

Growing Our Own: A Case Study of Teacher Candidates Learning to Teach for Sustainability in an Elementary School with a Garden

Joanne Carney
Western Washington University
Joanne.Carney@wwu.edu

Abstract

This case describes how four teacher candidates, placed for a year-long internship in an elementary school with a garden, learned to teach for sustainability. Evidence from the interns' Teacher Work Samples, survey data, interviews, and observational data are used to assess the extent to which teacher candidates demonstrated the knowledge, skills and dispositions to teach for sustainability. This study suggests some of the factors that may increase or decrease the likelihood of preservice teachers incorporating sustainability into their practice: methods courses that model appropriate strategies and materials, field placements where sustainability principles are enacted, and standards that target higher-level thinking and the application of learning.



Introduction

When we think about today's immense ecological and societal challenges—profound climate change, ecological degradation, unsustainable and inequitable global economic systems—it is clear that to be an engaged citizen in the 21st century one will need to be literate in areas related to sustainability. But what does it mean to be sustainability literate? Orr (1992) used the term "ecological literacy" to refer to knowledge, thinking, and values primarily focused on environmental preservation and restoration. Nolet (2009) has identified nine themes that appear frequently in the sustainability discourse; he argues that they may represent the core knowledge, disposition, and thinking associated with sustainability literacy. These themes include:

Joanne Carney, Ph.D., is an Associate Professor in the Woodring College of Education at Western Washington University. She teaches in the Elementary Education Department and the Instructional Technology Program. Her research interests include teacher education and professional development, with a focus on preparing teachers to teach for sustainability and for the integration of technology into instruction.

1) intergenerational perspective, 2) stewardship, 3) social justice and fair distribution, 4) respect for limits, 5) systems thinking and interdependence, 6) importance of local place, 7) economic restructuring, 8) nature as model and teacher, and 9) global citizenship.

Public schools, which have long been charged with the task of educating for citizenship, have significant responsibility for preparing young people to be sustainability literate. This means teacher education programs must attend to the preparation of sustainability literate teachers. In calling for the integration of sustainability education into the preservice preparation of teachers, Nolet (2009) noted: “Part of the work of a professional community engaged in sustainability education is development of rich case studies. The process of developing case descriptions can help the community clarify shared values and norms of practice and provide a vehicle for systematically evaluating the outcomes of a sustainability effort.”

This is one such case study—a descriptive analysis of sustainability efforts at an elementary school where four teacher candidates were engaged in a year-long internship. This research was undertaken as part of a two-year project that investigated strategies for integrating sustainability education into the preservice preparation of teachers. Funded by The Russell Family Foundation, the Sustainability Education for New Teachers (SENT) project was a collaborative effort of the Woodring College of Education at Western Washington University and Facing the Future. Facing the Future is a non-profit organization that develops curriculum materials, teacher resource guides, and a variety of web-based resources focusing on global issues and sustainability (Wheeler & Skelton, 2010).

The goal of the SENT project has been to develop prototype strategies for integrating sustainability education into teacher education programs. This case study sheds some light on some possible strategies and suggests what other factors in a setting may impact teacher candidates’ learning to teach for sustainability.

Research Methods

Case study methods were used to investigate to what extent four teacher candidates might develop the knowledge, skills and dispositions associated with sustainability-literacy during their three quarter internship at Juniper Elementary. The four intern-participants were chosen solely on the basis of their random assignment to an elementary school known to have a garden and various other sustainability initiatives underway. Other participants included the interns’ four cooperating teachers, approximately 20 other Juniper teachers and the school principal, as well as two teacher education faculty members. Although not direct participants in the study, nine other teacher candidates were part of a cohort of 13 completing Teacher Work Samples (TWS) at the same time as the four interns at Juniper, and their TWS were analyzed and compared to the subject group. The comparison group had been placed at schools without a garden and with little or no attention to sustainability.

The following questions provided a focus for investigation:

1. What understandings of sustainability and ideas about how to teach it did interns take with them from their teacher education coursework into this field experience?
2. What are the values, beliefs, and teaching practices of this school’s professional community around sustainability and how did they impact the interns’ curricular

- vision, understandings about their subject area, disposition about teaching and learning, professional practices and practical tools (Hammerness, 2006)?
3. To what extent did interns incorporate sustainability principles into their teaching during the second and third quarters of internship, when they had some autonomy to develop learning activities and units?

In seeking to answer these questions, data were gathered from the following sources: an online survey, focus group and semi-structured interviews, observation of a teacher workshop, observation of interns' teaching, and analysis of interns' Teacher Work Samples (Renaissance Group, 2002).

Learning to Teach for Sustainability in a Teacher Education Program

Western Washington University and the Woodring College of Education might be considered in the vanguard of higher education institutions working for a more sustainable future. WWU is one of only fifty schools nationally to commit itself to whatever measures are necessary to achieve climate neutrality. A student-led Green Power initiative resulted in Western becoming the first university in the country to implement a student fee to offset 100 percent of electrical energy use with the purchase of green energy. Numerous initiatives on campus bring faculty and students together to work for sustainability.

The Woodring College of Education (WCE) has been at the forefront of efforts to integrate sustainability into teacher education coursework. Teacher education programs within the college are strongly committed to fostering economic equity, environmental stewardship and social justice. The Woodring Initiative for Sustainability (WISE) and the Sustainability Education for New Teachers grant (SENT) are among a host of initiatives underway.

Certification Standards for Sustainability-Literate Teachers and Students

The Washington Professional Educator Standards Board (PESB), which has oversight over teacher licensure, has given impetus to the efforts of teacher education programs in Washington State to prepare candidates able to teach for sustainability. The PESB has developed a set of certification standards (Professional Educator Standards Board, 2007) that define essential competencies for new teachers. One of those standards, 5.3.D., states: "All [P-12] students are prepared to be responsible citizens for an environmentally sustainable, globally interconnected, and diverse society." Thus, it is not sufficient for teacher candidates to demonstrate a basic knowledge of sustainability—they must also be prepared to document their students' capacities in those areas.

The capstone performance assessment of the Elementary Education program—a Teacher Work Sample (Renaissance Group, 2002)—is a likely place for interns to document Standard 5.3.D. The Teacher Work Sample (TWS) is a comprehensive performance assessment that requires a teacher candidate to consider contextual factors for a given group of P-12 students, do pre-assessment to identify individual students' learning needs, then plan a 3-4 lesson mini-unit of instruction. During and after instruction, teacher candidates gather evidence of student achievement in order to evaluate the effectiveness of their instruction. This study analyzed lesson planning and student-based evidence in the TWS to determine if and how intern-participants were teaching for sustainability.

ELED Teacher Education Coursework

In trying to identify what factors might be contributing to interns' knowledge and dispositions to teach for sustainability, I began by examining their teacher education coursework. To what extent did the teacher certificate program in ELED address the nine themes Nolet defines as key to sustainability literacy?

Courses in the ELED program emphasize learner-centered, culturally responsive, and standards-based teaching practices. In examining early ELED coursework, I found only one course—Educational Foundations—that incorporated sustainability themes. It appears that, in spite of the college's avowed commitment to sustainability, sustainability principles have not yet been integrated into Elementary Education Department curriculum in any significant way. Of the nine themes identified by Nolet (2009) as foundational for sustainability literacy, four were a focus in the Foundations course:

- Intergenerational Perspective
- Social Justice and Fair Distribution
- Systems Thinking and Interdependence Importance of Local Place
- Economic Restructuring

During the stage of the program when interns are taking methods courses, I anticipated that science methods courses would be likely places to address sustainability. Three of Nolet's nine themes have ecological and/or scientific aspects (i.e., Stewardship, Respect for Limits and Nature as Model and Teacher). Yet in a focus group, interns reported a lack of explicit connections to sustainability in these courses. This may be due to science educators' unwillingness to venture into "values." As one instructor noted: "We recognize that science is an element (a very basic element) of sustainability but science methods is about how to teach science concepts and really, sustainability makes the leap to values—more analogous to environmental education." (This instructor evidently was unaware of research indicating that incorporating values into science education is worthwhile (e.g., Zeidler & Nichols, 2009).

During the first quarter of the ELED year-long internship, a social studies methods course explicitly dealt with sustainability themes under the umbrella of place-based education (Gruenwald, 2003). Because teacher candidates are in one school for the year, it allows for a host of community connections and these interns completed several assignments that drew upon such sustainability themes as Stewardship, Respect for Limits, Nature as Model and Teacher, and Global Citizenship, as they related to local schools and neighborhoods.

Learning to Teach for Sustainability at Juniper Elementary School

Because the beliefs and practices of preservice teachers are powerfully shaped by their experiences during student teaching (Borko & Putnam, 1998; Cochran-Smith, 1991; Feiman-Nemser & Buchmann, 1985), when we assess the likelihood that teacher candidates will implement particular practices in their own teaching, we ought to consider what messages and models they are exposed to in their internship.

The Elementary Education Department places teacher candidates in one school for an internship during the final three quarters of their program, thus intensifying the influence of one collaborating teacher and one school setting for interns learning to teach. During the first quarter of internship, interns take coursework at the university and spend two mornings per week in their P-12 school. During second quarter, interns spend two to

three full days in their school and complete the capstone ELED performance assessment—the Teacher Work Sample. The final quarter is full-time in the practicum school, doing what has been traditionally known as “student-teaching.”

Four ELED interns who were engaged in an internship at Juniper Elementary School (school name and all intern names are pseudonyms) were the focus of this case study. My research on their activities at Juniper began during internship quarter one and continued while I was their instructor for the second quarter Teacher Work Sample course and into their final quarter of full-time internship. These interns, who were all seeking ELED certification, had a variety of majors:

- Katherine—Spanish
- Tanya—Theater arts
- Kyle—English
- Brittany—Sociology

As I observed them in the school setting, I wondered: What might these interns learn about teaching for sustainability in this setting? (As noted in the Methods section, nine other interns in the cohort had been placed at schools without gardens and with little or no attention to sustainability; the Teacher Work Samples produced by this non-Juniper group would be compared to those produced by interns at Juniper.)

For several years, teachers at Juniper, with the assistance of community members, had maintained a school garden and attempted to use it as a teaching tool. This school was chosen for a case study by the Sustainability Education for New Teachers project because researchers theorized that perhaps a school with a garden might be a good place for preservice teachers to learn how to teach for sustainability—and to document promising practices for preparing sustainability-literate teachers. Perhaps at a school where teachers and administrators enacted their commitment to sustainability in such a tangible way, preservice teacher would be exposed to the kinds of practical models they need to teach for sustainability. As Nolet (2009) pointed out, “Because beginning teachers cannot be expected to simply conjure up images of enacted sustainability, they need to interact with tangible examples that support integration of sustainability into their own developing knowledge of practice.” We sought to investigate how the values and images of enacted sustainability in this school might impact the four interns placed there, and whether or not this might translate into their own teaching.

Demographics. Juniper Elementary School is a school of more than 550 students, with approximately four classes of grades K through 5. The median household income of \$72,324 is well above the statewide average of \$49,262. The parents of Juniper school children are generally well-educated—more than half holding bachelor’s degrees or above—and they are highly-involved in school affairs. The percentage of students receiving free and reduced lunch is 23%. Ethnically, the student body is predominantly Caucasian (78%), with small percentages (approximately 5%) of Hispanic, Asian, and Pacific-Islander students.

The garden. The Juniper Elementary garden was begun by a first-grade teacher and parent volunteers three years prior to this research. This teacher was strongly committed to involving parents in the education of their children, and upon hearing that one parent had just completed an advanced composting class, she asked the parent to help her involve the class in planting an organic garden. The school was already participating in a “Food to Flowers” composting initiative with the local refuse company, and so the

first-graders already had knowledge of some sustainability principles. During the garden's first year parent volunteers and teachers used donated materials to build 6 x by 7 raised bed.

Subsequently, the garden received a grant of \$1800 from the local Community Food Co-Op, which allowed volunteers to build another bed, with somewhat better materials, as well as a worm bin and rain barrel. The teacher who had been the driving force in starting the garden left the school, however, and a fifth-grade teacher took primary responsibility, with teachers from grades 1 and 4 peripherally involved.

During the 2007-2008 school year, which is when our interns began working in the school, three teachers were directly involved in the garden. One of these individuals was a cooperating teacher for an intern.

Other school sustainability initiatives. In addition to the garden, there were a number of school initiatives underway in the area of sustainability. These included:

- Food to Flowers (cafeteria composting project)
- Recycling
- Conservation efforts within school (lights, water)
- Letter to parents asking them to turn off cars when picking up children
- Efforts to help students understand their connection to the larger world
- Curriculum units on birds, frogs, and other endangered species
- School service club

Thus, this appeared to be a school community with at least some understanding of sustainability principles and a commitment to teaching elementary students how to be responsible citizens for a sustainable environment.

Sustainability Workshop

During the second month interns were in the school, a representative from Facing the Future presented a day-long workshop for Juniper teachers. The school principal used building professional development funds to pay for substitutes so that more than twenty teachers could attend. Three of the four interns were present—accompanied by their cooperating teachers. The principal also participated.

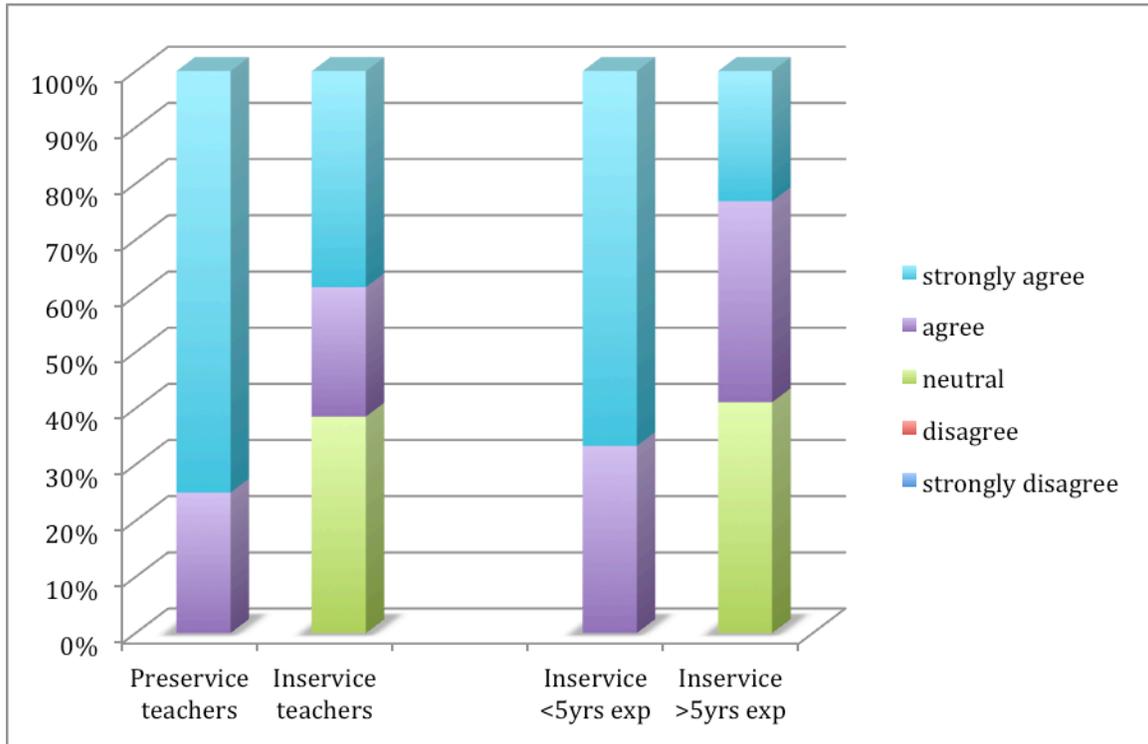
At the workshop, the presenter shared the goals of the project and then led the attendees through a series of learning activities designed to help them develop their understanding of sustainability and introduce them to curricular materials developed by Facing the Future. Each session of the workshop concluded with time for teachers (and interns) to meet with others in their team to make plans for incorporating more sustainability elements into their classroom curriculum. Free curricular materials were provided to each intern and to the school library.

Findings

Having given background information on the teacher education program and the school, I now present evidence in three important areas: 1) intern and teacher dispositions to teach for sustainability as the project began; 2) the extent to which the interns did teach for sustainability—analyzing evidence that they had incorporated sustainability themes into the lessons they taught during their second and third quarter of internship, focusing in particular on the TWS; and 3) interns' documentation in the TWS of P-12 student learning related to Washington Standards.

Dispositions of Juniper Teachers and Interns to Teach for Sustainability

As my research began, I sought to determine to what extent interns and teachers at Juniper were predisposed to teach for sustainability. Twenty-seven of the 28 teachers and interns participating in the project responded to an online survey that included this question prompt: “I am eager to incorporate principles of sustainability into my classroom” (Figure 1).



n = 23-inservice (14 with 5+ yrs of experience, 4 with -5 yrs of experience); **4-preservice**

*Figure 1:
Eagerness to incorporate sustainability principles into teaching*

Note that 100% of the intern-participants agree or strongly agree with a statement expressing eagerness to incorporate principles of sustainability into their teaching. Inservice teachers with less than 5 years teaching experience responded with similar eagerness. Teachers with more than 5 years experience, on the other hand, are more cautious—with 41% of them indicating a “neutral” stance. Yet, even among the veteran Juniper teachers, 59% indicated they agreed or strongly agreed with this survey statement intended to measure dispositional willingness to teach for sustainability.

As the teacher candidates engaged in their subsequent internship, I looked for evidence that they were doing what they had indicated they were eager to do—incorporate sustainability into their teaching. One important source of data were the interns’ Teacher Work Samples, since the TWS document the interns’ most significant unit of instruction during the second quarter of internship, and the TWS provide rich evidence of intern planning and evidence of their impact on P-12 student learning

Interns' Second-Quarter Teaching

During second quarter interns' teaching opportunities are rather limited because they spent only two or three days per week in the school; however, they do develop one mini-unit (three-four lessons) as the ELED program's capstone Teacher Work Sample.

Two of the four interns at Juniper included sustainability elements in their TWS units: Katherine used *Facing the Future* curricular materials in a unit on butterflies and Tanya made connections to the garden in her science unit on systems. The other two interns did their Teacher Work Samples in mathematics and made no connections to sustainability. Although it may not seem significant that two interns included sustainability elements in their second quarter teaching, it should be pointed out that no other interns in their cohort of 13 addressed sustainability in their TWS units.

Katherine—How are members of an ecosystem connected? Katherine was assigned to a veteran second grade teacher at Juniper. She accompanied her cooperating teacher to the Facing the Future workshop, where they were given, *Teaching Global Sustainability in the Primary Grades: A K-4 Curriculum Guide* (2007). Later, Katherine used an activity from this text in her TWS unit, using it to achieve the following learning goal:

LG1: Taking one ecosystem member, students will correctly identify at least 75% of the relationships that the given member has with nine other possible members. To reach this goal, students will participate in an ecosystem simulation activity. During this activity, students act like a certain member of the ecosystem and try to find others that they depend on. We will complete a visual of these connections on the board and explore the significance of each. Students will then complete a worksheet with the ten members shown and draw arrows to show the relationships between each.

In explaining the appropriateness of this learning goal in her TWS, Katherine makes the connection to sustainability principles: "It is important for them [students] to learn that butterflies (and animals in general) depend on other things to survive and that those things depend on others. Teaching this idea that everything is connected is an important concept for students to have if we want them to be environmentally conscious."

In the curriculum used for second grade throughout Juniper's school district, the butterfly life cycle is taught in isolation from the butterfly ecosystem. Yet Katherine was able to draw upon what she had learned at the school's sustainability workshop and the curricular resources received there, to teach about butterflies in an ecological context and with the intent to make her students more environmentally conscious.

TWS evidence of student learning. Katherine analyzed student learning for Learning Goal 1 and presented a graph to show the results (Figure 1). Katherine's analysis:

The following bar graph shows assessment results for five students' performances on the pre, formative, and post-assessments designed to measure student progress toward LG1. The pre-assessment was written and oral, the formative assessment data is taken from the worksheet in appendix C, and the post-assessment is taken from the Ecosystem Post-Assessment in appendix D.

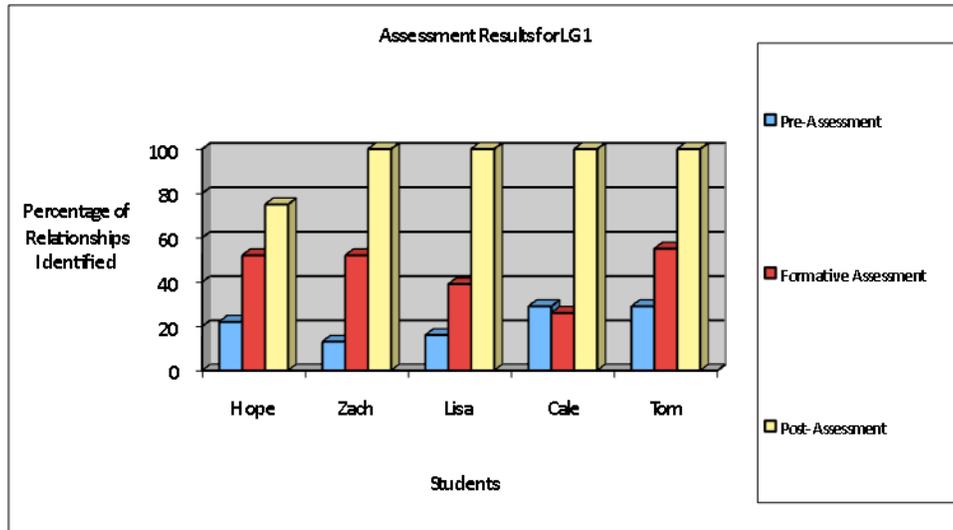


Figure 2:
Assessment results for LG1

According to the above data, all five students performed well below the standard set in LG1 on the pre-assessment. The formative assessment shows improvement towards meeting the goal in four out of five students, but none of them were able to identify 75% of the relationships yet. The post-assessment results show that all five students met the learning goal, and four surpassed this goal, identifying 100% of the relationships. My modification to the original design for instruction of having students work with only one ecosystem member for the post-assessment may be the explanation for this huge jump. If so, it seems to have worked well.

Yet in reflecting on the effectiveness of her instruction and identifying next steps, Katherine identifies the essential understandings her students still need to develop: All of the students met the learning goal, so they are probably ready to move on and use their knowledge in different situations. To really reinforce the idea that ecosystem members are interconnected, I might next have students transfer their knowledge to a new ecosystem. They could work with different members and think about how the members are connected. Something else that might help develop their understanding of ecosystems would be to have them look at the effects of having an ecosystem member disappear.

Katherine recognized that her goal wasn't simply to have her students be able to identify relationships in one particular ecosystem, but to achieve a deeper understanding about the interconnectedness of life.

Summary: Evaluating Katherine's TWS unit. Katherine was clearly influenced by the sustainability workshop and *Facing the Future* (2007) curricular materials. An important element of her unit was the ecosystem simulation adapted from the *Teaching Global Sustainability in the Primary Grades* text. She

used the simulation to ground student learning about butterflies in an ecological context. It is also noteworthy that Katherine's learning goals include the higher-level thinking task of application: to apply what they have learned about scientific diagrams to graphically represent ecosystem relationships.

I found it interesting to compare Katherine's approach to the butterfly unit with a similar unit being taught by another intern, whom I will call "Briana," who was teaching simultaneously in a second grade at a different school—a school without a strong emphasis on the environment. The unit taught by Briana did not include any connections to the butterfly's ecosystem and her learning goals were significantly less complex—most of them at the knowledge and explanation level of cognition. Briana's students were asked to identify and order the four stages of butterfly metamorphosis, explain the purpose and importance of each stage of a butterfly's life cycle and ask questions about butterflies to guide further investigation. Without access to appropriate curricular materials, Briana seemed to lack both a vision for how she might teach about butterflies in an ecological manner, and practical strategies for doing so.

Yet a teacher education program charged with documenting WA Standard 5.3.D., must consider whether Katherine's TWS contains evidence that her students "are prepared to be responsible citizens for an environmentally sustainable, globally interconnected, and diverse society." Although she presents quantitative assessment data that students at the end of her unit were able to identify at least 75% of the relationships of a given organism in a meadow ecosystem, this outcome would indicate the development of only some very basic ecological knowledge, not the full achievement of Standard V criteria. It is certainly a start for these second graders, but our evaluation of their understanding is limited by the rather low cognitive level of Katherine's goals and by a lack of student work samples.

Tanya—How are organisms systems? Tanya was assigned to a fifth grade classroom in the portable immediately adjacent to the school garden. Tanya's cooperating teacher was the individual most directly involved in garden maintenance, and she was able to make regular curricular connections with the garden.

Tanya's TWS unit was adapted from the Science *Environments FOSS Kit* (Delta Education, 2005) designed for 5th grade. The unit's first two unit learning goals were related to sustainability and built upon prior knowledge derived from the garden:

Learning Goal 1: *Students will be able to define and give examples of a system.* Currently most students can formulate a definition and give an example of a system due to their prior knowledge and experience in the class garden. Students also have great familiarity with the water cycle, so they have drawn connections from the definition of a cycle to the definition of a system. The majority of the students can only name one system and are unable to apply their definition in different experiments or other systems.

Learning Goal 2: *Students will name the different components and explain the interconnections of a system.* Students have some prior knowledge for this learning goal since they have been able to see how

organisms in the garden have responded to their care and hard work, and also their reactions to weather changes. Previous lessons have informed them about plant care and students have been able to list the different components that keep plants healthy, and explain how these components connect to each other. Students have experience with this one system, but do not have the practice of transferring this knowledge of systems to other areas of science.

Note how each of Tanya’s learning goals relies upon prior knowledge developed through the school garden: the water cycle, weather, and other interconnected components responsible for plant well-being.

TWS evidence of student learning. In interpreting her assessment data related to learning goal one, Tanya charted data showing that “All students were able to give one example of a system when starting the unit and by the end all of the students could name at least three examples of a system.”

Learning goal 2 was more complex—requiring students to explain interconnections within systems. Tanya evaluated students’ abilities to explain these systemic connections by means of a performance task: Students drew posters that showed the components of a system and explained the connections. These posters were evaluated by means of a rubric checklist, with criteria for content, quality and effort/creativity. Tanya charted student progress towards achievement of Learning Goal 2 in Figure 2:

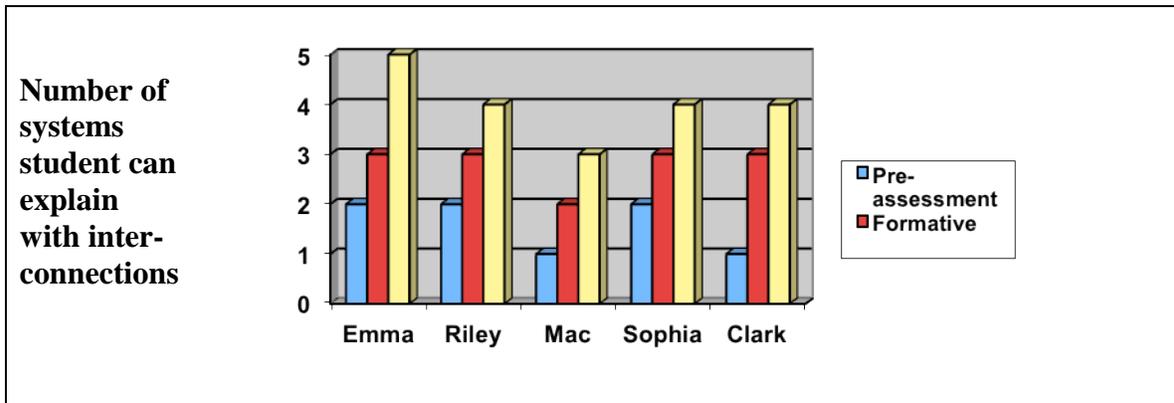


Figure 3:
Number of systems students can explain with inter-connections

Summary: Evaluation of Tanya’s student-based evidence. Tanya seemed to have benefitted from students’ prior knowledge of systems derived from the garden, but her two sustainability-related learning goals, while appropriate for her unit, are relatively limited—both addressing lower-level cognitive skills like knowledge and comprehension.

Unfortunately, Tanya’s student assessment data, like Katherine’s, does not provide sufficient student-based evidence to demonstrate Standard 5 competencies. Tanya did not include any exemplars of the posters students created as their culminating assessment for learning goal 2, and provides no evidence of their thinking, so it is difficult to make judgments about the extent to which her fifth-grade students are “prepared to be responsible citizens for an environmentally sustainable, globally

interconnected, and diverse society” (PESB, 2007). Tanya’s analysis of student assessment data related to learning goal 2, focused on the relatively low-level skills of identifying examples of systems and explaining the interconnections of a system.

Interns’ Third-Quarter Teaching

To what extent did these four interns incorporate sustainability principles into the lessons they taught during their third quarter of internship—which included at least three weeks of full-time teaching and primary responsibility for all lesson planning? Interns reported that they did indeed do some teaching for sustainability. Tanya did team-teaching of a number of lessons focused on sustainability with her cooperating teacher; she also reported that they also did practical work on the garden with their students:

In my final quarter of my internship we defined sustainability more thoroughly. We talked about the three spheres of sustainability, weeded and covered the garden with dry leaves for the winter, did a sustainability trivia game, read the book *If the World Were a Village*, took a fieldtrip to the water waste treatment plant. We also learned about the different types of energy and groups of four presented the pros and cons of each. The trivia game we played and the book we read really helped to make students realize how much of the world’s resources the U.S. receives.

Tanya and her cooperating teacher also made use of *Facing the Future* curricular materials—a simulation referred to as “Fishing for the Future” (Facing the Future, 2010). Tanya tells what this simulation involves:

For the Fishing for the Future simulation students had to catch so many fish to survive but the fish that were left in their ocean could only reproduce a given number so eventually if certain fisherman got greedy then the ocean’s fish population died and the people would have to go to other oceans, eventually causing extinction. This promoted the idea of respect for limits and stewardship. The students understood how greediness can cause problems for other parts of the world as well. We talked about examples of tragedy of the commons locally-- parks/recreation areas etc. We also talked about what changes the students could make in their own lives. We talked about how they could be more "green" in their living and what they would actually *do*, not just say they would do.

Note how these teachers made local connections and taught students how they might make changes in their own lives.

Two of the other interns also reported teaching a unit related to sustainability themes during third quarter internship, one of which seemed rather accomplished. Kyle was able to implement a unit on the watershed he had previously developed as an assignment for his social studies methods course. He explains:

I was able to bring the stewardship strand into many of my science lessons concerning water quality and drinking water in Bellingham. I was able to inform the learners about things they and their family do that may affect drinking water. It was also easy to bring in pieces about place in Bellingham. I created a mini-unit on the estuary and was able to back up the great information they received on their field trips with some

ideas about the importance and fragility of an estuary. I introduced a paper and pencil model to show how bio-diversity protects species from disease, and how less diverse areas such as estuaries require greater care and stewardship to maintain.

Place-based education was an important focus in Kyle's social studies methods course, but we should note also that this approach was also emphasized at Juniper—there had been previous field trips to the lake which provides drinking water for the community and to a local water treatment facility.

The other unit taught by an intern during third quarter was a unit on soil. In teaching this unit, Katherine used prepared materials from the district's science curriculum. Despite teaching about soil and "how it can be different in different places," she did not take children out to the school garden and, indeed, made no explicit connections to the garden or to principles of sustainability—an omission that is difficult to understand—unless one considers the time constraints teachers and interns were operating under late in the school year.

Discussion

Do these findings suggest that the teacher candidates in this study had become sustainability literate as a result of their teacher education coursework and internship? Were the values, beliefs and teaching practices of Juniper Elementary conducive to teaching for sustainability? To what extent did they receive tangible examples of sustainability they could integrate into their own developing knowledge of practice?

It does appear that three of the four interns demonstrated at least some of the attributes of sustainability-literacy—demonstrating a limited ability and dispositions to incorporate sustainability themes into their teaching. We must qualify this claim, however, by noting that we do not know to what extent the interns are able to teach for sustainability independent of their cooperating teacher; the one intern who did the most extensive teaching for sustainability (Tanya) did so under the auspices of a teacher who was already actively involved in incorporating principles of sustainability into her classroom curriculum and who was willing to commit a good deal of time and effort into maintaining a school garden. Kyle was able to teach his water quality lessons in part because his teacher had previously instituted a field trip and other learning activities related to water, and his unit was easily incorporated into existing classroom practice.

Values, beliefs and practices conducive to teaching for sustainability

How did the values, beliefs and practices in their internship placement contribute to interns' willingness to teach for sustainability? In this setting, interns were exposed to a school culture that generally had values in accord with sustainability; they also must have received at least tacit encouragement from their cooperating teachers to develop lessons with sustainability elements, since interns have limited autonomy and must have all of their teaching plans approved by their cooperating teacher. Several were also exposed to images of the possible as well as practical strategies for teaching sustainability. For example, Tanya and Kyle clearly benefited from work their cooperating teachers had done previously: each built upon sustainability-related units that had been pioneered by the classroom teacher. Other school initiatives related to sustainability provided additional tangible examples to make sustainability "real" to

elementary students. Facing the Future curricular resources also clearly benefited the interns: both Tanya and Katherine used learning activities from those texts.

Is it significant that this particular school had a garden? Only one of the interns made any curricular connections to the garden—Tanya’s science unit on systems. However, the learning activities she planned for the unit did not involve students in any actual work in the garden; it simply assumed as part of students’ prior knowledge, a familiarity with how organisms in a garden relied upon each other to survive and grow. None of the other interns’ units made any connections to the garden—even units that one might assume could benefit from student knowledge derived from the garden—the units on soil and water conservation. Thus, in this case, there was no “magic” associated with the garden. Inservice teachers themselves reported making few significant curricular connections to the garden, and it was clearly a burden to the teacher who had primary responsibility. In this case, while the garden offered opportunities for interns to teach principles of sustainability, they did not make curricular connections to the garden in their teaching. The Juniper garden was simply one indicator among many that this school had a culture receptive to sustainability education. We ought to ask ourselves then, why teachers didn’t make better use of the garden to teach for sustainability.

Barriers to teaching for sustainability

Although at Juniper Elementary interns were receiving messages that teaching for sustainability was desirable, they were also experiencing the barriers that tend to inhibit teachers from incorporating sustainability into a school curriculum. The interns’ collaborating teachers may have believed it was important to teach for sustainability, but they also believed it was difficult to do so. Survey data indicates that teachers see the barriers to teaching for sustainability as...

- Lack of support from students’ parents
- Lack of support from the administration
- Inability to fit it into the curriculum
- Standardized testing
- Lack of personal knowledge
- Non-applicability to a given subject area
- Time constraints

Figure 4 shows the relative importance of each of these factors, as perceived by the Juniper preservice and inservice teachers, when surveyed in February and June.

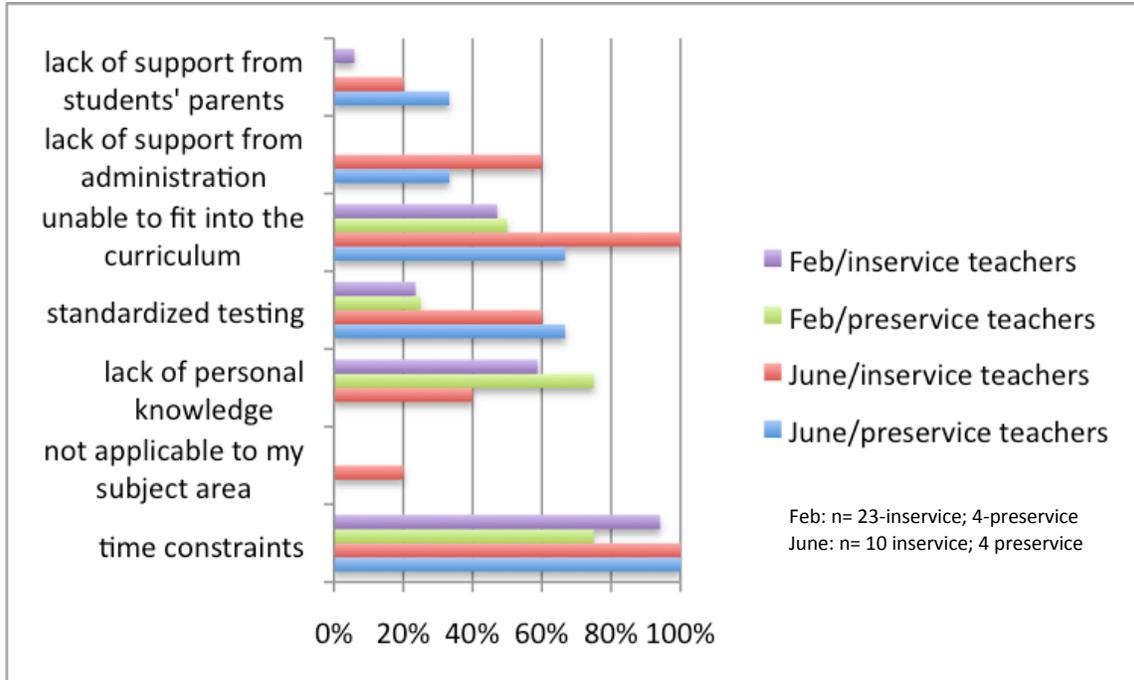


Figure 4:
Barriers to incorporating sustainability education into your classroom

Note how by the end of the year, all of the in-service and preservice teachers indicated that *time constraints* were barriers to incorporating sustainability into their teaching. Closely related are two other factors: *unable to fit into the curriculum*, and *standardized testing*. Many teachers are unwilling to delve too deeply into sustainability themes out of a concern that by doing so they might not be able to cover required curricula and leave their students and themselves vulnerable on standardized testing. Clearly teachers and interns were finding that no matter how desirable it might be to teach for sustainability, it is difficult to fit it into the curriculum. Perhaps this is why Katherine, in teaching a unit on soil during the late spring, chose not to take her second grade students out into the garden for some experiential learning—she may have felt there wasn't sufficient time for it.

Another factor, *Lack of support from administration* was not identified as a barrier to incorporating sustainability in the February survey, yet it was named by 60% of the in-service teachers and over 30% of the preservice teachers in June. When one Juniper teacher was asked why this factor might have been perceived as so much more important later in the school year, she responded: "I would say it was because in February we had that big inservice with the Facing the Future curriculum, but then absolutely nothing happened from then on. No release time, no directives." School administrators are very busy, and, unfortunately, they sometimes fail to follow up on initiatives. Teachers are frustrated by this all-too-common pattern in schools, which tends to allow promising initiatives to wither on the vine.

Limitations of this research

The conclusions we draw from this research are limited by the small number of interns who were studied and its relatively short duration (three quarters). While the

Teacher Work Samples provided rich evidence of the interns' planning and the impact of their teaching on P-12 student learning, evidence from the full-time internship quarter was limited to self-report data. Another important limitation of the study is that all of the data on the beliefs and practices of the collaborating teachers was also self-reported. Despite these limitations, a number of implications can be drawn.

Implications

Since I write from the perspective of one involved in teacher preparation and the focus of my study was on four preservice teachers, I will frame these implications first in terms of what is most important for the preparation of sustainability-literate teacher candidates, and then make a more general statement to suggest how each statement might apply to inservice teachers:

1. Sustainability principles need to be an explicit part of the regular curriculum in teacher education coursework.

The **preservice teachers** in this case were not explicitly taught methods for teaching sustainability principles and how to incorporate them into P-12 curriculum. Teacher education programs need to examine their curriculum in methods courses, in particular, to make sure that teacher education candidates are shown models for how sustainability might be integrated into various subject areas at particular grade levels. With all the forces constraining their time and autonomy during field experience, and insecure in their own professional knowledge, interns are most likely to teach for sustainability if they have access to quality materials that give them practical ideas for learning activities. This was clearly true for Katherine and Tanya.

Inservice teachers also need explicit, practical models for how to teach for sustainability and professional development that will teach them to how integrate sustainability into their curriculum. As the Juniper teachers report, many (40%) feel they lack the personal knowledge to teach for sustainability and even larger percentages feel constrained by curricular mandates and high-stakes testing.

2. Preservice teachers benefit from field experience in schools where sustainability principles are enacted.

Preservice teachers receive powerful messages about what is desirable and practical for teaching in the schools where they do field experiences—especially extended internships near the end of their teacher preparation. Juniper Elementary had some limitations, as do all school settings, but in general, as the inservice teacher survey data and many ongoing sustainability projects indicate, Juniper teachers modeled a commitment to sustainability principles. This positive environment enabled the interns to experiment with lessons that included sustainability themes—even in their relatively high-stakes Teacher Work Sample unit.

Inservice teachers also benefit from school environments with values and beliefs conducive to sustainability, yet they do not always receive support from administrators to implement those values and beliefs. If we expect teachers to incorporate sustainability principles into their curriculum and teaching practices in significant ways, administrators and district policies will need to provide consistent, long-term support for their efforts.

3. Preservice teachers need to be taught how to target higher-level thinking in learning goals and to collect evidence that P-12 students are developing the complex affective dispositions and problem-solving skills necessary to act for sustainability.

The **preservice teachers** in this case who documented positive impact on student learning in their TWS had focused on relatively low-level cognitive skills. They also gathered limited student-based evidence of learning in the form of work samples or other complex performances of understanding. Recognizing this, teacher educators might prompt interns who incorporate sustainability to tap into higher levels of affective and cognitive learning. This would be necessary to document the higher-level criteria in Washington’s Standard 5, for example.

Inservice teachers must also be prompted to target higher-level thinking and understanding in teaching for sustainability. Washington State has implemented standards to define such outcomes for P-12 students (Wheeler, 2009) as have other states and national bodies (e.g., NAAEE, 2004).

Conclusion

Despite the challenges in learning to teach for sustainability, on the basis of this case, we can say that in a school setting with values supportive of sustainability, images for how sustainability might be enacted by teachers and students, and access to appropriate curricular resources, preservice teachers will make the attempt to teach for sustainability. Whether these efforts will be sustained as the interns move into their own teaching careers in other schools, we do not yet know. More research is clearly needed, especially investigations to determine what types of professional development are most effective in prompting teachers to incorporate sustainability into their instruction. We also need research to explore the entire phenomenon of school gardens. What factors make school gardens, or any other experiential learning opportunity, more or less likely to be used for powerful teaching and learning about sustainability?

The four interns who learned to teach for sustainability in a school with a garden are now practicing teachers, but the work of “growing our own” sustainability-literate teachers continues.



Works Cited

- Borko, H., & Putnam, R. T. (1998). The role of context in teacher learning and teacher education. In Various (Ed.), *Contextual teaching and learning: Preparing teachers to enhance student success in and beyond school*. Columbus: Ohio State.
- Church, W. & Skelton, L. Emerging visions of sustainability education. *Journal of Sustainability Education, 1*, May 2010.
- Cochran-Smith, M. (1991). Reinventing student teaching. *Journal of Teacher Education, 42*(2), 104-118.
- Delta Education. (2005). *FOSS K-6 complete modules*. Berkley, CA: Delta Education.
- Facing the Future. (2007). *Teaching global sustainability in the primary grades: A K-4 curriculum guide*. Seattle: Facing the Future.
- Facing the Future. (2010). *Making Connections: Engaging Students in Language, Literacy, and Global Issues*. Seattle: Facing the Future.
- Feiman-Nemser, S., & Buchmann, M. (1985). Pitfalls of experience in teacher preparation. In J. Raths & L. Katz (Eds.), *Advances in Teacher Education, (2)*, 61-73. Norwood: Ablex.
- Hammerness, K. (2006). *Seeing through teachers' eyes: Professional ideals and classroom practices*. New York: Teachers College Press.
- NAAEE. (2004). *Excellence in Environmental Education Guidelines for Learning (K-12)*. Washington, DC: North American Association for Environmental Education
Retrieved from: <http://www.naaee.org/programs-and-initiatives/guidelines-for-excellence/materials-guidelines/learner-guidelines>
- Nolet, V. (2009). Preparing Sustainability-Literate Teachers. *Teachers College Record, 111*(2), Retrieved from <http://www.tcrecord.org>
- Orr, D. (1992). *Ecological literacy: Education and the transition to a postmodern world*. Albany, NY: SUNY
- Professional Educator Standards Board. (2007). Standard V. Retrieved 12/1/10 from: <http://www.k12.wa.us/certification/ProfEd/default.aspx>
- Renaissance Group Teacher Work Sample Consortium. (2002). Teacher Work Sample: Performance Prompt, Teaching Process Standards, Scoring Rubrics. Retrieved 12/01/10 from: <http://edtech.wku.edu/rtwsc/resources.htm>
- Wheeler, G. (2009). *Washington State K-12 Integrated Environmental and Sustainability Education Learning Standards*. Olympia: Office of the Superintendent of Public Instruction, Retrieved from <http://www.k12.wa.us/EnvironmentSustainability/Standards/default.aspx>
- Zeidler, D. & Nichols, B. (2009). Socioscientific issues: Theory and practice. *Journal of Elementary Science Education, 21* (2), 49-58.