Integrating Sustainability Education into the University Pre-Service Elementary Teacher Curriculum through the Use of School Gardens

Introduction

This curriculum is intended to provide pre-service elementary school teachers a sustainability learning experience in sustainable agriculture through the use of school gardens. Using predominantly experiential learning, pre-service teachers will develop the necessary skills to educate future generations about sustainable agriculture, food systems, and sustainability (see Figure 1) as a general concept.

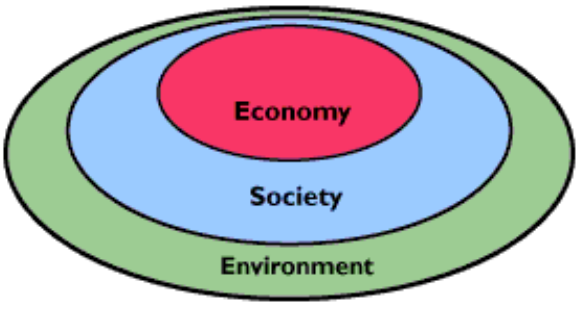

Figure 1. Sustainability as three concentric circles (Hart, 2000).

What is the Curriculum Design?

This curriculum was developed based on the information gathered through the literature review and suggestions from experts in the field of elementary education, food systems and sustainable agriculture. Each lesson plan reflects the value of sustainability education in higher education. The curriculum is also experiential and active, focusing on gardens as a lens through which pre-service elementary education teachers can develop their own sustainability-literacy, while also developing their ability to teach about sustainability.

The lesson plans in this curriculum were design using the Backward Design model (Wiggins & McTighe, 2005) (see Figure 2). This model begins by identifying the goals and objectives of a particular lesson. Next, the desired results of the lesson are identified. Lessons are then designed with activities that promote the intended knowledge of the lesson. Several theories, including constructivism, experiential education, multiple intelligences, and place-based learning, were used to frame the design of this curriculum. Insights provided by the emerging field of educational neuroscience have also been integrated into the curriculum.

Content Standard(s):	
Understanding (s)/goals:	**Essential Question(s):**
Student objectives (outcomes):	
Performance Task(s):	**Other Evidence:**
Learning Activities:	

Figure 2. Backwards Design blank template (Wiggins & McTighe, 2005).

Who is this Curriculum for?

This curriculum is designed for pre-service elementary education students in their junior year in a science education class, participating in a National Council for Accreditation of Teacher Education (NCATE) accredited teacher education program at a four-year university providing a program to license elementary school teachers. Although the curriculum is designed for science education courses, it is intended to provide students with an interdisciplinary experience. The curriculum is broad enough so that it can be easily amended and applied in other subject areas. The curriculum should be used with pre-service teachers prior to their student-teaching experience, generally in their third year of an education program. This curriculum aims to enhance pre-service teachers' understanding of sustainability education and sustainable food systems so that they may apply what they've learned to their student teaching experience.

What are the Outcomes?

The measures are divided into short-term, intermediate and long-term outcomes. The short-term outcomes of this curriculum include changes in the knowledge, awareness, skills and attitudes of pre-service teachers. Project participants will:

- Gain knowledge of the concept of sustainability (the balance between environment, society and the economy) through experiential learning.
- Explain the role of gardens in sustainability education.
- Apply their knowledge of elementary education to an experience with sustainable agriculture through school gardens.

The intermediate and long-term outcomes measures are not assessed as part of this curriculum. The intermediate outcomes include changes in the behavior and practices of pre-service teachers by:

- Demonstrating the use of a school garden to integrate teaching of sustainable agriculture concepts and practices with student learning in health, language arts, math, science, and social studies.
- Using school gardens to engage K-12 students in active learning about the ecological principles, knowledge, and skills related to specific sustainable agriculture practices (i.e. holistic planning, organics, integrated pest management, etc.).

The long-term outcomes of training pre-service teachers about sustainable agriculture school gardens, as a vehicle to actively engage students, would be expected to include:

- Successful and ongoing education of K-12 students through the use of sustainable agriculture concepts and skills integrated with major subjects areas.
- Teachers, students, and the community will increase their understanding of the importance of sustainable agriculture to their personal and their communities' health.

How to Present this Curriculum

The goal of this curriculum is that it will be integrated into existing pre-service teacher education courses. The assumption is that the institution through which this curriculum will be presented (four year accredited university) will have access to garden facilities both on or near campus and in the surrounding community. The curriculum should be implemented in either late spring (to accommodate planting experiences) or early fall (to accommodate harvest experiences).

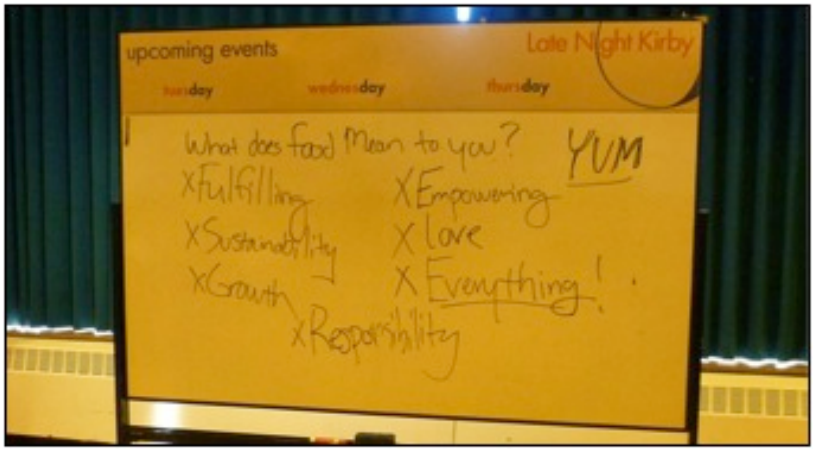

Figure 3. Photo of the "What does food mean to you?" brainstorm activity from a field test of this curriculum.

This curriculum is designed for both in the classroom and in the field. Many of the activities included in the curriculum are designed for use in the college classroom.

However, some of the activities, such planting, harvesting, and field trips, must take place outside the classroom (e.g. a garden site). The components of this curriculum include local experts, in-class discussions and activities, field experiences, and a field trip to local farms.

This curriculum has one unit and is comprised of four lesson plans, which focus on teaching about the concept of sustainability through gardens. The lessons plans within this curriculum area designed to be implemented and completed within four, three-hour class periods. The first lesson is designed to take a minimum of 2 hours including breaks. The other three lessons are designed to take 3 hours including breaks, as these lessons include time both in and outside of the classroom. The lessons are presented in the following sequence:

1. Introduction to sustainability with guest speaker (2 hrs including breaks and transitions)
    a. Introduction to Sustainability (50 min)
    b. Guest Speaker and conclusion (50 min)
2. Introduction to School Gardens (3 hrs including breaks and transitions)
    a. Benefits of teaching through a garden (50 min)
    b. Logistics of school gardens (50 min)
    c. Lesson plan development (50 min)
3. Garden Field Experience (3 hrs including breaks and transitions)
    a. School Garden Review and Exploration Activity (50 min)
    b. Lesson plan teaching and discussion (50 min)

c. Site Design and Planting/Harvesting (50 min)

4. Sustainable Agriculture Field Trip and Final Discussion (3 hrs including breaks and transitions)

    a. Farm/garden tour (2 hrs)

    b. Final discussion (50 min)

Figure 4. Photo of a team of students creating a school garden lesson plan during the field test of this curriculum.

Both the regular course instructor and guest instructors are intended to deliver the lessons. Guest instructors, including the guest speaker in lesson one, bring thoughts, experience and perspectives of practitioners in the field to the classroom. Students are expected to participate in the training in the same manner as they would during a typical class. Students are asked to be active participants in the learning process (e.g. take notes, ask questions, participate in discussion, complete required assignments).

The majority of the instruction takes place near the classroom location. Additional instruction takes place in the field (field experience and field trip). Field

experiences take place at a garden or farm site, which may not be located in proximity to the regular classroom location. The Field Trip lesson requires travel to several farm and garden sites. Additional time may be required to facilitated travel to multiple locations.

Evaluation

Students will be assessed on their understanding of these major themes:

1. What is sustainability?
2. What is a food system, and what does it have to do with sustainability education?
3. What is sustainable agriculture?
4. How can a school garden be used to teach elementary students about sustainability, food systems and sustainable agriculture?

Evaluating the effectiveness of student learning will occur through the following methods:

- Student Portfolio of learning (assignments, journal entries, lesson plan)
- Class discussion and Participation

Required Resources

- Creating and Growing Edible Schoolyards: A How to Manual for School Professionals (http://www.health.state.mn.us/divs/hpcd/chp/cdrr/nutrition/docsandpdf/CreatingandGrowingEdibleSchoolyardsManual.pdf)
- Arden Bucklin-Sporer, A. & Pringle, R. (2010). *How to grow a school garden: A complete guide for parents and teachers.* Portland, OR: Timber Press.

References

Hart, M. (2000). Sustainability as three concentric circles [Figure]. From *A better view of sustainable community.* Retrieved from http://www.sustainablemeasures.com/node/26.

Wiggins, G. & McTighe, J. (2005). *Understanding by design* (2nd Ed.) [Figure]. Alexandria, VA: Association for Supervision and Curriculum Development.

Integrating Sustainability Education into the University Pre-Service Elementary Teacher Curriculum through the Use of School Gardens

Lesson 1: Introduction to Sustainability

Length of Lesson: 2 hours (including Guest Speaker, breaks and transitions)

Lesson Overview: Sustainability is becoming an increasingly important concept for students at all levels. Through the lens of agriculture and food systems, this lesson will provide students with a brief introduction to the concept of sustainability.

- Students will also learn about how sustainability relates to food systems and agriculture from a guest speaker.
- Students will have the opportunity to reflect on their personal understanding of sustainability and how they think sustainability can fit into their future teaching activities.

Lesson Author: Brian Bluhm, 2016
Lesson Topic: Introduction to Sustainability
Length of Lesson: 120 minutes (including guest speaker, transitions and breaks)

<table>
<tr><th colspan="2">Stage 1 – Desired Results</th></tr>
<tr><td colspan="2">NCATE Approved Program Standard(s):

Elementary Education – 5.1 Professional growth, reflection and evaluation

“Candidates are aware of and reflect on their practice in light of research on teaching, professional ethics, and resources available for professional learning; they continually evaluate the effects of their professional decisions and actions on students, families and other professionals in the learning community and actively seek out opportunities to grow professionally,” (Association for Childhood Education International, 2007).

Environmental Education – 2.2 Environmental Literacy of Candidates

“Candidates demonstrate an understanding of the processes and systems that comprise the environment, including Earth as a physical system, the living environment, and human social systems and influences,” (North American Association for Environmental Education, 2007).</td></tr>
<tr><td>Enduring Understandings

Sustainability is the balance and interrelationships between the economy, society and environment.

Sustainability is becoming an ever-increasingly important concept the education of students at all levels.

School gardens are an important teaching tool for about food systems, sustainable agriculture and the concept of sustainability.</td><td>Essential Questions

A. What does sustainability mean?

B. How does the concept of sustainability relate to food systems and agriculture?

C. How can food systems and agriculture be used for sustainability education in the elementary education context? (Central essential question throughout this unit.)</td></tr>
<tr><td colspan="2">Student objectives/learning outcomes

Students will:
I. Define sustainability.
II. Describe how sustainability is an important concept in education.
III. Discuss sustainability education as it can be applied at the elementary education</td></tr>
</table>

level.

IV. Create and communicate a definition of sustainability as it relates to food systems and agriculture.

Stage 2 – Assessment Evidence

Performance Tasks	**Other Evidence**
• Students effectively apply the concept of sustainability with food systems and agriculture. • Students will apply the definition of sustainability to elementary education through a brainstorming exercise.	• Students actively participate in activities • Students actively participate in the discussion on what sustainability is. • Students will journal class applications of how sustainable food systems fit into the elementary education curricula. • Students ask thoughtful questions pertaining to how sustainability can fit into their lives.

Stage 3 – Learning Plan

Learning Activities

1. **Materials and Resources:** Farm to Plate to Farm Game materials (handout A); *Creating and Growing Edible Schoolyards: A How to Manual for School Professionals* (online manual); *How to Grow a School Garden: A Complete Guide for Parents and Teachers* (book); "Sustainability Defined" (handout B); "Sustainability as three concentric circles" (handout C); journal/notebook (for notes to be included in final portfolio assignment)

2. **Timeline:**
   - Introduction to School Garden Unit (5 min.)
   - Farm to Plate to Farm Game (15 min.)
   - Introduction to Sustainability (30 min.)
   - Guest Speaker and Discussion (40 min.)
   - Discussion, Assignment and Conclusion (10 min.)

3. **Introductory activities:**

   What did you eat today?
   1. Ask students what they ate today. Students share ideas. Where does your food come from? How does it get to you? How does food relate to the concept of sustainability? Students share ideas.

2. Briefly describe that the unit will used food systems and agriculture to investigate the concept of sustainability. The outcome will be that they will learn how to use school gardens as a tool to teach about sustainability.
3. Describe the assessment methods for the unit, including journal assignments, sustainable agriculture lesson plan, and reflections (photos, technical resources, teaching resources, ideas for future lessons, etc.) and the final portfolio of work collected during the unit.

4. **Developmental activities:**

Farm to Plate to Farm Game: Systems Thinking

1. Distribute Farm to Plate to Farm playing cards (See Handout A)
2. Ask students to identify how their card fits within the larger food system (from farm to your plate and back to the farm).
3. Ask the students as a group to discuss how they might arrange their card in the wider system. They should be thinking about what it takes to make this process happen. Have students physically arrange themselves in a circle based on their assigned card.
4. Once the students have arranged themselves, have each student read out loud their card. Discuss the cycle, and have students re-arrange according to what the group decides.
5. Once re-ordered, have everyone read their card again (there is not one necessarily correct order, the emphasis is to get students to think about the food system.
6. Reflect as a group on the game. Briefly explain that sustainability is about the interrelationships between environment, society, and economy. The game highlights systems thinking. Have students discuss how the interrelationships of sustainability (environment, society, economy) are reflected in the game.
7. Discuss how food systems can be used to investigate the concept of sustainability.

What is Sustainability?

1. Distribute the "Sustainability Defined" handout (See Handout B).
2. Have students review the definitions.
3. Show students the "Sustainability as three concentric circles" (See Handout C) diagram and discuss.
4. Discuss the definition of sustainable agriculture. According to the Sustainable Agriculture Research Education (2012) organization, sustainable agriculture has three goals:
    a. Profit over the long term
    b. Stewardship of our nation's land, air and water
    c. Quality of life for farmers, ranchers and their communities

5. Discuss the definition of food system: "The food system spans the activities, people and resources involved in getting food from field to plate. Along the way, it intersects with aspects of public health, equity and the environment," (Johns Hopkins Bloomberg School of Public Health, 2010).
6. Journal Activities:
    a. Ask students to write a definition of sustainability as it relates to food systems and agriculture in their journal informed by the "Farm to Plate to Farm" game, "Sustainability Defined" definitions, "Sustainability as three concentric circles" diagram, as well as from their own experiences with the concept.
    b. Ask students to outline why is sustainability education important in elementary education and in their own lives?
    c. Ask students to apply their definition of sustainability as it relates to food systems and agriculture to their own understanding of elementary education and brainstorm appropriate activities.
7. Ask students to group together to discuss.
8. As a large group, ask students to share the highlights of the conversation. Write these highlights on the board or another place all students can see. Take a picture of these highlights for documentation.

Food Systems Guest Speaker

1. Guest speakers can be effective in connecting the concepts of sustainability, food systems and sustainable agriculture to a real-world context. Depending on the course in which this lesson is used, the guest speaker can represent one of many kinds of organizations: local school garden, local community garden program, community health program, STEM education program, etc.
2. Students can also have the opportunity to learn about effective use of guest speakers through this addition to the lesson. This discussion could focus on the following topics:
    a. Steps to identify and invite a guest speaker to present in a classroom.
    b. Providing the guest speaker with a clear explanation of the purpose and context of the presentation, and giving the guest speaker enough to prepare for the presentation (three weeks).
    c. Facilitating the presentation, discussion and/or activities while being aware of time limitations.

5. **Closing activities:**

    a. Conclusion – Review highlights from the conversation.
        a. What is sustainability?

b. How does sustainability relate to food systems and agriculture?
c. Why is sustainability education important in elementary education? How does sustainability relate to your own life?
d. What does sustainability education have to do with food systems and sustainable agriculture?
e. How can food systems and agriculture frame learning about sustainability in the elementary education context?

b. Discussion of Upcoming Sessions: Introduction to School Gardens, Field Experience, and Field Trip
c. Discussion of Assigned Readings:
    a. Online Manual: Creating and Growing Edible Schoolyards: A How to Manual for School Professionals (http://www.health.state.mn.us/divs/hpcd/chp/cdrr/nutrition/docsandpdf/CreatingandGrowingEdibleSchoolyardsManual.pdf)
    b. Book: *How to grow a school garden: A complete guide for parents and teachers. (*Arden Bucklin-Sporer, A. & Pringle, R., 2010)
d. Assignments:
    a. Read the introduction in *Creating and Growing Edible Schoolyards* and the introduction and Chapter One "Why School Gardens?" in *How to Grow a School Garden: A complete Guide for Parents and Teachers.*
    b. *Journal Assignment: Highlights of the section for you as you imagine your future teaching career.*
        i. Why are school gardens important as teaching tools?
        ii. What can children learn through school gardens?
        iii. How can school gardens be used to teach students about sustainability?
        iv. *Reflection on guest speaker: how was this discussion relevant to your future teaching career (to your curricula and to the lives of your students)? What questions do you have?*
        v. *Identify 3-5 local resources for school gardens, sustainable agriculture and sustainability education available to teachers in your area.*
    c. Read Chapter Two "Laying the Groundwork" in *How to Grow a School Garden: A complete Guide for Parents and* Teachers, and read Section One, Two, Seven and Eight of *Creating and Growing Edible Schoolyards* to prepare for discussion in lesson two.

Attachments (Handouts)

- "Farm to Fork to Farm" game cards (see Handout A)
- "Sustainability Defined" (see Handout B)
- "Sustainability as three concentric circles" (see Handout C)

References

Association for Childhood Education International. (2007). *Association for childhood education international elementary education standards and supporting explanation*. Retrieved from http://www.acei.org/sites/default/files/aceielementarystandardssupportingexplanation.5.07.pdf.

Hart, M. (2000). Sustainability as three concentric circles. From *A better view of sustainable community.* Retrieved from http://www.sustainablemeasures.com/node/26.

Johns Hopkins Bloomberg School of Public Health. (2010). *Teaching the food system*. Retrieved from http://www.jhsph.edu/research/centers-and-institutes/teaching-the-food-system/.

North American Association for Environmental Education. (2007). *Standards for the initial preparation of environmental educators*. Retrieved from http://www.ncate.org/LinkClick.aspx?fileticket=Fm%2fqA4uarLk%3d&tabid=676.

Sustainable Agriculture Research & Education. (2012). *What is sustainable agriculture?* Retrieved from http://www.sare.org/Learning-Center/SARE-Program-Materials/National-Program-Materials/What-is-Sustainable-Agriculture.

Additional References

National Council for Accreditation of Teacher Education (NCATE) Program Standards for pre-service elementary education students can be assessed from the following web address:
http://www.ncate.org/Standards/ProgramStandardsandReportForms/tabid/676/Default.aspx

HANDOUT A – Farm to Fork to Farm Game

The Farm to Fork to Farm game provides students with an opportunity work together to determine the yearly sequence of events in a food system. This game be should be used during the "Farm to Fork to Farm Game: Systems Thinking" discussion. Two versions of the game are included. The first version provides students with a general idea. The second version focuses on the yearly sequence of growing tomatoes. The instructor should match the number of cards with the number of students by removing cards or adding additional cards using the blank cards.

Farm to Fork to Farm Game – Version One
Created by Brian Bluhm, 2016
Lesson One

Farmer determines demand for produce	**Farmer determines times to plant**
Farmer creates a budget for the upcoming season	**Farmer purchases seeds**
Farmer purchases compost to improve the soil	**Farm starts seeds in greenhouse**

Farmer prepares the soil	**Farmer plants early season crops**
Farmer waters seedlings	**Farmer weeds around seedlings**
Farmer thins out seedlings	**Farmer waters plants**
Farmer plants late season crops	**Farmer harvests early crops**

Farmer sells early season produce at Farmers Market	**Farmer sells early season produce to Grocery Store**
Farmer harvests late season crops	**Farmer sells late season produce at Farmers Market**
Farmer sells late season produce to Grocery Store	**Grocer displays produce**
Family decides on meal ingredients	**Family purchases produce**

Family prepares food	**Family eats food**
Family composts leftovers	**[place your own action here]**
[place your own action here]	**[place your own action here]**
[place your own action here]	**[place your own action here]**

Farm to Fork to Farm Game – Version Two (Farmer and Tomato)
Created by Brian Bluhm, 2016
Lesson One

The Winter Solstice	**The farmer plans for her summer crops.**
The farmer purchases tomato seeds.	**The farmer plants tomato seeds in the greenhouse.**
The tomato seedlings sprout.	**The farmer prepares the soil in the garden.**

The last frost of the spring.	**The soil warms to 70 degrees.**
The farmer transplants the tomato seedlings to the garden.	**The farmer fertilizes the tomato plants with compost.**
The farmer puts mulch around the tomato plants.	**The farmer weeds and thins the tomato plants.**
The Summer Solstice	**The tomato plants flower.**

Fruit begins to form on the tomato plants.	**The farmer stakes up the tomato plants.**
The days get shorter.	**The fruit ripens on the tomato plants.**
The farmer harvests tomatoes.	**The farmer sells the tomato fruit at the farmers' market.**
The tomatoes purchased at the market are prepared into a tomato sauce.	**The food waste from the tomatoes used for the sauce is composted.**

The farmer harvests the last of the tomatoes.	**The first fall frost.**
The farmer cans the extra tomatoes to use over the winter.	**The farmer prepares the garden for the winter.**
[place your own action here]	**[place your own action here]**
[place your own action here]	**[place your own action here]**

HANDOUT B – Sustainability Defined

This handout provides several examples of definitions of the concept of sustainability and sustainability education. This handout should be used during the "What is Sustainability" discussion. The purpose of the handout is to give students a common understanding of sustainability and sustainability education from which to build upon. This handout uses definitions relevant to the University of Minnesota Duluth students. Instructors should use definitions of sustainability relevant to their particular school setting.

Sustainability Defined
Created by Brian Bluhm, 2016
Lesson One

Sustainability and sustainability education are defined based on the particular perspectives and objectives of different organizations and agencies. Yet, each definition suggests a balance between environmental, social and economic spheres.

United Nations
"Sustainable development is development that meets the needs of today without compromising the ability of future generations to meet their own needs," (1987).

U.S. Environmental Protection Agency
"Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations. Sustainability is important to making sure that we have and will continue to have, the water, materials, and resources to protect human health and our environment," (2013).

University of Minnesota Duluth Office of Sustainability
"Put simply, sustainability is about being responsible with our resources. It is about not using more than our share. It is making sure there is enough, for all, forever," (2015).

Guideposts for a Sustainable Future Project
(Sustainability Project/7th Generation Initiative, n.d.)
Well-being can be sustained when activities:

1. Use materials in continuing cycles.
2. Use continuously reliable sources of energy.
3. Come mainly from the potentials of being human (i.e. creativity, communication, coordination, appreciation, and spiritual and intellectual development.)

Long-term well-being is diminished when activities:

1. Require continual inputs of non-renewable resources.
2. Use renewable resources faster than their rate of renewal.
3. Cause cumulative degradation of the environment.
4. Require resources in quantities that undermine other people's well-being.
5. Lead to the extinction of other life forms.

Common Goals of Sustainability
Although there are some disagreements among sustainability groups, there are remarkable similarities in their intentions and objectives. These include: concern for the environment, the economy and social equity; understanding of our dependence on the

health of natural systems (clean air, clean water, healthy soils and forests, biodiversity) for our survival and well-being; knowledge of the limits of the Earth's ecosystems and the detrimental impact of unchecked human activities (populations, pollution, economic growth); and a long-term, intergenerational perspective in actions and goals (Edwards, 2005).

Sustainability Education

Sustainable Schools Project
The Sustainable Schools Project defines education for sustainability as "learning that links knowledge, inquiry, and action to help students build a healthy future for their communities and the planet," (2013).

UNESCO
"Education for Sustainable Development aims to help people to develop the attitudes, skills, perspectives and knowledge to make informed decisions and act upon them for the benefit of themselves and others, now and in the future. ESD helps the citizens of the world to learn their way to a more sustainable future," (n.d.).

References

Edwards, A. (2005). *The sustainability revolution: Portrait of a paradigm shift*. Gabriola Island, BC: New Society Publishers.

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United Nations. (1987). *Report of the world commission on environment and development: Our common future*. Retrieved from http://www.un-documents.net/our-common-future.pdf.

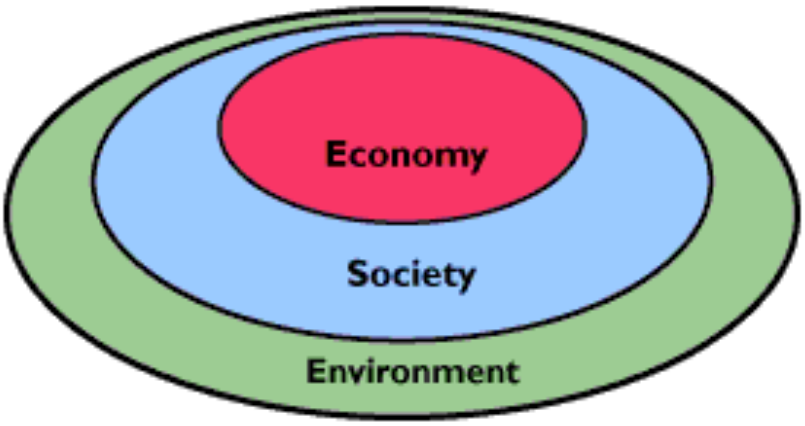
University of Minnesota Duluth. (2015). *Sustainability mission statement*. Retrieved from http://www.d.umn.edu/sustain/.

United Nations Educational, Scientific and Cultural Organization. (n.d.). *Education for sustainable development*. Retrieved from http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/

United States Environmental Protection Agency. (2013). *Sustainability home: Basic information.* Retrieved from http://www.epa.gov/sustainability/basicinfo.htm.

HANDOUT C - "Sustainability as three concentric circles"

This handout provides students with common conceptualization of sustainability. This image shows that an economy exists within a society and a society is bound by the limits of the environment. This image can be either handed out to students and/or projected to help guide discussion during the "What is Sustainability?" section of the lesson.



(Hart, 2000)

Integrating Sustainability Education into the University Pre-Service Elementary Teacher Curriculum through the Use of School Gardens

Lesson 2: Introduction to School Gardens

Length of Lesson: 170 minutes (3 hour class period with breaks)

Lesson Overview:

Students will build upon their understanding of sustainability, acquired through the activities in lesson one, to investigate the role of school gardens in sustainable agriculture and sustainability education.

- Students will begin the lesson by sharing their reflections on lesson one and assignments (what is sustainability, school gardens as a teaching tool, guest speaker highlights and discuss local resources for school gardens, sustainable agriculture and sustainability education.
- Students will investigate the logistics of planning, creating and managing a school garden through a role-playing activity.
- Students will also work in groups to create an inquiry-based short lesson.
- Students will reflect on food systems and agriculture as a method to teach about sustainability in the elementary education throughout the lesson.

Extension Activity – Newspaper Pot Activity

Lesson Author: Brian Bluhm, 2016
Lesson Topic: Introduction to School Gardens
Length of Lesson: 170 minutes

<table>
<tr><th colspan="2">Stage 1 – Desired Results</th></tr>
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Sustainability is the balance and interrelationships between the economy, society and environment.

Sustainability is becoming an ever-increasingly important concept the education of students at all levels.

School gardens are an important teaching tool for about food systems, sustainable agriculture and the concept of sustainability.</td><td>Essential Questions

A. Why are school gardens important teaching tools?

B. Who are the different stakeholders in a school garden program?

C. How can food systems and agriculture be used for sustainability education in the elementary education context? (Central essential question throughout this unit.)</td></tr>
<tr><td colspan="2">Student objectives/learning outcomes

Students will:

I. Discuss school gardens as a teaching tool in elementary education.</td></tr>
</table>

II. Identify the needs of stakeholders in a school garden program.

III. Explore inquiry and create an inquiry-based short lesson using school gardens.

Stage 2 – Assessment Evidence

Performance Tasks	**Other Evidence**
• Students will compare the needs of various stakeholders in a school garden program. • Students will create an inquiry-based short lesson plan.	• Students actively participate in the discussion of lesson one assignments. • Students actively participate in the role-playing activity. • Students ask thoughtful questions pertaining to planning and managing school gardens and the practice of sustainability education in elementary education.

Stage 3 – Learning Plan

Learning Activities

1. **Materials and Resources:** *Creating and Growing Edible Schoolyards: A How to Manual for School Professionals* (online manual); *How to Grow a School Garden: A Complete Guide for Parents and Teachers* (book); School Garden and Orchard Curriculum Resources (handout); Lesson Plan Worksheet (handout); laptop computers/access to the internet; journal/notebook (for notes to be included in final portfolio assignment)

2. **Timeline:**
   - Review of Lesson One and Assignments (20 min.)
   - School Garden Stakeholder Role-Play (60 min. w/ a 10 min. break)
   - Creation of inquiry-based short lesson plan (60 min. w/ a 10 min. break)
   - Optional Newspaper Pot Activity (instructor will need to re-arrange times to include this activity)
   - Discussion, Assignment and Conclusion (10 min.)

3. **Introductory activities:**

   Review Lesson One Highlights
   1. Review sustainability and sustainability education in the elementary education context.
   2. Review the concepts of sustainable agriculture and food systems.
   3. Review the key points from the guest speaker.

4. Discuss assigned reading questions:
    a. Why are school gardens important as teaching tools?
    b. What can children learn through school gardens?
    c. How can school gardens be used to teach students about sustainability? Examples include: community involvement, life skills (collaboration, communication, critical thinking), personal sustainability (health, how to prepare meals)
5. Share local resources for school gardens, sustainable agriculture and sustainability education. Collect on the board or in a document to share with students.

What does food mean to you?

1. Ask students to describe the meaning they attach to food in one word.
2. Collect students' ideas.
3. Discuss how food has a personal meaning for people, and how food can be used as a lens through which to make the concept of sustainability more tangible.

4. **Developmental activities:**

School Garden Program Stakeholder Role Play (Note: Be sure to allow adequate time for the role play to take the full course of discussion.)

1. Ask students to discuss key points from the assigned reading of Chapter Two "Laying the Groundwork" in *How to Grow a School Garden: A complete Guide for Parents and* Teachers, and read Section One – Two of *Creating and Growing Edible Schoolyards*.
2. Break the class into small teams of six students.
3. Assign roles to each student in each group based on the stakeholders outlined in Section One of *Creating and Growing Edible Schoolyards* (teachers, building/grounds/maintenance staff, food service staff, students, parents, community volunteers).
4. Ask students to review the descriptions and concerns of their assigned stakeholder role.
5. Using Handout D as a guide, ask students to develop goals and an action plan for their garden as a team. Students can create a document based on the suggestions from Section Two of *Creating and Growing Edible Schoolyards (see Handout D and Example Edible Schoolyard Garden Policies in Creating and Growing Edible Schoolyards beginning on p. 28)*.
6. Reflect as a group on the activity. Ask each team to describe their goals and action plan. Discuss the different concerns of each stakeholder.

Inquiry-based Short Lesson Plan

1. Ask students to create a short lesson based on the teaching and learning

method of inquiry. According to Jacobson, McDuff, & Monroe (2006), inquiry is "structuring a learning opportunity to engage learners in the process of pursuing their questions," (p. 50). Through inquiry-based learning, the instructor guides learning through specific questions to build curiosity in the topic with learners. Inquiry-based learning is influenced by Kolb's Experiential Learning Cycle, and students taking part in an inquiry-based lessons are encouraged to build upon prior knowledge to pursue a greater understanding of the topic being explored (Jacobson, McDuff, & Monroe, 2006, p. 45-50). Jacobson, McDuff, & Monroe (2006, p. 45) note that through inquiry, learners:

a. Actively question
b. Engage in an experience
c. Seek information
d. Use that information to make sense of the world

Additional information about inquiry can be found in Outdoor Education: Methods and Strategies (Gilbertson, Bates, McLaughlin, & Ewert, 2006) (see Handout C).

2. Explain the assignment to students:
    a. Create a short lesson for the assigned grade level and subject using the resources available (Handout A), the assigned readings and any other resources.
    b. Use the Backwards Design Lesson Plan Worksheet (Handout B)
    c. Lessons should be no longer than 10 minutes (or less depending on the size of the class) in duration.
    d. Lessons should include a hands-on/experiential component in a garden space.
    e. Lessons should also aim to teach a simple concept of sustainability, sustainable agriculture and/or food systems.
    f. Students will be teaching their lesson plan to a group of their peers during the next lesson at a garden field site.
3. Distribute School Garden and Orchard Curriculum Resources (see Handout A) and Lesson Plan Worksheet (see Handout B).
4. Project the School Garden and Orchard Curriculum Resources and explore some of the links to resources. Students can also use resources available in the assigned readings (see Section Seven "Linking Edible Schoolyards to School Curriculum" and Section Ten "Garden Resources" in *Creating and Growing Edible Schoolyards*, and Chapter 9 "Year-Round Garden Lessons and Activities" and the "Resources" section of *How to Grow a School Garden*.
5. Break the class into small groups (the number of students in each group depends on the number in the class). Assign groups a grade level (First or Third) and subject (Mathematics, Social Studies, Science, Language

Arts, Health and Physical Education). Students will need to complete this assignment before the next class period at a garden field site.

Extension activity - Newspaper Pots

1. Creating pots for starting seeds using old newspapers is an easy garden activity for future teachers to use as an introduction to food systems in their classrooms. Materials needed: newspaper, potting soil, old jars, scissors, and seeds (tomatoes work well).
    a. Wrap strips of newspaper around a jar. Tuck in the extra newspaper into the opening of the jar. Pull the rolled newspaper off the jar (the newspaper should be in the shape of the jar. It should stand on the section of newspaper folded into the jar making a pot.
    b. Fill the newspaper pot with soil. The newspaper pot with soil should stand upright.
    c. Plant seeds in the soil. Follow growing instructions on the seed packet.
2. Additional information and instructions can be found online by searching "newspaper planting pots" or similar keywords.

5. **Closing activities:**

    1. Conclusion – Review highlights from both lessons.
        a. What is sustainability?
        b. How does sustainability relate to food systems and agriculture?
        c. Why is sustainability education important in elementary education? How does sustainability relate to your own life?
        d. How does sustainability education have to do with food systems and sustainable agriculture?
        e. How can food systems and agriculture frame learning about sustainability in the elementary education context?
            i. Why are school gardens important as teaching tools?
            ii. What can children learn through school gardens?
            iii. How can school gardens be used to teach students about sustainability?
        f. How can inquiry learning be applied to sustainability education in elementary education?
    2. Discussion of Upcoming Sessions – Field Experience and Field Trip
        a. Review the lesson plan assignment. Students will be teaching this lesson plan to their peers during the next lesson.
            i. Remind students to bring everything the need for the lesson to the field experience.
        b. Describe the field experience (each field experience will be unique depending on the location

i. Students need to dress for the weather.
ii. Students need to prepare for their comfort. Describe if students need to bring snacks and water, and describe the restroom situation (depending on the location of the field experience).
iii. Ask students to bring their journals and assigned readings (readings will be helpful in the garden design discussion).
iv. Students may need to arrange transportation (depending on the location of the field experience).

3. Assignments:
   a. Read Section Three, Four, Five, Six, Nine and Ten of *Creating and Growing Edible Schoolyards* and Chapter Three "Getting the most from your site", Chapter Four "Ground Breaking, Budgeting and Fundraising", Chapter Five "Developing your school garden program", Chapter Six "A healthy outdoor classroom" and Chapter Seven "Tricks of the Trade" in *How to Grow a School Garden: A complete Guide for Parents and Teachers.*
   b. *Journal Assignment: Highlights of the section for you as you imagine your future teaching career.*
      i. What are some key issues (environmental, financial, scheduling, etc.) to be aware of when designing, planting and maintaining a school garden?
      ii. What does classroom management look like in a school garden?
      iii. Other highlights for sustainability education (focusing on food systems and sustainable agriculture) that can be learned in a school garden.

Attachments (Handouts)

- School Garden and Orchard Curriculum Resources (see Handout A)
- Backward Design Lesson Plan Worksheet and Inquiry Handout (see Handout B)
- Inquiry Handout (see Handout C)
- Garden Goals and Action Plan Worksheet (see Handout D)

References

Association for Childhood Education International. (2007). *Association for childhood education international elementary education standards and supporting explanation*. Retrieved from http://www.acei.org/sites/default/files/aceielementarystandardssupportingexplanation.5.07.pdf.

Gilbertson, K., Bates, T., McLaughlin, T., & Ewert, A. 2006. *Outdoor education: Methods and strategies*. Champaign, IL: Human Kinetics.

Jacobson, S.K., McDuff, M.D., & Monroe, M.C. (2006). *Conservation education and outreach techniques*. New York: Oxford University Press Inc.

North American Association for Environmental Education. (2007). *Standards for the initial preparation of environmental educators*. Retrieved from http://www.ncate.org/LinkClick.aspx?fileticket=Fm%2fqA4uarLk%3d&tabid=676.

Additional References

National Council for Accreditation of Teacher Education (NCATE) Program Standards for pre-service elementary education students can be assessed from the following web address:
http://www.ncate.org/Standards/ProgramStandardsandReportForms/tabid/676/Default.aspx

HANDOUT A – School Garden and Orchard Curriculum Resources

This handout includes suggested resources for pre-service teachers to use while they are creating their own school garden lesson plans. Several of the resources included are specific to the Duluth, MN area. Students can look for similar resources in their area as the resources listed.

School Garden and Orchard Curriculum Resources
Created by Brian Bluhm, 2016
Lesson Two

Books

Appel, G. & Jaffe, R. (2007). *Growing classroom: Garden-based science*. National Gardening Association.

Arden Bucklin-Sporer, A. & Pringle, R. (2010). *How to grow a school garden: A complete guide for parents and teachers.* Portland, OR: Timber Press. **(See *Resources* section beginning on page 197)**

Dunn, Niall. (2013). *Easy compost: BBG guides for a greener planet*. New York: Brooklyn Botanical Garden.

Hannemann, M., Hulse, P., Johnson, B., Kurland, B., & Patterson, T. (2007). *Gardening with children*. Brooklyn, New York: Brooklyn Botanic Garden.

Kite, P.L., (1995). *Gardening wizardry for kids*. Hauppauge, New York: Barron's Educational Series, Inc.

Online Resources

Creating and Growing Edible Schoolyards: A How to Manual for School Professionals
- http://www.health.state.mn.us/divs/hpcd/chp/cdrr/nutrition/docsandpdf/CreatingandGrowingEdibleSchoolyardsManual.pdf **(See *Section Ten: Garden Resources* beginning on page 17)**

Grow to Learn NYC
- http://growtolearn.org/

Nutrition to Grow On - California Department of Education
- http://www.cde.ca.gov/ls/nu/he/nrttogrow.asp

Additional Websites

Minnesota Farm to School Program
- http://www.extension.umn.edu/food/farm-to-school/

  School Gardens
  - http://www.extension.umn.edu/food/farm-to-school/school-gardens/

School Orchard in Moorhead - Moorhead Public Schools planted apple trees on its school grounds, paid for with Farm to School pilot funds from the Minnesota legislature. The district planted 100 apple trees in 7 different varieties at 6 schools throughout the district in hopes of feeding students for years to come.
  - https://www.moorheadschools.org/

New Hampshire Farm to School Program
- www.nhfarmtoschool.org/

Apple Resources
- http://www.nhfarmtoschool.org/apple-resources

Shelburne Farms' Sustainable Schools Project
- http://sustainableschoolsproject.org/

Sustainable Agriculture Research & Education (SARE) Resources

Sustainable Agriculture Resources & Programs for K-12 Youth
- http://www.sare.org/Learning-Center/Courses-and-Curricula/Sustainable-Agriculture-Resources-and-Programs-for-K-12-Youth

Youth Education Curriculum Guides
- http://www.sare.org/Learning-Center/Courses-and-Curricula/Youth-Education-Curriculum-Guides
  - Teaching the Food System
    - http://www.jhsph.edu/research/centers-and-institutes/teaching-the-food-system/
  - Journey to Planet Earth: Land of Plenty, Land of Want
    - http://www.pbs.org/journeytoplanetearth/programs/land-plenty-land-want/

Local Organizations

Duluth Community Garden Program
- http://www.duluthcommunitygarden.org/

Healthy Duluth Area Coalition
- http://healthyduluth.org/

Lake Superior Sustainable Farming Association

- http://lssfa.org/

North Central SARE

- http://www.northcentralsare.org/

UMD Sustainable Agriculture Project (SAP)

- http://www.d.umn.edu/cscd/sap/main/index.php

Minnesota State K-12 Academic Standards
http://education.state.mn.us/MDE/EdExc/StanCurri/K-12AcademicStandards/index.htm

Minnesota K-12 Academic Standards English Language Arts
http://education.state.mn.us/MDE/EdExc/StanCurri/K-12AcademicStandards/LangArts/index.html

Minnesota K-12 Academic Standards Health and Physical Education
http://education.state.mn.us/MDE/EdExc/StanCurri/K-12AcademicStandards/HealthPhysEduc/index.html

Minnesota K-12 Academic Standards Mathematics
http://education.state.mn.us/MDE/EdExc/StanCurri/K-12AcademicStandards/Math/index.html

Minnesota K-12 Academic Standards Science
http://education.state.mn.us/MDE/EdExc/StanCurri/K-12AcademicStandards/Science/index.htm

Minnesota K-12 Academic Standards Social Students
http://education.state.mn.us/MDE/EdExc/StanCurri/K-12AcademicStandards/SocialStudies/index.html

Minnesota Department of Education STEM
http://education.state.mn.us/MDE/EdExc/StanCurri/K-12AcademicStandards/STEMScienceTechnologyEngineeringandMathematics/index.htm

"STEM education provides intentionally designed and linked learning experiences for students to develop and apply understandings of science, technology, engineering, and mathematics concepts and processes. Integrated STEM education exemplifies standards-based, best practice instruction from each field to explore relevant questions and problems based in the natural and designed world."

School Gardens in Duluth, Minnesota (I.S.D. #709)

- Congdon Elementary
- Duluth East High School
- Homecroft Elementary
- Lincoln Park Middle School
- Lowell Elementary
- Myers□Wilkens Elementary
- Piedmont Elementary

HANDOUT B - Backward Design Lesson Plan Worksheet

This handout is an outline of the backward design model (Wiggins & McTighe, 2005). Students should use this outline to design their Inquiry-based Short Lesson Plan. An outline of the concept of inquiry as a teaching method is also included for students.

Backward Design Lesson Plan Worksheet

Wiggins, G. & McTighe, J. (2005). In Glisczinski, D. (2015). Educ 4501. University of Minnesota Duluth. Retrieved September 3, 2015 and Adapted from http://www.d.umn.edu/~dglisczi/4501web/4501Notes/UBD_Template_blank-1.doc

Lesson Author:
Lesson Topic:
Grade level:
Length of lesson:

<table>
<tr><th colspan="2">Stage 1 – Desired Results</th></tr>
<tr><td colspan="2">Content Standard(s):</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions

A
B
C</td></tr>
<tr><td colspan="2">Student objectives/learning outcomes

Students will:

I

II

III</td></tr>
<tr><th colspan="2">Stage 2 – Assessment Evidence</th></tr>
<tr><td>Performance Tasks
•</td><td>Other Evidence
•</td></tr>
<tr><th colspan="2">Stage 3 – Learning Plan</th></tr>
<tr><td colspan="2">Learning Activities</td></tr>
</table>

HANDOUT C – Inquiry as a Teaching Method

This handout provides an overview of inquiry-based learning and inquiry as teaching method. The instructor may want to provide additional resources about inquiry-based learning.

Inquiry Handout
Created by Brian Bluhm, 2016
Lesson Two

What is inquiry?

According to Jacobson, McDuff, & Monroe (2006), inquiry is "structuring a learning opportunity to engage learners in the process of pursuing their questions," (p. 50). Through inquiry-based learning, the instructor guides learning through specific questions to build curiosity in the topic with learners. Inquiry-based learning is influenced by Kolb's Experiential Learning Cycle, and students taking part in an inquiry-based lessons are encouraged to build upon prior knowledge to pursue a greater understanding of the topic being explored (Jacobson, McDuff, & Monroe, 2006, p. 45-50). Jacobson, McDuff, & Monroe (2006, p. 45) note that through inquiry, learners:

- Actively question.
- Engage in an experience.
- Seek information.
- Use that information to make sense of the world.

What are the steps using inquiry as a teaching method?

Kindsvatter, Wilen, and Isher (1996) (as cited in Gilbertson, Bates, McLaughlin, & Ewert, 2006, p. 119-120) recommend the following steps for using inquiry as a teaching method:

- Identify and clarify the problem.
- Form hypotheses.
- Collect data.
- Analyze and interpret data to test hypotheses.
- Draw conclusions.

References

Gilbertson, K., Bates, T., McLaughlin, T., & Ewert, A. 2006. *Outdoor education: Methods and strategies*. Champaign, IL: Human Kinetics.

Jacobson, S.K., McDuff, M.D., & Monroe, M.C. (2006). *Conservation education and outreach techniques*. New York: Oxford University Press Inc.

HANDOUT D – Garden Goals and Action Plan Worksheet

This handout provides a guide for students working through the School Garden Program Stakeholder Role Play activity. This worksheet is adapted from *Creating and Growing Edible Schoolyards: A How to Manual for School Professionals.*

Garden Goals and Action Plan Worksheet
Created by Brian Bluhm, 2016
Lesson Two
Adapted from *Creating and Growing Edible Schoolyards: A How to Manual for School Professionals* (p. 4)

The Edible Schoolyard Advisory Committee is in charge of identifying the goals and objectives of the garden. Invite all members to participate in the creation of the goals, objectives, and action plan.

Do not forget to discuss how the garden is to be maintained during the summer months and determine how the fruits of the harvest with be enjoyed.

Use these questions as a guide to develop the goals and objectives:

1. What is the purpose for creating this garden?
2. What are the benefits and challenges in creating a garden?
3. How will the garden be funded?
4. Who will be in charge of supervising the garden activities?

The action plan provides clarity, visibility and a level of commitment and responsibility necessary to achieve the goals and objectives. It should identify:

1. The individual tasks necessary to achieve the garden plan.
2. The resources needed (both tangible and non-tangible).
3. The budget.
4. Individual roles and responsibilities.

Integrating Sustainability Education into the University Pre-Service Elementary Teacher Curriculum through the Use of School Gardens

Lesson 3: Garden Field Experience

Length of Lesson: 170 minutes (3 hour class period with breaks)

Lesson Overview:

Students will apply their knowledge of sustainability, sustainable agriculture and delivery of sustainability education through the use of school gardens, acquired through lessons one and two, while participating in experiential learning at a field site.

- Students will begin the lesson by reflecting and discussing highlights from lessons one and two. Students will use discuss experiential learning as a teaching methodology.
- Students will explore the selected field site and participate in a guided discovery lesson focused on site design. Students will then reflect and journal their experience.
- Students will teach their inquiry-based lesson plan to their peers.
- Students will design a school garden space using available resources from the assigned readings to inform their choices.
- Students will also have the opportunity to plant in the available garden space.
- At the end of the lesson, students will be guided to reflect on their experience and apply lessons learned to their future teaching career.

Lesson Author: Brian Bluhm, 2016
Lesson Topic: Garden Field Experience
Length of Lesson: 170 minutes

<table>
<tr><th colspan="2">Stage 1 – Desired Results</th></tr>
<tr><td colspan="2">NCATE Approved Program Standard(s):

Elementary Education – 5.1 Professional growth, reflection and evaluation

“Candidates are aware of and reflect on their practice in light of research on teaching, professional ethics, and resources available for professional learning; they continually evaluate the effects of their professional decisions and actions on students, families and other professionals in the learning community and actively seek out opportunities to grow professionally,” (Association for Childhood Education International, 2007).

Environmental Education – 2.2 Environmental Literacy of Candidates

“Candidates demonstrate an understanding of the processes and systems that comprise the environment, including Earth as a physical system, the living environment, and human social systems and influences,” (North American Association for Environmental Education, 2007).</td></tr>
<tr><td>Enduring Understandings

Sustainability is the balance and interrelationships between the economy, society and environment.

Sustainability is becoming an ever-increasingly important concept the education of students at all levels.

School gardens are an important teaching tool for about food systems, sustainable agriculture and the concept of sustainability.

Experiential learning is a powerful approach to educate students about sustainability.</td><td>Essential Questions

A. Why are school gardens important teaching tools?

B. What are the highlights of teaching and learning in a garden?

C. How does the experience of actually planning, planting and growing a garden help to educate students about sustainability?

D. How can food systems and agriculture be used for sustainability education in the elementary education context? (Central essential question throughout this unit.)</td></tr>
<tr><td colspan="2">Student objectives/learning outcomes

Students will:</td></tr>
</table>

I. Discuss experiential learning as it relates to school gardens as a teaching tool in elementary education.

II. Teach an inquiry-based short lesson using school gardens to peers.

II. Synthesize information (readings and available resources) to design and plant a school garden plot.

Stage 2 – Assessment Evidence

Performance Tasks	**Other Evidence**
• Students will review key themes of sustainability education through school gardens. • Students will participate in a guided discovery experience. • Students will teach an inquiry-based short lesson plan to their peers. • Students will participate in hands-on site design and planting activities.	• Students actively participate in the discussion of key themes. • Students actively participate in the guided discovery lesson and short lesson plans. • Students ask-questions pertaining to planning and managing school gardens and the practice of sustainability education in elementary education.

Stage 3 – Learning Plan

Learning Activities

6. **Materials and Resources:** *Creating and Growing Edible Schoolyards: A How to Manual for School Professionals* (online manual); *How to Grow a School Garden: A Complete Guide for Parents and Teachers* (book); Guided Discovery Worksheet (handout); Completed lesson plans; journal/notebook and camera (for notes and pictures to be included in final portfolio assignment); an empty garden space; seeds and/or seedlings to plant; access to garden tools (trowels, watering can, gloves, etc.). Extra time needed for set-up of planting.

7. **Timeline:**
    - School Garden Review and Guided Discovery Activity (50 min and a 10 min. break)
    - Peer teaching of inquiry-based short lesson plan (50 min. and a 10 min. break)
    - Site Design and Planting/Harvesting (40 min)
    - Discussion, Assignment and Conclusion (10 min.)

Introductory activities:

Discussion of Lesson One and Two Highlights

1. Review sustainability and sustainability education in the elementary education context.
    a. What is sustainability?
    b. Why is sustainability education important in elementary education?
    c. How does sustainability relate to your own life?
2. Review the concepts of sustainable agriculture, food systems and key points from the guest speaker.
    a. What does sustainability education have to do with food systems and sustainable agriculture?
    b. How can food systems and agriculture frame learning about sustainability in the elementary education context?
3. Review the highlights of using school gardens as teaching tools:
    a. Why are school gardens important as teaching tools?
    b. What can children learn through school gardens?
    c. How can school gardens be used to teach students about sustainability? Discuss Journal Assignments:
    d. What are some key issues (environmental, financial, scheduling, etc.) to be aware of when designing, planting and maintaining a school garden?
    e. What does classroom management look like in a school garden?
    f. Other highlights for sustainability education (focusing on food systems and sustainable agriculture) that can be learned in a school garden.

Discussion of Experiential Learning

1. Give students a definition of Experiential Education: "Experiential education is a philosophy that informs many methodologies in which educators purposefully engage with learners in direct experience and focused reflection in order to increase knowledge, develop skills, clarify values, and develop people's capacity to contribute to their communities," (Association for Experiential Education, 2015).
2. Ask students to discuss their experience with experiential learning as students.
    a. Have they experienced and/or used experiential learning as a teaching method?
    b. How has experiential learning enhanced your teaching and learning?
3. Based on the definition, ask students to describe reasons why experiential learning is important for sustainability education.
4. Ask students to discuss how school gardens can be used in an experiential learning methodology of teaching sustainability.

Developmental activities:

Guided Discovery

1. Distribute the Guided Discovery Worksheet (Handout A). Discuss guided discovery with students (see Gilbertson, Bates, McLaughlin, & Ewert, 2006).
2. Break students into small groups and ask students to explore the field site using the worksheet and the assigned readings to frame the experience (see Chapter 3 "Getting the Most from Your Site" and Chapter 6. "A Healthy Outdoor Classroom" in *How to Grow a School Garden,* and Section Three "Designing the Edible Schoolyard" and Section Four "Planting the Edible Schoolyard" in *Creating and Growing Edible Schoolyards*).
3. Once the lesson is complete, ask students to journal on what they experienced. Each field site will be unique (on-campus, urban setting, rural setting).
    a. What do you hear, smell, see, feel and taste?
    b. How did the guided discovery lesson help to focus the experience?
    c. How can you use guided discovery as a sustainability education/school garden method?
    d. Bring students back together. Ask students to briefly share their highlights with the group. Collect students' statements to share.

Inquiry-based Short Lesson Plan Peer Teaching

1. Explain that students will be peer teaching their inquiry-based lesson (assigned in lesson 2). Break the class into two groups depending on their lesson plan grade level (first grade or third grade).
2. Ask students to take turns teaching their inquiry-based short lesson plan to their peers. Make sure to provide adequate time for all students to complete their lessons.
3. Once all students have taught their lessons, review highlights from the activity. Based on your experience creating and participating in inquiry-based garden lessons:
    a. How was experiential education used to teach about sustainability, sustainable agriculture and food systems?
    b. What have you learned about teaching an elementary education lesson in a school garden?
    c. What classroom management concerns do you anticipate and how can you address concerns (see *How to Grow a School Garden* p. 94, 122-125).

Figure 1. Elementary Education students creating garden-based lesson plans.

Site Design and Planting

This activity is intended to give students the opportunity to apply some of the concepts from discussions and the assigned readings about site design. The complexity of this activity will depend on access to seeds, plants, planting space and the size of the class. See Chapter 8 "Planting, Harvesting, and Cooking in the Garden" in *How to Grow a School Garden* and Section Ten *of Creating and Growing Edible Schoolyards* for information on choosing vegetables/plants for this activity. This activity can also be re-designed as a site design and harvesting activity depending on the time of year and location. Encourage students to take pictures to document learning and include in their final portfolio assignment.

1. Describe the activity to students: Using what you've learned so far, and the materials available (plants/seeds, assigned readings, garden space) design and plant a garden.
2. Ask students to discuss readings on site design and review the guided discovery activity (see Section Three, Four, Five of *Creating and Growing Edible Schoolyards* and Chapter Three "Getting the most from your site," Chapter Six "A healthy outdoor classroom" and Chapter Seven "Tricks of the Trade" in *How to Grow a School Garden* either in small groups or as a large group (depending on the size of the class). Needs to consider:
    a. Access to sunlight and water
    b. Accessibility of the space
    c. Types of plants and educational goals of the garden space
3. Ask students to create a garden design to optimize student learning using the available space and seeds and/or seedlings in their journal. Ask students to detail their rationale.
4. Next, using the materials available, ask students to plant the empty garden space using their site design as a guide. Depending on the available seeds/plants, space, and garden tools, this could be an

individual or group activity. Follow planting instructions provided on plants/seeds.

5. Ask students to discuss the experience and what they would apply to their future teaching activities.
    a. How is planting a garden experiential education?
    b. What are the major considerations you need to be aware of when designing and planting a garden with your future students?
    c. What can students learn about sustainability, sustainable agriculture and food systems by designing and planting a garden?

Figure 2. Students planting in a school garden demonstration site.

Closing activities:

1. Conclusion – Review highlights from each lesson. Examples of discussion questions include:
    a. What is sustainability?
    b. How does sustainability relate to food systems and agriculture?
    c. Why is sustainability education important in elementary education? How does sustainability relate to your own life?
    d. How does sustainability education have to do with food systems and sustainable agriculture?
    e. How can food systems and agriculture frame learning about sustainability in the elementary education context?
        iv. Why are school gardens important as teaching tools?
        v. What can children learn through school gardens?
        vi. How can school gardens be used to teach students about sustainability?
    f. What are some key issues (environmental, financial, scheduling, etc.) to be aware of when designing, planting and maintaining a school garden?

g. Reflect on teaching a lesson in a school garden.
    i. What does classroom management look like in a school garden?
    ii. What is the role or potential of inquiry, experiential education and guided discovery?
h. What are the highlights and lessons learned of designing and planting a garden?

2. Discussion of Upcoming Session – Field Trip
    a. Describe the field trip (each field trip will be unique depending on the locations available to visit in the area).
        i. Students need to dress for the weather.
        ii. Students need to prepare for their comfort. Describe if students need to bring snacks and water, and describe the restroom situation (depending on the locations of the field trip).
        iii. Students may need to arrange transportation (depending on availability transportation options, such as a bus).
3. Assignments:
    a. Journal a response to the question "How does your experience at the field site impact your understanding of sustainability education in elementary education?"
    b. Identify major opportunities and barriers to teaching in a school garden. Include references to your experiences at the field site.
    c. Read Chapter Eight "Planting, Harvesting, and Cooking in the Garden", Chapter Nine "Year-Round Garden Lessons and Activities" in *How to Grow a School Garden: A complete Guide for Parents and Teachers* to gain an understanding of further school garden activities.
    d. Read Chapter Ten "A decade in a School Garden" in *How to Grow a School Garden: A complete Guide for Parents and Teacher.* Reflect on highlights described in this chapter in your journal. What can you expect as an elementary educator using school gardens to teach about sustainability?
    e. Reflect on the upcoming field trip in your journal. What questions do you have for the various sites you will visit? (Make this question more specific based on the field trip sites arranged.)

Attachments (Handouts)

- Guided Discovery Definition and Garden Field Site Guided Discovery Activity (see Handout A).

References

Association for Childhood Education International. (2007). *Association for childhood*

education international elementary education standards and supporting explanation. Retrieved from http://www.acei.org/sites/default/files/aceielementarystandardssupportingexplanation.5.07.pdf.

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Additional References

National Council for Accreditation of Teacher Education (NCATE) Program Standards for pre-service elementary education students can be assessed from the following web address:
http://www.ncate.org/Standards/ProgramStandardsandReportForms/tabid/676/Default.aspx

Handout A – Guided Discovery Definition and Garden Field Site Guided Discovery Activity

The purpose of this guided discovery activity is two-fold. First, pre-service teachers will have the opportunity to explore the garden field site through a guided discovery experience. The students will identify and describe aspects of the garden purpose, site design and use as identified by the assigned texts. Secondly, the experience of actually taking part in a guided discovery lesson will give students a better understanding of the method. Students will be asked to reflect on how guided discovery can be used as a method in their future sustainability education activities.

Garden Field Site Guided Discovery Activity
Created by Brian Bluhm, 2016
Lesson Three

In small groups, explore the garden field site. Take special note of what you sense (touch, taste, smell, feel, hear). Use the following questions to frame your experience of the site:

- How is sustainability reflected in this garden space (site design, educational goals, location and population served, economic drivers)?
- How can guided discovery be used in sustainability education through school gardens (connections between environment/society/economy, systems thinking, etc.)?

Example Guided Discovery Questions

1. Does the garden site receive direct sunlight? Is the space designed to receive optimal daylight?

2. How is water supplied to the site (natural sources, rain barrel, location of spigots, etc.)?

3. What kind(s) of planting beds are used in this space (raised bed, in-ground, planters)? What factors could have played a role in the decision to use these kinds of planting beds?

4. Do you see evidence of management of soil health (compost, cover crops, mulch, etc.)? If so, list the management methods you see, and describe how each promotes soil health.

5. What are the educational goals of this space? How are the educational goals of this space reflected in the site design (use of certain plants, pathways, themed areas, etc.)?

Review Questions

How is sustainability reflected in this garden space (site design, educational goals, location and population served, economic drivers)?

How can guided discovery be used in sustainability education through school gardens (connections between environment/society/economy, systems thinking, etc.)?

Integrating Sustainability Education into the University Pre-Service Elementary Teacher Curriculum through the Use of School Gardens

Lesson 4: Sustainable Agriculture Field Trip and Final Discussion

Length of Lesson: 170 minutes (3 hour class period with breaks as necessary)

Lesson Overview:

The goal of this field trip is to give pre-service elementary education teachers an experience in the many places sustainable agriculture is taking place in the local community. This lesson will vary greatly depending on location and availability of community sites, transportation and costs.

- Students will come away from this field trip with a greater understanding of the connections between environment, society and economy (the core of sustainability).
- Students will view how sustainable agriculture is practiced by a variety of organizations and individuals in the local food systems.
- Students will identify existing and potential connections and collaborations between the community and the classroom.
- The lesson will end with a reflective discussion of the unit, addressing essential questions and providing students with a base from which to continue to learn about sustainability education and sustainable food systems. Students will be guided to reflect on their experience and apply lessons learned to their future teaching careers.

Extension Activity - Ideally, the unit will end with a shared meal featuring food from the local community. Options include a meal at a local restaurant that features local food, class potluck featuring food from within 100 miles, picnic at local school garden, etc.

Lesson Author: Brian Bluhm, 2016
Lesson Topic: Sustainable Agriculture Field Trip and Final Discussion
Length of Lesson: 170 minutes

<table>
<tr><th colspan="2">Stage 1 – Desired Results</th></tr>
<tr><td colspan="2">NCATE Approved Program Standard(s):

Elementary Education – 5.1 Professional growth, reflection and evaluation

“Candidates are aware of and reflect on their practice in light of research on teaching, professional ethics, and resources available for professional learning; they continually evaluate the effects of their professional decisions and actions on students, families and other professionals in the learning community and actively seek out opportunities to grow professionally,” (Association for Childhood Education International, 2007).

Environmental Education – 2.2 Environmental Literacy of Candidates

“Candidates demonstrate an understanding of the processes and systems that comprise the environment, including Earth as a physical system, the living environment, and human social systems and influences,” (North American Association for Environmental Education, 2007).</td></tr>
<tr><td>Enduring Understandings

Sustainability is the balance and interrelationships between the economy, society and environment.

Sustainability is becoming an ever-increasingly important concept in the education of students at all levels.

Gardens are important teaching tools to educate about food systems, sustainable agriculture and the concept of sustainability.

Sustainable agriculture is demonstrated at local schools, non-profits, farms and businesses.</td><td>Essential Questions

A. Why are gardens valuable teaching tools for sustainability, both at schools and in the community?

B. How is sustainable agriculture being used in the local community? What are the intended outcomes of those gardens – or the community garden program?

C. How is sustainability reflected in community sustainable agriculture projects?

C. How can food systems and agriculture be used for sustainability education in the elementary education context? (Central essential question throughout this unit.)</td></tr>
</table>

Student objectives/learning outcomes

Students will:
I. Apply knowledge to a community food system field experience.
II. Synthesize understand of school gardens as a teaching tool in elementary education.

Stage 2 – Assessment Evidence

Performance Tasks	**Other Evidence**
• Students will participate in field trip experience. • Students will contribute to discussions by asking questions about sustainability, sustainable agriculture and food systems during the field trip. • Students complete a final portfolio as an assessment of learning over the course of the unit.	• Students relate their understanding of school gardens and sustainability education in the classroom to a community experience. • Students actively participate by asking questions about the sustainable agriculture and food systems in the community context, and how this relates to the classroom and school gardens.

Stage 3 – Learning Plan

Learning Activities

8. **Materials and Resources:** Journal/notebook and camera (for notes and pictures to be included in final portfolio assignment) Field Trip (planned by instructor and/or students – see Developmental activities section for site suggestions)

   Planning Steps:
   - Identify sites (sites can be resources identified by students as part of the assignment following lesson one – see below for additional suggestions)
   - Develop a field trip schedule. Each site will have different times available.
   - Address logistics of the field trip.
     - Transportation (carpool, public transportation, bike, bus, walk)
     - Costs (transportation, insurance, meals)

9. **Timeline:**
   - Farm/garden tour (2 hrs. with breaks as necessary)
   - Final Discussion and Unit Conclusion (50 min.)

Introductory activities:

Reflection Questions for Field Trip

4. Discuss student questions for field trip sites (assigned from lesson three).
5. Distribute Reflection Question Guide before departing for the field trip (see Handout A). Students should fill in their answers to these reflection questions during the field trip. These questions will guide the final discussion at the end of the field trip.

Developmental activities:

Sustainable Agriculture Field Trip Outline

Main Questions to Address during the Field Trip:

- What does sustainability mean to you and/or your organization?
- What does sustainable agriculture mean to you and/or your organization?
- What does a sustainable food system look like to you and/or your organization?
- What are some examples of current or potential community-school connections?
- What would you and/or your organization like students to learn about sustainable agriculture and local food systems?
- How will you use what you have learned about sustainability in your classroom?

Figure 1. Photo of elementary education students at a community sustainable agriculture site.

Examples of Field Trip Sites

- Local resources identified by students after lesson one
- Elementary School Garden: Visit a local elementary school garden and discuss how the garden has been integrated into the culture of the school (successes, challenges, lessons learned, next steps, how to prepare as a future teacher to use school gardens as a method, future plans).
- Community Garden Site: Visit a local community garden site and discuss the mission of the organization, connections to the community, site design considerations, yearly schedule and site maintenance, etc.
- Farmers' Market: What is the history and mission of the organization? Does the market have connections with local schools?
- Sustainability Education and/or Sustainable Agriculture Non-Profit Organization: What are the main issues the organization addresses?
- Restaurant with a sustainable food system focus
- Business with a sustainable food system focus
- Local compost/re-use organization and/or business

Figure 2. Photo of the entrance to a community orchard (example of a sustainable agriculture organization).

Closing activities:

Final Discussion and Unit Debrief Conclusion

4. Final Discussion and Unit Debrief Conclusion (see Handout A). The instructor may also use the essential questions and specific review and closing activity questions from each lesson to help guide the discussion.

5. Assignments: Final Portfolio
    a. Due after the completion of the unit. The portfolio should be a reflection of student learning through out the unit and items relevant to future teaching activities: journal and reflection assignments, inquiry-based lesson plan related to sustainability plus a lesson plan using a school garden as a learning tool to teach sustainability, completed activities and handouts, and photos. In addition, the unit instructor may want to add class specific assessments to the required contents of the final portfolio.

Attachments (Handouts)

- Reflections Questions for Field Trip (see Handout A).
- Example Garden Tour Contacts and Schedule (see Handout B).
- Research and Resources (see Handout C).

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North American Association for Environmental Education. (2007). *Standards for the initial preparation of environmental educators*. Retrieved from http://www.ncate.org/LinkClick.aspx?fileticket=Fm%2fqA4uarLk%3d&tabid=676.

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See Handout C for Additional Resources on Pre-Service Teacher Sustainability Education

Additional Options for the Instructor to adapt this training:

- Collaborate with other instructors to ensure continuation of learning.
- Integrate unit lessons over the course of the growing year or during a summer course.
- Focus a year-long unit through the lens of the growing year (start seeds in March through harvest in September/October).

Handout A – Reflections Questions for Field Trip

The following questions are intended to encourage students to reflection upon each topic addressed in this curriculum. These questions can also be used to frame to final discussion. Students should fill in their answers to these reflection questions during the field trip.

Reflection Questions for Field Trip
Created by Brian Bluhm, 2016
Lesson Four

Reflection Questions for Field Trip

1. Review your personal sustainability statement. How has it changed?

2. What are key elements of sustainability as a concept? What are key elements of sustainability in practice?

3. What are some examples of teaching methods that can be used for sustainability education?

4. What are some key elements of sustainable agriculture and local food systems?

Handout B – Example Garden Tour Contacts and Schedule

This handout is intended to provide students with an example of the necessary information to collect when coordinating a field trip: location addresses, contacts names, phone and e-mail, information about the transportation to be used (bus in this example) and a detailed itinerary. This handout can also be used as the template for the lesson four field trip itinerary. The timing of each visit will need to be agreed upon by each location contact and then scheduled by the course instructor.

Example Garden Tour Contacts and Schedule
Created by Brian Bluhm, 2016
Lesson Four

Urban Garden Tour Contacts:

Garden Contacts:

1. Community School Collaborative Garden – Contact Person – Phone and E-mail
2. Community Orchard – Contact Person – Phone and E-mail
3. Community Action Urban Garden Program – Contact Person – Phone and E-mail
4. Local Restaurant Greenhouse – Contact Person – Phone and E-mail
5. Lunch at Local Restaurant – Contact Person – Phone and E-mail

Bus Rental Contacts:

- Contact 1 – Phone and E-mail
- Contact 2 – Phone and E-mail

Urban Garden Tour Schedule (11:00 AM – 3:00 PM)

10:45 - Meet at pre-determined location at university
11:00 - Depart
11:10 - Arrive at Community School Collaborative Garden: Address
11:40 - Leave Community School Collaborative Garden
11:45 - Arrive at Community Orchard: Address
12:00 - Leave Community Orchard
12:15 - Arrive at Community Action Urban Garden: Address
12:45 - Leave Community Action Urban Garden
1:00 - Arrive at Local Restaurant Greenhouse: Address
1:30 □ Leave Local Restaurant Greenhouse
1:45 - Arrive at Local Restaurant for lunch and final reflection/de-brief: Address
2:30 - Leave Local Restaurant
2:45 - Return to university

Handout C – Research and Resources

This handout provides the instructor with current research focusing on pre-service teacher education, sustainability education and school gardens. The instructor may wish to integrate these resources in the unit.

Selected School Garden and Pre-Service Teacher Education Research and Resources
Created by Brian Bluhm, 2016
Lesson Four

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