 186) in the context of the four stages of development originally articulated by Webster (2004). In fact, Scott lists five stages, the first being Number Zero (2013). This stage begins with

diffuse interest by students, teachers or parents in “greening” of the school. In the next, “first” stage, isolated curricular or programmatic items are created, usually in spite of the indifference of leaders. In the second and third stages, the principal buys into sustainability, makes budget and resource decisions supportive of sustainability and forges salient community relationships. The fourth stage is an idealized vision of a culturally and ecologically transformative school. We focus on Scott’s (2013) and Webster’s (2004) second and third stages, because when a principal seeks to implement an ecoliterate school mission, she or he has bypassed the previous stages. As the principal moves forward, this is where leadership standards and guidelines may scaffold him or her.

An additional theoretical concept relevant here is that of refocusing, as discussed by Bottery (2011) and Zachariou, Kadji-Beltran & Manoli (2013). These workers recast the fundamental purposes of education in terms of social and environmental welfare, versus the production of workers for a capitalist society. This refocus is accomplished by cross-curricular pedagogy, deep mastery, and what we label the “pedagogy of empathy” (i.e., caring for others and the environment).

School leaders must be resilient planners that foster a culture of community inside and outside of their buildings. When considering where theory meets practice in ecoliteracy, principal standards are best contextualized in the theoretical frameworks we have discussed. What follows is our analysis of how the standards support ecoliterate education

Principal Training and Evaluation in Michigan and Texas

We focus on the states of Michigan and Texas because the two states provide an interesting study in contrasts. Texas schools are subject to more direct regulation by the state legislature than in Michigan. Texas is a right-to-work state; educational labor unions do not have a particularly strong presence there, and collective bargaining is rare. Despite the ratification of Michigan’s right-to-work status in 2012, labor unions maintain a strong presence, and collective bargaining is commonplace in the state’s public education settings. Michigan adopted the Common Core Science Standards (Common Core State Standards Initiative, 2018), but Texas did not.

Principal Evaluation in Texas

In 2014 the Texas Education Agency (TEA) adopted Chapter 149, Commissioner's Rules Concerning Educator Standards, Subchapter BB, Administrator Standards, §149.2001, Principal Standards, in accordance with the Texas Educational Code (TEA, 2014). The TEA principal standards may be categorized into school culture, operations, human capital and leadership. This last category contains two subcategories; first is Executive Leadership, which we equate with Michigan’s category of Leadership and Vision (Michigan standards are discussed below). The second subcategory is leadership in Learning and Curriculum. The TEA does not have a separate category for external or collaborative relationships, but this is addressed in the TEA standard concerning school culture. TEA standards include Performance Indicators specifically aligned with their ‘Principal Knowledge and Skills’ standards.

Principal Evaluation in Michigan

Chapter 380.1249, “Performance Evaluation System for Teachers and School Administrators” of the Michigan Revised School Code mandates *the evaluation of an administrator’s job performance using multiple rating categories that take into account student growth and assessment data.* (Michigan Legislature, 2013)

In Michigan, no state-authored procedure exists for school administrator evaluation. However, the MDE does recommend the use of either the Reeves Leadership Performance Rubric (Reeves, 2016) or the Michigan Association of School Administrators Advance™ Administrator Evaluation System for Learning, Growth and Adaptation (MASA, 2016). The Reeves Rubric’s possible principal ratings are Highly Effective, Effective, Needs Improvement and Unsatisfactory. To provide an example of this rubric’s ‘flavor,’ the criterion for “Highly Effective” in Domain 2.2, Personal Behavior & Professional Ethics: Emotional Control, reads:

The leader deals with sensitive subjects and personal attacks with dignity and self-control. The leader never meets anger with anger, but defuses confrontational situations with emotional intelligence, empathy, and respect.

The MASA rubric provides three possible ratings of principal performance: Minimally Effective, Effective and Highly Effective. The general flavor of this rubric can be seen in the ‘Highly Effective’ criterion for Domain 5: System—Technology Integration & Competence Factors, Leadership for Technology Characteristics:

Works with staff to identify evidence-based technology practices that improve instruction, extend learning opportunities and foster student and parent engagement in the learning process.

Principal Training and Certification in Michigan

While no doubt useful in some contexts, the Reeves and MASA rubrics do not compare in a straightforward manner with Texas legislation §149.2001, especially in the context of identifying support for establishing building-level ecoliteracy. However, the Educational Leadership Constituents Council (ELCC) 2011 Standards (National Policy Board for Educational Administration [NPBEA], 2016) to guide principal preparation programs are organized in a manner parallel to Texas legislation. The Michigan State Board of Education (MSBE), a unit within the MDE, formally adopted these principal preparation standards in 2012 (MSBE, 2013). ELCC standards are divided into seven basic categories: Leadership and vision, school culture, school operations, personnel management, external/collaborative relationships, ethics and learning/curriculum. These standards are further articulated by subsets of Standard Elements, each of which lists required content knowledge and related (future) performance expectations. The NPBEA (2011) standards compare favorably with the Texas standards described earlier.

Principal Training and Certification in Texas

Texas Administrative Code (2016) Title 19, Part 7, Chapter 241, Rule §241.15 specifies the standards for principal certification in that state. These standards bear a strong similarity to the evaluation standards. The categories include School Culture, Leading Learning (instructional aspects of the school), Human Capital, Executive Leadership, Strategic Operations, and finally Ethics, Equity and Diversity. The Administrative Code delineates a set of knowledge and skills for each of these categories. Texas requires principals pass a certification test covering these standards. Principals must also to hold a valid teaching certificate and at least a Master’s degree from an accredited institution.

Leadership Standards that Support Ecoliteracy Education

We use the term “leadership standards” as shorthand when referring to both the Texas performance indicators and the Michigan standard elements. Otherwise, we use the terms “indicators” when discussing Texas, and “elements” when discussing Michigan. Many of the Texas indicators and Michigan elements are generic in nature. For example, “implementing a rigorous curriculum” can certainly support ecoliteracy, but also many other curricula. We therefore limit our discussion to leadership standards for which more specific and compelling arguments can be made. Table 1 summarizes relevant leadership standards, and those numbered items are discussed below.

Table 1: Summary of Texas and Michigan Leadership Guidelines that support principals in establishing ecoliteracy.

Summary of Texas and Michigan Leadership Guidelines that support principals in establishing ecoliteracy.

Principal certification standards aligned w/environmental education		
Category	TX Indicators	MI Elements
Leadership & vision	3.B.i, 5.B.i, 5.B.iii, 5.B.iv	1.1.4, 1.3.2
School culture	4.B.iii	2.1.2, 2.1.4, 2.3.3
Operations	-	-
Personnel management	2.B.i, 2.B.iii	1.3.3
<u>External/collaborative relationships</u>	4.B.iii	4.2.1, 4.3.2, 4.3.3
Ethics		5.3.1, 5.3.2, 5.4.2, 5.5.1, 5.5.2
Learning & curriculum	1.B.ii, 1.B.iii	6.1.1, 6.1.2, 6.3.1, 6.3.2

Ecoliteracy and Executive Leadership & Vision

Four Texas indicators suggest compelling alignments:

3.B.i. Resiliency and change management. The leader remains solutions-oriented, treats challenges as opportunities, and supports staff through changes.

5.B.i. Strategic planning. The leader outlines and tracks clear goals, targets, and strategies aligned to a school vision that improves teacher effectiveness and student outcomes.

5.B.iii. Tactical resource management. The leader aligns resources with the needs of the school and effectively monitors the impact on school goals.

5.B.iv. Policy implementation and advocacy. The leader collaborates with district staff to implement and advocate for district policies that meet the needs of students and staff.

Performance Indicator 3.B.i. seems quite generic on first inspection. However, resiliency and change management are particularly important to a curriculum implementing the four principles of ecoliteracy education. 3.B.i is less specific to other subjects, e.g. mathematics, chemistry or reading. In the context of the principles of environmental justice and stewardship, a dynamic curriculum needs to respond to teachable moments inherent in real-time, real-world developments, particularly in disempowered communities. Examples include environmental racism in the forms of pervasive lead contamination in Flint, Michigan (e.g. Hanna-Attisha, et. al, 2016); illegal waste disposal in communities of color in throughout Michigan (Bryant, 2011.); and the distribution of impoverished communities in areas highly prone to natural disasters in Texas (Adler, 2005). A principal must have sufficient leadership skills to coordinate an ecoliteracy-curriculum response to such community developments, especially local ones. Proper change management could include spreading an environmental justice incident across disciplines. For example, chemistry students could balance equations of acid-lead pipe interactions, and social studies students could analyze governmental response to contaminated water supplies.

In the context of the ecoliteracy principle of systems thinking, change management is a curricular leadership skill in the face of, for example, our evolving understandings of the mechanisms and impacts of climate change and attendant human response. For example, as our technological capability for atmospheric engineering grows (Robock, 2014), those advances, and their consequences for the climate system, can be examined within the school curriculum.

The principal's resiliency skills apply when teachers are under pressure to avoid teaching subjects such as the age of the Earth. A calm, thoughtful strategy crafted by the principal, grounded in legal precedent, is ideal; however, such tactics are usually ineffective against teleological opposition (e.g., U.S. District Court, 2005). The principal must be able to modify his/her policy accordingly, and in the face of the typical patterns (Matsumura, 1995) of multiple sectarian attacks.

Texas Performance Indicator 5.B.i, Strategic Planning, is relevant because prepackaged ecoliteracy curricular materials do not exist. However, the *parts* are available—lesson plans and multimedia materials relevant to the four principles of ecoliteracy. Feig (2004) argued that the assembly of these parts should be specific to the site and community where they are deployed. While the 'Edible Schoolyard' worked well in the northern California climate, a teaching garden would be more difficult to establish and maintain in a location with a much shorter growing season, or in an arid climate. Furthermore, the study of environmental justice should be related to the regional community and its issues—this increases the agency of teachers and students. In the face of these issues, a Texas principal is authorized by this Performance Indicator to foster an ethos of innovation at the school. This ethos empowers teachers, which in turn improves school effectiveness (e.g. Bogler & Somech, 2004). Of course, the principal is obligated to structure the

school's vision of ecoliteracy to align with student achievement mandates. A holistic, cross-disciplinary environmental curriculum has long been shown to be the same as or better than a testing-driven, single-subject approach (Bartosh, et al., 2009; Lieberman & Hoody, 1998; Monroe, Randall & Crisp, 2001; Mueller, et al., 2014). An ecoliteracy curriculum is better positioned to improve student outcomes.

A vision and curriculum of ecoliteracy are highly reliant on Performance Indicator 5.B.iii, Tactical Resource Management. Ecoliteracy resource needs go beyond materials; stakeholders inside and outside the school should be active participants in the teaching and learning process (Comnes, 1999; Feig, 2004; Williams & Taylor, 1999). Advanced professional development for teachers in content expertise is another need. 'Bubble-in' assessment techniques are by themselves insufficient to measure learning goals in such areas as an internalized sense of environmental stewardship, or personal agency in the face of environmental injustice. The principal must be able to leverage, or assist teachers to leverage, the resources necessary.

A principal must have sufficient autonomy to establish a vision and curriculum of ecoliteracy. We suspect that a principal attempting to implement ecoliteracy would encounter substantial obstacles at the site, district and community levels. District policies, visions and curricula are tailored for wide application, efficiency of promulgation and cost effectiveness. Ecoliteracy is a radical departure from the status quo, and the principal may need to be a fierce advocate for the change. Performance Indicator 5.B.iv provides codified support for a principal's efforts to push for district policies that allow nonstandard practice at the building level. However, it is incumbent on the principal to demonstrate how ecoliteracy benefits students and staff and, ultimately, the district.

The Performance Indicators in Michigan's Standards for Principal Preparation are in the form of unnumbered, bulleted lists within numbered Standard Elements. For example, the third bullet under Standard Element 1.1, "Candidates understand and can collaboratively develop, articulate, implement, and steward a shared vision of learning," reads as follows:

Develop a comprehensive plan for communicating the school vision to appropriate school constituencies.

For our purposes, we have modified the Standard Elements numeration such that the above Performance Indicator is referred to as 1.1.3.

Two Michigan elements lend support to school ecoliteracy:

1.1.4. Formulate plans to steward school vision statements.

1.3.2. Design a transformational change plan at the school-building-level.

Consistent with 1.1.4, vision statements of ecoliteracy must be preserved and protected. Because ecoliteracy is such a radical departure from traditional practice, it will likely be prone to attack or dismantling. For strategies to steward this vision, we point to examples from place-based education, e.g. Smith (2007) and Stevenson (2007). We concede that this Performance Indicator is oriented more towards compliance than scaffolding; however, in any novel and revolutionary implementation, vision must be safeguarded.

Prior to safeguarding a vision of ecoliteracy, that vision must be articulated. Performance Indicator 1.3.2 requires the design of a ‘transformational change plan’ for schools, in keeping with the legacy of constant and relentless calls for school reform across the nation (Cuban, 1990; Watkins, 2015). “School change” in Michigan and Texas tends to reinforce a culture of high-stakes testing (e.g. Education Achievement Authority of Michigan, 2016). However, ecoliteracy represents a change that improves high-stakes test performance, while simultaneously subverting that system by moving away from drill-and-kill test-prep (e.g. Williams & Taylor, 1999). While ecoliteracy may not be the change that the district has in mind, a principal could refer to this Performance Indicator as an endorsement of a particularly radical transformation.

Ecoliteracy and school culture

Three Michigan elements lend support to a vision and curriculum of ecoliteracy:

2.1.2. Incorporate cultural competence, personality types in development of programs, curriculum, and instructional practices.

2.1.4. Recognize, celebrate, and incorporate diversity in programs, curriculum, and instructional practices.

2.3.3. Design the use of differentiated instructional strategies, curriculum materials, and technologies to maximize high-quality instruction

Cultural competence, a component of Performance Indicator 2.1.2, is a keystone of ecoliteracy. The stakeholders in a school’s ecoliteracy efforts include municipalities, businesses and community members. This last group is the most crucial, and of the widest potential diversity. Community members include the district’s residents, landowners (both private and public) and leaders, including clergy and organizers/activists. These players interact in the physical, cultural and political environment. Together with parents, students and school personnel, they are a living network (Capra, 1996) that informs and is informed by the Earth environment and the study thereof. By definition, ecoliteracy incorporates cultural components into curriculum, programs—and the school—and is well supported by this Performance Indicator. For the same reasons, the focus on diversity on 2.1.4 supports ecoliteracy. The pedagogy of ecoliteracy expands the ways of knowing about the Earth environment, and its interaction with humanity, beyond Western scientific thought. A principal facilitating the challenge of integrating diverse communities, points of view and social actors into a science program is supported by this Performance Indicator.

As we noted earlier, a prepackaged ecoliteracy curriculum and associated materials do not exist at present. Thus, it is incumbent upon the principal to design or facilitate the design of those materials. Performance Indicator 2.3.3 specifically calls for the principal to do so, and is therefore supportive of this needed activity.

One Texas indicator is relevant to ecoliteracy:

4.B.iii. Intentional family and community engagement. The leader engages families and community members in student learning.

As shown by the examples from Oregon and California, community engagement is core to ecoliteracy. Community members bring other ways of knowing. For example, migrant farm workers, whose children attend public schools, bring knowledge of soil, agriculture and weather, and the transfer of technology between farm locations. Their ways of knowing are acknowledged and valued in ecoliteracy pedagogy. An effective principal engages with these and other community members on the basis that the school and its community exist together in the local ecosystem.

Ecoliteracy and oversight of operations

The operations/oversight leadership standards in both states yield no compelling alignments in support of ecoliteracy education. Generic alignments of course exist, such as “efficiently use human, fiscal, and technological resources” (MI); and “assess current needs of their schools” (TX). We note that while explicit support is lacking, these Performance Indicators certainly do not work against ecoliteracy in a school.

Ecoliteracy and personnel management

This category of leadership standards is exceedingly generic; nevertheless, we call attention to two from Texas and one from Michigan:

TEXAS 2.B.1. Targeted selection, placement, and retention. The leader selects, places, and retains effective teachers and staff.

TEXAS 2.B.3. Staff collaboration and leadership. The leader implements collaborative structures and provides leadership opportunities for effective teachers and staff.

MICHIGAN 1.3.3. Design a comprehensive, building-level professional development program.

We discuss these leadership standards here not because they explicitly scaffold ecoliteracy, but rather because ecoliteracy is highly dependent upon them. Of course, ecoliteracy is also dependent, like any curriculum, on successful building operations. However, its dependence on successful personnel management is greater and more specific. This is because of the need to cross disciplinary (content) boundaries. For example, social studies teachers and science teachers need to be able to sufficiently overlap into the other’s area, in order to jointly teach the interconnections between human affairs and Earth processes. This means the principal must retain teachers skilled enough—and willing enough—to work across disciplines.

Furthermore, because ecoliteracy is based on interconnected, living networks, collaboration, professional development and teacher placement are crucial. Environmental, geological and meteorological events (crises) develop in real time, and can involve mechanisms beyond the knowledge base or experience of school staff. The principal may then want to develop ‘just-in-time’ professional development opportunities where teachers can obtain needed information and resources. Examples may include informal partnerships with universities, and local National Weather Service offices and natural science museums.

Ecoliteracy and external relationships & collaborations.

Both Texas and Michigan leadership standards focus primarily on family-school relationships:

TEXAS 4.b.iii. Intentional family and community engagement: The leader engages families and community members in student learning.

MICHIGAN 4.2.1. Identify and use diverse community resources to improve school programs.

MICHIGAN 4.3.2. develop collaboration strategies for effective relationships with families and caregivers.

MICHIGAN 4.3.3. involve families and caregivers in the decision-making processes at the school.

Texas 4.B.iii applies here as well as to school culture, and Michigan's elements expand the basic idea we discussed above. The principal is expected to find and use local businesses, government agencies and other loci of expertise (4.2.1). For example, partnerships with city planners, and water and electric utilities support student learning about energy and infrastructure. These agencies assess environmental impacts on an ongoing basis. These agencies, together with the school, could take on joint stewardship of a plot of land near the school, to facilitate project-based learning guided by the utility and its experts.

The principal is also expected to extend decision-making beyond the building itself. Fortunately, the pedagogy of ecoliteracy already opens up the school by placing the building and its curricula in the local community and environment. Distributed leadership among families, caregivers and community members is required, which makes administrative micromanagement of the school infeasible.

Ecoliteracy and ethics

Interestingly, no Texas indicators in this area specifically support ecoliteracy. This is because unlike Michigan, Texas does not have a separate category of standards for ethics. However, the expectation of ethical behavior and ethical actions on the part of principals is present throughout the Texas indicators.

Five of Michigan's elements speak specifically to ecoliteracy:

5.3.1. Develop, implement, and evaluate school policies and procedures that support democratic values, equity, and diversity issues.

5.3.2. Develop appropriate communication skills to advocate for democracy, equity, and diversity.

5.4.2. Evaluate school strategies to prevent difficulties related to moral and legal issues.

5.5.1. Review and critique school policies, programs, and practices to ensure that student needs inform all aspects of schooling, including social justice, equity, confidentiality, acceptance, and respect between and among students and faculty within the school.

5.5.2. Develop the resiliency to uphold school community values and persist in the face of adversity.

Equity and democracy are fundamental parts of an effective ecoliteracy curriculum. Performance Indicator 5.3.1 and to an extent, 5.3.2, discuss school policy, rather than instruction. However, policy supports instruction; equitable and democratic policy will spread those values into instruction. We view the legal issues mentioned in 5.4.2 to be concerned with student discipline. Many disciplinary issues arise due to the perceived dullness and lack of relevance of the curriculum. Our take is that an integrated, project based curriculum focused on the local environment will keep students engaged sufficiently to reduce disciplinary issues. Furthermore, we view moral issues (whatever those may be) in the context of social (environmental) justice. Ecoliteracy should include democratic practice, self-agency and personal relevance to the students. If a school implements ecoliteracy, then the social justice requirements of 5.5.1 are met: “Respecting the Earth” begins with respecting oneself—a value schools already strive to impart to students.

We have already discussed “resiliency” as it was articulated in the Texas indicators. Even though it appears in the Michigan standards under “Ethics,” the same arguments apply. Ecoliteracy will come under multiple attacks. The principal who is pressured to repeal this curriculum has leadership standards that support (and require) his or her persistence in the face of that adversity.

Ecoliteracy and learning & curriculum

One Texas indicator supports ecoliteracy:

1.B.ii. Effective instructional practices. The leader develops high-quality instructional practices among teachers that improve student learning.

Three Michigan elements support ecoliteracy:

6.1.1. Analyze how law and policy is applied consistently, fairly and ethically within the school.

6.1.2. Advocate based on an analysis of the complex causes of poverty and other disadvantages.

6.3.1. Identify and anticipate emerging trends and issues likely to affect the school.

Ecoliteracy is applied on both global and local levels, or “glocally” (Roudometof, 2015). This “glocalisation” of a curriculum integrates economic, cultural, social, political and scientific

knowledge across multiple scales. For example, when children look out their windows and see air pollution, they can be taught about the following:

- Formation of photochemical smog
- Landscape features that allow air pollution to accumulate
- Travel of the pollution through and across communities
- What communities are disproportionately affected by pollution, in terms of race or income
- The response of governmental agencies (or lack thereof)
- The distribution of pollution as compared to the distribution of resources.

These concepts are a combination of scientific and sociological means of understanding environmental justice. They underscore the notion that connections between location, socioeconomic status and environment are complex, and provide an opportunity for (self) advocacy, and the examination of equity in the community. These strategies are directly expressed by the Michigan elements listed above.

Limitations and Challenges

The Theory of Planned Behavior (TPB) (Ajzen, 2002) and the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980) are lenses through which the principals and principles of our discussion refract. The principal that expects substantial pushback from parents and/or the board may behave, predictably, in a manner that undermines his or her efforts in, for example, fostering a non-combative school culture. While this “planned behavior” may seem incidental to the situation, it is predicated on the perception of others’ (e.g., parents, the board) attitudes. TPB suggests that despite the support of staff and community, the principal may still feel no control over the choice of school mission (Veronese & Kensler, 2013). Veronese & Kensler (2013) trace this phenomenon to the fact that leading “environmentally sustainable” schools is outside the purview of principal preparation programs and extant policy. For our purposes, this translates into a fundamental shortfall for ecoliteracy in schools. In spite of that, we have made a case for the potential support that administrator leadership guidelines can lend to ecoliteracy education.

However, we identify three specific major challenges. First, neither Texas nor Michigan’s leadership standards explicitly address environment, ecology or sustainability by name or directive. Furthermore, the Professional Standards for Educational Leaders-2015 (formerly the Interstate School Leaders Licensure Commission Standards) (NPBEA, 2015), which provide direction for the training and certification of school leaders, are silent on the issue of environmental education. While a principal may find within leadership guidelines some degree of latitude to implement his or her school goals, this strategy is double-edged. Boards of education and district offices may respond in unfavorable and unpredictable ways. A counterargument may be made that a mission of ecoliteracy diverts resources; or works against the district’s strategic plan; or would alienate community members in the district’s particular political climate. Despite sound arguments for ecoliteracy, a principal may find an insurmountable resistance to change. It is not possible to make an ironclad case for the promulgation of ecoliteracy using leadership guidelines. Rather, our goal is to demonstrate that the guidelines are broad enough to provide a foundational level of regulatory support for ecoliteracy. These are things that the principal can fall back on in an environment of adversity.

The second major challenge is that state standards for student learning are generally not designed for the cross-disciplinary, holistic nature of ecoliteracy. States tend to compartmentalize and separate subjects. Math, civics, science and language arts have widely separated domains/content expectations. This situation is difficult to reconcile with the principles of ecoliteracy. Ecoliteracy resists convenient assessment via high-stakes testing; questions of environmental justice and stewardship are not easily assessed by ‘bubble-in’ concept inventories. The fact that holistic approaches can improve student performance on standardized assessments is not widely recognized. This further impedes implementation.

This leads into the third major challenge, which is a conceptual contradiction between the habits of mind of current accountability climates and the use of leadership standards to promote ecoliteracy. We are mindful that an ecoliteracy curriculum must still adhere to established standards of accountability—including high stakes standardized testing. Teachers and board members may see accountability as driving a one-dimensional educational environment, and the multidimensional nature of ecoliteracy may provoke an extreme dissonance for them. In both Texas and Michigan, student performance on tests is weighted heavily in teacher evaluation. Therefore, ecoliteracy may be seen as a threat to the very livelihood of teachers. In states like Michigan, the support of labor unions may mitigate this issue—but probably not in Texas. Ultimately, reckoning ecoliteracy with state-level student expectations and accountability is beyond the scope of this paper.

The Principals-Principles overlap, however, is fundamentally about educational access and justice. Environmental degradation affects every human, and disenfranchised people especially so. In a social and political climate that seeks to turn away from Earth systems as a subject of study, the overlaps between theory and policy are not merely intellectual curiosities. These overlaps are instead part of an arsenal available to school leaders in their efforts to provide children access and opportunity to learn about their planetary home.

Future Directions and Applications

The 2013 Next Generation Standards (NGSS) present some opportunities for ecoliteracy. NGSS takes more of an integrated-systems approach to the sciences, with a strong emphasis on engineering principles. Engineering is fundamentally a discipline of human-environment interactions, and thus represents a nucleus around which an ecoliteracy school mission could be established.

Most schools are required to develop improvement plans, and this is a requirement of Title 1 federal funding. Ecoliteracy can be incrementally integrated into a school’s goals and objectives. Over the course of a few years, integration can start with community relations, then curriculum, then resources and personnel. This strategy is an area of future research.

In terms of other future research, we see opportunity to structure a formal paradigm of ecoliteracy education as a model that integrates diversity, social justice, physical environment and interdisciplinary teaching. In addition, the revision of the ELCC standards into the National Educational Leadership Preparation Standards (NPBEA, 2016) presents an opportunity to

introduce to ideas of ecoliteracy into leadership standards, and to drive convergence between the two. This begins with the support of policy boards (e.g. University Council for Educational Administration (UCEA) and the Council of Chief State School Officers (CCSSO), and state boards of education).

In the absence of national policy, we issue a call for school leaders to be empowered to make a school's local ecosystem and the school's sustainable place within it the teaching mission. Should those leaders be in a position to connect this teaching mission with applicable leadership standards, a future study would assess the impact of this connection on these principals.

The Ecoliterate School, High-Stakes Testing and Environmental Crisis

We recognize that the potential deal breaker for the ecoliterate principal is the specter of high-stakes testing. A school mission of ecoliteracy might be compelling, but perhaps difficult to view as helpful when facing the present reality that staffing and funding are strongly tied to testing "achievement." We assert that what is helpful is a matter of context. The current American high-stakes testing milieu is the result of a pedagogy of economics. Business interests have a strong hand in educational policy (e.g., The Business Roundtable, 2018); schools are sites for economic renewal (Hutchison, 1998); and children "learn to earn" (Feig, 2004, p. 2). In the pedagogy of economics, the Earth environment is not intrinsically valuable. It simply contains extractable resources to fuel economic success. Anecdotally, many school leaders and other educators express a desire to change or even eliminate the high-stakes testing culture in public schools. We suggest that this kind of paradigm shift is so vast and so fundamental that it could only be precipitated by an external catastrophe. The time is ripe for such a catastrophe—one driven by environmental crisis.

Catastrophic environmental crises driven by global change are imminent. No actual, legitimate doubt about this exists among Earth scientists. Global mean sea level rise has accelerated (Dieng, Cazanave, Meyssignac & Ablain, 2017); human population increases to 8-10 billion by 2050 (Lutz & KC, 2010) will lead to food shortages and biodiversity losses (Crist, Mora & Engleman, 2017); climate warming is increasing desertification and drought frequency and intensity (Huang, Yu, Guan, Wang & Guo, 2016). Communities and their schools in sensitive locations (e.g., on the edge of a shrinking aquifer) will be disproportionately harmed by environmental change. The pedagogical culture of high-stakes testing is not concerned with any of this. Ecoliteracy, however, is a pedagogy deliberately built to do so. The four principles of environmental justice, interconnected systems, deep time and stewardship explain day-to-day life in the building as that life is impacted by environmental crisis. The principles of ecoliteracy underscore how the high-stakes testing climate punishes schools that are environmentally vulnerable.

In many communities, schoolchildren face food shortages, pollution-related illness and lack of access to clean water. In places like Flint, Michigan, these are issues of environmental justice (Butler, Scammell & Benson, 2016). These issues can reduce a school's standardized test achievement, and the high-stakes testing culture responds by punishing those schools. Global climate change will exacerbate environmental justice problems and spread them through

interconnected systems. The more environmental injustice schools experience, the more they will be punished.

Earth processes operating far away from a school can affect its community, because natural processes are interconnected over large distances. For example, temperatures have risen globally, causing Pacific Ocean water to warm; warmer ocean water causes more rain in the U.S. to fall in the winter than in the summer; U.S. grasslands experience drought, which dries up aquifers (Volder, Briske & Tjoelker, 2013). The community on the edge of this aquifer—and its schoolchildren—is now in a water crisis. Lack of access to water impacts the health and wellbeing of schoolchildren, and their test scores drop. The high-stakes testing culture punishes the school.

Environmental changes are gradual and incremental—they are deep-time processes, taking longer than a typical generation. Environmental systems are interconnected and can only be fully understood through a holistic approach. Standardized tests can measure facts-based knowledge, but how well do they assess holistic, iterative understanding? If justice, interconnection and deep time resist testing, then they will not be tested, and they may not be taught. This is a pre-emptory punishment, because knowledge and information are withheld. If deep-time processes drive the well-being of a community, its school and its children, should they not be taught?

This leads us to the ecoliteracy principle of stewardship. Teaching students how to protect and preserve the environment, and the value of doing so, is both a proactive and reactive response to environmental crisis. Pedagogically, stewardship is the degree of care for the Earth environment. Practically, stewardship of the Earth environment is critical for the future well-being of society. How is stewardship assessed in a culture of high-stakes testing driven by the pedagogy of economics? We argue that ecoliteracy is crucial to individual and societal survival. We advocate for the pedagogy of ecoliteracy to replace the pedagogy of economics, and we call for the end of the high-stakes testing culture. We foresee a time when natural catastrophe will force this this to happen, in some form, and however painfully.

We return to the original question: How is ecoliteracy helpful to the principal now? In the example of the Edible Schoolyard, a revolution took place at the building level, driven by the principal. The deliberate focus on the physical environment improved the school. Ecoliteracy holds the same potential; not as an intervention, like at the Edible Schoolyard, but as a pedagogy that permeates every aspect of the school. This not only includes learning and curriculum, but also school culture, operations, personnel, ethics, external relationships, and leadership vision—elements in which the principal is trained and evaluated. In Michigan and Texas, the codified standards can support the principal whose vision sees ecoliteracy as a social good achieved through education.

Conclusion

As environmental crises encroach ever further into human affairs, schools will likely be both training grounds and battlegrounds for environmental awareness and action. Establishing and sustaining ecoliteracy education in public school settings rests squarely on the shoulders of

principals. They need to be equipped and supported to respond as educators and advocates. In fact, the public school principal may be a community's final bulwark against anti-intellectualism, science denial and environmental crisis in America.

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