

Essential Elements of Sustainability in Teacher Education

Susan Santone

Creative Change Education Solutions

Shari Saunders

University of Michigan

Chris Seguin

Madonna University

Abstract: This article focuses on defining the proficiencies new teachers need in order to be able to lead in—educating for sustainability (EfS). Educating for sustainability involves teaching and learning collective problem solving skills to address critical environmental, economic, and social issues. This article addresses the essential elements of EfS (content knowledge, skills, behaviors, and dispositions) that need to be taught in teacher education programs so that new teachers can lead implementation of EfS with K-12 students. A set of five EfS proficiency areas are identified. For each proficiency area a brief rationale and literature review are provided, followed by traits of teacher education courses that develop the proficiency area. Evidence of these traits tells us when EfS is happening in pre-service teacher education programs. Alignment of each EfS proficiency area to national teacher InTASC Standards concludes each section.

Keywords: Educating for Sustainability, EfS, EfS Proficiencies, Teacher Education

Susan Santone is the founder and Executive Director of Creative Change, based in Ypsilanti, Michigan. A former classroom teacher, she specializes in instructional design and training for sustainability, ecological economics and cultural issues. As head of Creative Change, she has led multiple curriculum reform and teacher education initiatives, working nationally with public schools, universities and nonprofit organizations. She is also an adjunct instructor in Teacher Education at Eastern Michigan University, where she has taught "Schools in a Diverse and Democratic Society" and "Teaching Ecological Economics." Susan has a Master's degree in Intercultural and International Management from the School for International Training in Brattleboro, Vermont.

Shari Saunders is a faculty member at the University of Michigan, Ann Arbor. She works with prospective teachers in the university classroom as well as in school sites. Her primary responsibility is facilitating the development of future K-12 teachers to become empowered educators who are committed to working toward social justice in education. Some of her areas of interest include place-conscious education, restorative justice practices in education, and school lunch reform. She has a Master's degree in Learning Disabilities from Northwestern University and a Ph.D. in Education from the University of Virginia.

Chris Seguin is Associate Professor and Chair of Teacher Education at Madonna University in Livonia, Michigan. Chris' areas of expertise cover the wide region of creative, relation-based teacher preparation, Arts infused teaching for authentic learning and Love Lake Michigan, a nature-based initiative advocating the right for all Michigan youth to experience Lake Michigan to learn, and love, citizen stewardship of the Great Lakes watersheds. Chris earned both the Ed.D. in Curriculum and Instruction and the M.Ed. in Art Education at Wayne State University

Education for Sustainability is a paradigm of education that puts citizenship and the creation of resilient, secure and prosperous communities at the center of teaching practice. This article focuses on defining the proficiencies new teachers being prepared today need in order to be able to lead in —educating for sustainability‖ (EfS). Educating for sustainability involves teaching and learning collective problem solving skills to address critical environmental, economic, and social issues. This article addresses the essential elements of EfS (content knowledge, skills, behaviors, and dispositions) that need to be covered in teacher education programs so that newly prepared teachers can lead implementation of EfS in their schools with K-12 students. The primary target population of the discussion —new teachers‖ are those currently enrolled in college or university teacher preparation programs. They are also referenced here as —pre-service teachers,‖ —aspiring teachers‖ and —teacher candidates.‖

The paper begins with the authors' fundamental understandings about the purpose of schools, teaching and learning. Background is given on the national teacher education standards (InTASC), which must now be met in most states, and UNESCO's Sustainability Teacher Education Initiative (UNESCO, 2005). We then identify a set of five EfS proficiency areas that integrate development of sustainability oriented teaching philosophies, content knowledge, pedagogical skills, assessment and professional development for teachers. For each EfS proficiency area we include a brief rationale and literature review. We then describe the ideal traits of teacher education courses that develop each EfS proficiency area, focusing on course content, pedagogy and assessment approaches. Evidence of these traits tells us when EfS is happening in pre-service teacher education programs. An alignment of each EfS proficiency area to InTASC Standards concludes each section.

Enduring Understandings of Teaching and Learning

As educators ourselves who are teachers of teachers, we believe that developing the ability of citizens to create sustainable, resilient communities—locally and globally—defines the very purpose of schooling. The following fundamental understandings also drive this document:

- ❑ The way to increased prosperity for all citizens is through collectively addressing the critical environmental, economic, and social issues of our local communities.
- ❑ An —effective‖ teacher is one who helps all students achieve high levels of academic success, develops their personal and social wellbeing, and inspires meaningful involvement in their local social, economic and ecological communities.
- ❑ An effective teacher educator is one who prepares teachers to do the work outlined above.
- ❑ In order to be integrated into curricula, EfS approaches must be implemented in ways that meet InTASC Standards; this is creative work for teachers and teacher educators.

InTASC - National Standards for Teacher Preparation

The Interstate Teacher Assessment and Support Consortium (InTASC) is a consortium of 45 states' education agencies responsible for policy oversight of teacher preparation programs, teacher professional development and teacher evaluation systems. Created in 1987 by the Council of Chief State School Officers (CCSSO), InTASC has recently defined standards for what all American teachers should know and be able to do.

These standards are guided by one basic premise: *An effective teacher must ensure all students learn and perform at high levels* (CCSSO/InTASC, 2013). The InTASC Standards focus on skills and knowledge applicable to all teachers' content knowledge, professional practices and ability to serve diverse student needs.

Sustainability-based teacher education aims to develop teacher effectiveness by meeting InTASC knowledge and skill standards in the context of sustainability. This approach is echoed in the teacher preparation competencies defined in UNESCO's Sustainability Teacher Education Initiative (UNESCO, 2005). Because EfS encompasses far more contexts than just the science disciplines, teacher education must embed sustainability principles, knowledge and skill development across a range of courses and field experiences. Teacher education courses can provide opportunities for supporting pre-service educators to become sustainability literate teachers (Nolet, 2009). Given its complexity, only multiple EfS experiences across a teacher preparation programs' courses can achieve the goal of preparing educators to teach from sustainability paradigms.

Sustainability Proficient Teachers

A set of teaching proficiency areas have been identified by the authors. These skill sets are informed by UNESCO outcomes and InTASC standards. The proficiency areas incorporate the essential knowledge, skills and dispositions needed by teachers to educate for sustainability. These include the abilities to:

- A. Clearly state philosophies of sustainable education
- B. Identify sustainability content knowledge
- C. Practice sustainability oriented pedagogy and instructional design
- D. Use sustainability appropriate assessments
- E. Seek professional growth and collaboration as EfS teachers

In the sections below we provide descriptions of each proficiency area with literature references. The traits of teacher education courses that develop each proficiency, emphasizing course content, pedagogy and evaluation are described. We then offer the proficiency area's alignment with InTASC teacher professional development standards.

EfS Proficiency Area A: Stating Clear Philosophies for EfS

This proficiency addresses the relationship and obligation of schooling to the larger community (local, national, or global). (Apple & Beane, 1995). When educating for sustainability, teachers analyze specific aspects of the educational system (policies, resources, curricula (including standards), pedagogy, assessment and evaluation, school climate and more) in ways that consider the social, emotional, and physical health of children and youth, the sustainability of the community and educational equity. In this context, an effective teacher is able to compare the underlying values and assumptions of sustainability with those of other social forces, such as globalization. Teachers educating for sustainability are able to describe how cultural beliefs, values, and philosophical orientations affect progress towards sustainability (Bowers, 1999; Quinn, 1992).

An effective teacher who is educating for sustainability articulates and reflects upon purposes of schooling that integrate democracy and citizenship. The teacher can advocate for policies and practices that support preparing K12 students for their personal, civic and work lives. The teacher understands how philosophical orientations to education and sustainability

influence decisions about curriculum, pedagogy and assessment. Effective EfS teachers can describe the roles of teachers and students when educating for sustainability, as well as the broader purposes of the educational system. In addition, the effective EfS teacher is able to explain the relationship between schools and the community in a sustainable society and can engage in collaborations with others to foster and support K12 students' academic, social- emotional, ethical and physical development.

Teacher Education Course Traits for Developing Area A Proficiencies

Content. Course readings and assignments explicitly explore ethical and democratic dimensions of school and community relations, policies and practices. The pre-service teachers analyze tensions and consequences emerging from differing beliefs, values and philosophical orientations. Topics may include language, identity and notions of —citizenship| (both of students and teachers). (P. Attwood, personal communication, June 16, 2012).

The following polarities may be covered:

- social replication vs. democratic education,
- competitive individualism vs. cooperation and interdependence,
- deficit vs. asset-based thinking,
- structural inequalities vs. systemic efforts to dismantle inequity.

As well, civic engagement, environmental justice, and other issues that affect the interrelated wellbeing of schools, communities, families, children and youth may be explored as pre-service teachers begin to engage in advocacy that contributes to these integrated topics.

Pedagogy. College instructors teach using methods that model democratic practices such as cooperative learning, class-community connections, student-led inquiry, communication forums and establishing the class as a learning community with mutual rights and obligations. Incorporating varied field experiences into courses provides opportunities for pre-service teachers to a). explore the ethical, political and/or social dimensions of authentic community issues, b). examine and critique their own beliefs and practices and the consequences of these, and c). advocate and support equal opportunity for families and children. In addition, aspiring teachers need opportunities for deep analysis of observed inequalities in policies and resulting practices.

Evaluation. Assessment methods are open-ended and require analysis of work with the relevant polarities described above. It is essential to look at how such polarities support or undermine positive, reciprocal relationships among schools, communities, families and children. Formats may include critiques of community research or analysis of participatory action research, as well as assessment of advocacy extended for particular policies or

practices that will contribute to the well-being of children, youth, families, educators, other school practitioners and communities.

Alignment of Proficiency Area A with InTASC Standards

Standard 1 (Learner development). The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and

implements developmentally appropriate and challenging learning experiences.

Standard 2 (Learning Differences). The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard 3 (Learning Environments). The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Standard 9 (Professional Learning and Ethical Practice). The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard 10 (Leadership and Collaboration). The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

EfS Proficiency Area B: Identifying Sustainability Content Knowledge

Sustainability literate teachers can explain how their fields of study relate to key environmental, economic, and social issues within local, national, or global contexts. They are able to conduct analysis of conditions affecting communities using —systems approaches that consider environmental, economic, and social factors. Such analysis is driven by questions such as: *To what extent is a community moving towards or away from sustainability in the areas of food systems, energy, social stability, etc.?* and *How are ecological, economic and equity factors related?*

Educating for sustainability requires trans-disciplinary learning in which students construct and integrate knowledge across disciplines, applying learning to address real community problems (Weiss & Pasley, 2007). A teacher who is effectively educating for sustainability integrates knowledge within and across fields to challenge students to solve complex, real-world issues. The teacher thinks in systems, making connections across time, place and scale.

Teacher Education Course Traits for Developing Area B Proficiencies

Content. An authentic EfS teacher preparation program features course content that engages pre-service teachers in systems' analysis of how their disciplines relate to key environmental, economic, and social conditions/issues within local, national or global communities. Guided by these lenses, content is approached *transdisciplinarily* - framed around problems drawn from the real world, with disciplines integrated to posit possible approaches to creative solutions. A transdisciplinary approach to teacher preparation is characterized by willingness of college education instructors to engage societal problems, with content based on —life as it is being lived and experienced. (Apple & Beane, 1997, p. xi; Hirsch Hadorn et al, 2006; Horlick-Jones, & Sime 2004).

College instructors ground EfS study for aspiring teachers in real-world issues, problems and consideration of what is at stake in terms of community, the environment and social justice. Principles such as equity, democracy and community-based learning guide the ethical applications of knowledge. Sustainability and systems thinking serve as instructional lenses to integrate disciplines and apply the combined knowledge to environmental, economic and equity questions.

Pedagogy. Content is presented in ways that emphasize connections within and across disciplines. Activities engage pre-service teachers in analysis of content from interdisciplinary perspectives and the applications to real-world issues. For example, they may conduct community research on a specific issue and conceptualize how to involve local residents in contributing to solutions. Labs, field placements and other hands-on investigations support this interdisciplinary engaged approach.

Evaluation. Pre-service teachers must be asked to explain or demonstrate how their teaching discipline contributes to an understanding of real-world sustainability issues. Assessments may include rubrics that clarify success with assignments that incorporate interdisciplinary analysis of a local, global or national issue such as energy dependency or community redevelopment, or a literature review that makes connections to other disciplines.

Alignment of Proficiency Area B with InTASC Standards

Standard 4 Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.

Standard 5 Innovative Applications of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

EfS Proficiency Area C: Sustainability Oriented Pedagogy and Instructional Design

Teachers who are educating for sustainability are able to use pedagogical strategies that support the whole child's social-emotional, academic, ethical and physical development. The teacher supports diverse learners, using a range of communication and teaching methods to engage, challenge and support all students. And the teacher conducts

ongoing evaluation of student learning, adjusting instruction as needed.

The complexity of transdisciplinary learning requires instructional design and pedagogy that engages students, and makes interconnected knowledge accessible while challenging and inspiring them to solve real problems. Framing inquiry as a narrative is one approach to transdisciplinary instructional design. In this method, learning unfolds as a —story| driven by questions that emerge through in-depth investigations. With story as the metaphor, students and other stakeholders are characters, communities are the settings, and sustainability challenges form interconnecting plot narratives. Students live and shape the story in a four-stage process that establishes relevance, supports in-depth investigations, and culminates in decision-making and positive action (Creative Change Educational Solutions, 2011).

When educating for sustainability teachers can use a wide range of instructional strategies known to impact student achievement (Marzano, 2003; Marzano, Pickering, & Pollock, 2001).

These include:

- Activating prior knowledge using activities or prompts that situate issues within students' lives and communities.
- Generating hypotheses with inquiry-based lessons that challenge students to develop and test their ideas, use the scientific process and engage in experimental problem solving activities.
- Providing differentiated and culturally-responsive instruction, connecting content to students' experiences as entry points, students learn to communicate and collaborate across multiple cultural contexts (Gay, 2000; Santamaria, 2009).
- Structuring lessons with cooperative learning. Sustainability pedagogy emphasizes interdependence and collaboration arrived at through projects utilizing the core elements of cooperative learning (Sapon-Shevin & Schniedewing, 1991).
- Engaging students in setting goals for real-world applications of learning and generating criteria for success.

When planning instruction an EfS effective teacher will utilize —backwards design| processes (Wiggins & McTighe, 1998) to give lessons and units clear purpose and direction. The teacher meets standards in the context of teaching and learning about sustainability topics in sequenced, developmentally appropriate transdisciplinary units.

Teacher Education Course Traits for Developing Area C Proficiencies

Content. The course challenges pre-service teachers to plan units that engage K12 learners with inquiry-based approaches. The aspiring teacher learns to select relevant sustainability topics to support K12 learners' cognitive, physical and social-emotional development. The —size| of an issue or problem and its geographic/historical/cultural aspects are scaled to K12 learners' developmental readiness. For example, a first grade unit is framed with the question, *How can we make our classroom a healthier place?* instead of,

How can we save the world? Problems are not introduced without engaging students in conceptualizing positive, age-appropriate solutions. Topics for younger K12 students are local, concrete and relevant, with the gradual introduction of more global or abstract concepts as students develop.

Unit construction causes analysis that unfolds as stories about relevant issues. Learning begins by situating students as characters exploring an issue (the plot) set in the community. The —plot thickens as students engage in interdisciplinary investigations driven by the demands of the issue. As the story reaches a climax (*What should we do?*), the pre-service teacher can guide K12 students to apply their learning in the school, community or larger world to create a solution or a segue into a new story. (Creative Change Educational Solutions, 2011)

Pedagogy. The course instructor integrates practical and theoretical aspects of pedagogy, emphasizing effective pedagogy driven by an understanding of learners' cognitive, linguistic, social-emotional, ethical and physical development, as well as the influence of language and culture (K12 students' and teachers'). Teacher candidates learn practical strategies for creating supportive learning environments for all learners. They experientially explore, in the college classroom or the field, topics such as resiliency, student motivation, and social-emotional learning to challenge simplistic pedagogies focused on building self-esteem. They learn to differentiate instruction through nuanced adaptations of content, processes and assessments appropriate to their disciplines and the full range of learners' needs. Teacher candidates review contrasting research on teaching methods in their fields, evaluating for credibility and bias. When appropriate, they analyze pedagogical approaches and their related historical or political dynamics, for example, whole language and phonics or environmental and sustainability education.

The course models multiple instructional techniques while providing opportunities for pre-service teachers to enact, reflect on and evaluate these techniques. Methods may include explaining, demonstrating, facilitating discussions or using adaptations—all in the context of understanding the full range of learners' needs and developmental levels. When applicable, the course includes school field experiences or observations.

Evaluation. Authentic performance with innovative transdisciplinary content and cooperative pedagogies is part of course evaluation. Pre-service teachers receive feedback from instructor and peers. They are challenged with opportunities to reflect on their practice in ways that blend EfS content and pedagogy.

Alignment of Proficiency Area C with InTASC Standards

Standard 1 (Learner Development). The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard 2 (Learning Differences). The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard 3 (Learning Environments). The teacher works with others to create

environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Standard 7 (Planning for Instruction). The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard 8 (Instructional Strategies). The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections and to build skills to apply knowledge in meaningful ways.

EfS Proficiency Area D: Uses Sustainability Aligned Assessment

Because of the hands-on, engaged, project-based learning approaches that can be used in EfS teaching and learning, both formative and summative assessments provide learner engaged feedback on projects. Possible expectations for outcomes are discussed at the front end of projects by all participants; data is sought during projects to affirm, challenge, document or illustrate outcomes and project processes

Teacher Education Course Traits for Developing Area D Proficiencies

Content. Teacher candidates are presented with instruction, planning and assessment exercises that focus on local community, national or global projects. They experience teaching standards as supporting development of K12 learners' understandings of the larger story rather than serving as isolated ends unto themselves. Pre-service teachers select appropriate resources and technology, then plan differentiated instruction and assessment based on the demands of the content and K12 learners' needs.

Pedagogy. The course's instructor models and engages pre-service teachers in multiple instructional design skills, defining and sequencing interdisciplinary —Big Ideas through lenses of sustainability and social justice, aligning these themes to standards.

Evaluation. The college or university instructor and the teacher candidates evaluate planning and assessment of units using rigorous criteria for determining appropriate content, effective sequencing, alignment of outcomes, standards and assessments, differentiation, depth of the sustainability theme, cultural and community connections and effective use of multiple resources and technologies. If applicable, pre-service teachers —publish or share their work through portfolios, course-based or professional conference presentations, blogs, or websites.

Pre-service teachers may also enact lessons in the field and evaluate these based on K12 student outcomes, personal reflections or input from practitioners in the field, for example, supervising or mentor teachers.

Alignment of Proficiency Area D with InTASC Standards

Standard 6 (Assessment). The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide

the teacher's and learner's decision making.

Standard 8 (Instructional Strategies). The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections and to build skills to apply knowledge in meaningful ways.

EfS Proficiency Area E: Professional Growth And Collaboration as EfS Teachers

Central to the work of teachers engaged in EfS is the development of the whole child's academic, social-emotional and physical life while addressing the civic purpose of schooling. Families and community members must play important roles in these processes, with parents engaged in the work of schools. Educators, in turn, must develop and implement curricula that bridges school and home cultures. Schools can help serve the health and social services needs of families with partnerships that bring resources to their communities. Engaged parents and other community members become available to support learning goals (Sanders, 2006) and contribute to school improvement (Oakes & Lipton, 2007). According to Sanders, —community involvement can equip schools to provide students with more relevant, challenging learning opportunities in nurturing environments. (2006, p. 13)

Fostering the development of the whole child requires consistent collaboration among school personnel, family and community members and shared advocacy at multiple levels. As Athanases and De Oliveira (2008) indicate, —advocating for equity begins with a focus on student learning (p. 67). Teachers have an ethical responsibility to advocate for conditions, policies and practices that facilitate the achievement of student learning goals. They can advocate:

- a) for addressing the diverse needs of individual learners,
- b) through their classroom practice,
- c) through their efforts to create positive classroom environments,
- d) by connecting with students' families and directing them, when needed, to appropriate community resources, and
- e) through civic actions and/or testimonies in support of policies that are more likely to facilitate student learning and against those that are likely to hinder it.

Along with a focus on student learning, teachers must reflect on the consequences of their teaching practices, making necessary adaptations to meet students' needs. This can be done through participation in a community of practice or professional learning communities. Ball and Cohen (1999) state,

continuing thoughtful discussion among learners and teachers is an essential element of any serious education, because it is the chief vehicle for analysis, criticism, and communication of ideas, practices, and values. In the education of professionals, discourse serves additional purposes, which are related to building and sustaining a community of practitioners who collectively seek human and social improvement (p. 13).

Ongoing collaboration is necessary for building and maintaining effective EfS practice. An effective teacher educating for sustainability communicates and collaborates with families across community cultures to meet the diverse needs of learners. The teacher advocates for equity and excellence within the school, community, state and the nation. And the teacher engages in on-going reflective collaboration with peers, focusing on the implications of their practice including the ways in which they address the diverse learning and developmental needs of their K12 students.

Teacher Education Course Traits for Developing Area E Proficiencies

Content. The course addresses the cultural contexts that influence the lives of the pre-service teachers and a community's children, including dynamics among families, communities and schools from historical and sociological perspectives. This facilitates the development of contextually responsive practical skills. Pre-service teachers analyze their own cultural backgrounds and how their experiences have impacted their perceptions of youth culture, communities, schools, families and students. They learn skills to communicate and operate in multiple cultural contexts.

Teacher candidates learn that no aspect of teaching is value-neutral, and that —not taking a stand is in fact taking a stand in support of the status quo or present state of affairs. The course helps teacher candidates develop ethical frameworks based on principles of equity, democracy and sustainability, and challenges them to respond to controversies from an ethical framework based on these principles. Course content exposes teacher candidates to aspects of teacher advocacy (defending students' rights, advocating for policy changes, advocating for evidence-based curriculum and pedagogical approaches) as components of ethical practice.

Pedagogy. Course experiences include modeling and extensive classroom practice of engaged, hands-on learning and professional collaboration, creating professional learning communities, communities of practice or school-based leadership teams. These experiences include analysis and in-depth reflection. Course assignments include opportunities for aspiring teachers to interact with families, community organizations or policymakers such as school administrators, school board members or legislators to address issues of sustainability and equity. The course provides occasions for peer collaboration and leadership to model these professional practices.

Evaluation. Teacher candidates' performance outcomes involve leading engaged, hands-on learning using EfS content and pedagogy in ways that meet a wide range of learners' needs. These performances are assessed formatively and summatively. Pre-service teachers can demonstrate leadership and collaboration skills through group projects, action research, case studies, advocacy activities or other authentic tasks that require application of course content.

Papers or other written assignments require students to link their practice to theory, ethics, research and EfS strategies.

Alignment of Proficiency Area E with InTASC Standards

Standard 1 (Learner Development). The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard 9 (Professional Learning and Ethical Practice). The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard 10 (Leadership and Collaboration). The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Conclusions

Preparing future teachers with an EfS framework means engaging them in transformative educational processes so they benefit from transdisciplinary experiential learning. They themselves need to experience new ways of learning and teaching in order to be able to sustainably re- rethink the:

- a) purposes of education and schooling
- b) role and responsibilities of teachers
- c) curriculum
- d) pedagogical practices
- e) assessment
- f) classroom and behavior management
- g) school and classroom climates.

Evidence from application of EfS proficiencies in teacher preparation courses and classroom use is encouraging, with K12 programs led by the authors showing increased academic achievement and student engagement. For example, teachers in a high-poverty district outside of Detroit integrated sustainable food systems into their K-8 curriculum, resulting in increased achievement on targeted state standards. Teachers utilized EfS content and pedagogy as they delivered interdisciplinary lessons on life cycle analysis, regeneration of renewable resources and history of the food system and other sustainability topics.

The authors are deepening their work in these areas, guided by the proficiencies and course traits outlined in this article. It is suggested that incorporating the EfS proficiencies in already existing teacher preparation programs' courses is a reasonable avenue for beginning to implement EfS studies for aspiring teachers. Assessing for evidence of the suggested course traits for developing each proficiency area offers options for augmenting current

program structures. In addition, there is tremendous opportunity to create college or university based professional development programs for already certified teachers that focus on scaffolding their development of these proficiencies in ways that support their teaching and contribute to their learning communities.

References

- Apple, M., & Beane, J. (1995). *Democratic Schools*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Athanases, S. Z. & De Oliveira, L. C. (2008). Advocacy for equity in classrooms and beyond: New teachers' challenges and responses. *Teachers College Record*, 110 (1), 64–104
- P. Attwood, personal communication to S. Santone, June 16, 2012
- Ball, D. L. & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In G. Sykes and L. Darling-Hammond (Eds.), *Teaching as the Learning Profession: Handbook of Policy and Practice* (pp. 3-32). San Francisco: Jossey Bass.
- Bowers, C.A. (1999). Changing the dominant cultural perspective in education. In G. Smith & D. Willams (Eds.), *Ecological education in action: On weaving education, culture, and the environment* (pp. 161-178). Albany, NY: State University of New York Press.
- Council of Chief State School Officers/ (2013, April). The Interstate Teacher Assessment and Support Consortium *InTASC Model Core Teaching Standards and Learning Progressions for Teachers. 1.0: A resource for ongoing teacher development*. Washington, DC: Author.
- Creative Change Educational Solutions (CCES). (2011). *Inquiry as narrative: What story will you and your students shape?* Document posted in CCES' online Curriculum and Resource Center (CRC), archived at <http://www.creativechange.net>.
- Gay, G (2000). *Culturally Responsive Teaching: Theory, Research, & Practice*. New York, NY: Teachers College Press.
- Hirsch Hadorn, G., Bradley, D., Pohl, C., Rist, S., & Wiesmann, U. (2006). Implications of transdisciplinarity for sustainability research. *Ecological Economics*, 60(1), 119–128.
- Horlick-Jones, T. & Sime, J. (2004). Living on the border: knowledge, risk and transdisciplinarity. *Futures*, 36(4), 441–457.
- Marzano, R. J. (2003). *What Works in Schools: Translating Research into Action*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001). *Classroom Instruction that Works: Research-based Strategies for Increasing Student Achievement*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Nolet, V. (2009). Preparing sustainability-literate teachers. *Teachers College Record*, 111(2), 409-442.
- Oakes, J. & Lipton, M. (2007). *Teaching to Change the World* (3rd ed.). New York, NY: McGraw Hill.
- Quinn, D. (1992). *Ishmael: An adventure of the mind and spirit*. New York, NY: Bantam Books.
- Sanders, M. G. (2006). *Building School-Community Partnerships: Collaboration for Student Success*. Thousand Oaks, CA: Corwin.
- Santamaria, L. (2009). Culturally responsive differentiated instruction: Narrowing gaps between best pedagogical practices benefiting all learners. *Teachers College Record*, 111(1), 214–247.

- Sapon-Shevin, M., & Schniedewing, N. (1991). Cooperative learning as empowering pedagogy. In Christine E. Sleeter (Ed.), *Empowerment through Multicultural Education*. Albany: SUNY Press.
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2005). *Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability*. Education for Sustainable Development in Action. Technical Paper N° 2 – 2005. Paris: UNESCO Education Sector.
- Weiss, I. R. & Pasley, J. D. (2007). Teaching Math and Science: Improving Instruction through Local Systemic Change Initiatives. *Phi Delta Kappan*, 88(9), 669–675.
- Wiggins, G. & McTighe, J. (1998). *Understanding by Design*. Alexandria: Association for Supervision and Curriculum Development.