Grade 9 Science Biology Unit Plan: Building a School Garden in Ontario

Saya Szparlo

I am enthusiastic to submit this inquiry-based outdoor learning biology unit plan for the Don Galbraith Preservice Teacher Award of Excellence, as a guide for a Grade 9 academic Science classroom. The goal for this resource is to build on a previous chemistry unit, incorporate both scientific learning, and sustainable classroom practices in the form of community building exercises and building a school garden. This resource was created as a cross curricular unit that does not need to be completed in sequence; but rather can be started and returned to throughout a semester or school year. Moreover, the timeframe of the unit plan can be extended to further develop ideas and concepts. It was important for me to incorporate thorough and sufficient detail in this unit plan with an emphasis on experimentation, pursuit of student ideas, local resources and the local environment in order to provide a complete resource that anyone could utilize. A teacher can use this guide as a point of departure to create an engaging learning environment that responds to the specific needs of their students. Additionally, this unit can be adapted for a grade 9 applied Science classroom.

Teaching sustainability in a general science classroom can be intimidating with limited experience or lack of guidance. This unit plan was created to assist educators in providing both academic and hands-on ecological lessons. I have been fortunate enough to have specific training in facilitating local nature and wilderness education in urban environments through the organisation, the Pine Project. My experiences with the Pine Project inspired me to bring these ideas into the classroom and to motivate my teacher colleagues to do the same. With that in mind, I have included free professional development resources. My colleagues can facilitate the understanding of the interconnectedness of biology and chemistry through 12 flexible and scaffolded lessons including topics such as sustainability, nature connection, indigenous storytelling, social justice topics, drawings, graphing and activities on mental wellness.

An academic paper explaining the choices made for the unit plan is included after the unit plan which can be read at your leisure. Note this work was accomplished through the support of many mentors, colleagues and friends listed at the end of this document

Table of Contents

Hyperlinks are imbedded throughout the unit plan for quick access to materials.

Curriculum Connections
Big ideas from Biology • Ecosystems are dynamic and have the ability to respond to change, within limits, while maintaining their ecological balance. • People have the responsibility to regulate their impact on the sustainability of ecosystems in order to preserve them for future generations. • The use of elements and compounds has both positive and negative effects on society and the environment.
Overall Curriculum Expectations: **A1.** demonstrate scientific investigation skills by planning, performing and recording, analysing and interpreting, and communicating. **B1.** Understand the impact of human activity that threatens land and water living (ecological) communities. Explain positive and negative aspects of government initiatives in Canada that affects land living communities. **B2.** Study factors related to human activity that affect land and water living (ecological) communities and explain how they affect of these ecosystems long-term. **B3.** Show understanding of the changing nature of ecosystems (ecological community), the ecological balance and the impact of human activity on the sustainability of terrestrial and aquatic ecosystems **C2.** Study the physical and chemical properties of common chemicals.

Calendar: Unit at a Glance				
Lesson 1: Sustainability	**Lesson 2: Water**	**Lesson 3: Soil**	**Lesson 4: Growth**	**Lesson 5: Ecosystems**
Video, Think-Pair-Share, Post-it method, Flowchart, Research, Sharing & Exit Card	Lobbying, Popcorn answering, Squeeze test, Jar test and Earth Worm test & Medicine walk	Demo, Planting, NPK test, pH test, KWL Chart, Jar test & Data input	PEOE Model, Think-Pair-Share, Lecture, Discussion, Gallery Walk, Vote & Sharing	Think-Pair-Share, Vermicomposting, Predator and prey game & Discussion
Lesson 6: Land Connection	**Lesson 7: Sprouts**	**Lesson 8: Trans-plant-ation**	**Lesson 9: Growth**	**Lesson 10: Sunshine**
Gratitude, Interviews, Squeeze test, Jar test and Earth Worm test, Sit spot & ***Lab #1 Due***	NPK test, pH test, KWL Chart, Jar test, Data input, Peer editing & ***Quiz*** & ***Poster Draft #1***	Transplanting Game, Discussion, Story, Transplanting, Drawing & ***Poster Draft #2 Due***	Journaling, Discussion, Gratitude, Questions, ***Jigsaw*** & ***Lab #2 Due***	Observations & ***Unit Test Due***
Lesson 11: Support	**Lesson 12: Garden**			
Animating lyrics, Discussion, Public Speaking Practice, Journaling & ***Final Poster Due***	Greeting guests, Public Speaking, Sharing Garden & ***Symposium***			

**** Formative Assessment***
**** Summative Assessment***

Table of Contents

Overview: Lesson Sequence		
Lesson topic & expectations	**Main Ideas and Brief Description**	**Student Activities**
1. Sustainability	- Sustainability and community gardens - Equity, food security and sustainable agriculture - Building connection and empathy	Video, TPS, Post-it method, Flowchart, Research, Sharing & Exit Card
2. Water	- Human rights and sustainability - Urban gardens and sustainable agriculture - Connecting with local ecosystems	Lobby, Popcorn answering, Squeeze test, Jar test and Earth Worm test & Medicine walk
3. Soil	- Environmental connection to potential health hazards - Investigating school soil health - Addressing lab report concerns	Demo, Planting, NPK test, pH test, KWL Chart, Jar test & Data input
4. Growth	- Observing and Predicting - Communicating and managing a school garden - Building support in a class community	TPS, PEOE Model, Lecture, Discussion, Gallery Walk, Vote & Sharing
5. Ecosystems	- Creating sustainable soil - Balancing a sustainable ecosystem - Ethical practices	TPS, Vermicomposting, Predatory prey game & Discussion
6. *Field Trip* Land Connection	- Gratitude and land acknowledgement - Urban gardens, forests and sustainable agriculture - Reflection and awareness	Gratitude, Interviews, Squeeze test, Jar test and Earth Worm test, Sit spot & ***Lab# 1***
7. Sprouts	- Investigation and observation of sprouts - Investigating High Park Garden and Forest Soil Health - Peer Assessment and Feedback	NPK test, pH test, KWL Chart, Jar test, Data input, Peer editing, ***Quiz*** & ***Poster Draft #1***
8. Trans-plant-ation	- The delicate process of transplanting - Application and advocacy for sustainability - An Indigenous story	Transplanting Game, Discussion, Story, Transplanting, Drawing & ***Poster Draft #2***
9. Growth	- Food and mental health - Student-led unit test review - Sharing gratitude for one's community	Journaling, Discussion, Gratitude, Questions, ***Jigsaw*** & ***Lab #2***
10. Sunshine	- Testing Knowledge - Scientific Investigation	Observations & ***Unit Test***
11. Support	- Presentation and public speaking icebreaker - Organisation and public speaking practice - Self-reflection on presentation	Animating lyrics, Discussion, Public Speaking Practice, Journaling & ***Final Poster***
12. Garden	- Welcome the Local Community - Effective Science Communication - Celebration	Greeting guests, Public Speaking, Sharing Garden & ***Symposium***

Formative Assessment
Summative Assessment

Table of Contents

Lesson 1: Sustainability

Time: 75 minutes	**Setting:** Classroom + Computer Lab

Curriculum Expectations
Overall: A1, B1, B2, B3
Specific: A1.1, A1.2, A1.3, A1.4, B1.1, B1.2, B2.1, B2.3, B3.5

Success Criteria:
- ☐ Define sustainability
- ☐ Understand the function and importance of community gardens
- ☐ List 3 solutions to issues with urban gardens
- ☐ Participate in discussions on the topic of inequality

Materials
- ☐ Projector
- ☐ Computer
- ☐ Chart paper
- ☐ Markers
- ☐ Notebook

Minds on: Sustainability and Community Gardens (~15 minutes)
- Show videoclip: ***Ron Finley: Urban Gangsta Gardener in South Central LA Game Changers***
- Pose Post-it Method to brainstorm answers to the following questions:
    - *How does gardening link to sustainability? How is this a human rights issue?*
- Take up exemplary answers, correct misconceptions and students take notes

Action: Equity, Food Security and Sustainable Agriculture (~45 minutes)
- Show video***: Toronto school teaches students to grow produce***
- In small groups students, using *Grown in Mississauga Training Manual* and *From the Ground Up* create a flow chart, including all steps, to creating a successful school garden
- Think-Pair-Share (TPS) or small group discussion with notes to the following:
    - *What issues might arise in an urban garden? What solutions might help to address these issues? What questions would you like to explore related to community gardens?*
        - ***See Appendix for potential topics (1a)***
    - Research: Students can then consult resources (articles, internet sites, etc.) for community gardens and additional information
    - Ideas can be shared and collected on chart paper and/or using google docs, etc

Consolidation: Building Connections and Empathy (~15 minutes)
- Reflective Journal exit card: students will be reminded of the purpose of a community gardens and the topic of privilege. Using their notes from the minds on, students will write an exit ticket to demonstrate their understanding of these ideas through questioning like:
    - *Does everyone have equal access to food? What factors might impact food security? "Before I thought"… "Now I think"…*

Safety Guidelines:
- Students and teacher will have already built and signed a safety contract for the classroom **(1c)**

Formative Assessment:	**Homework:**	**Supporting Resources (1b)**
Conversation: Discussion Product: Flow chart, Exit ticket	Students to research potential native plants to use in community garden. **(1d)**	**Accommodation Opportunities (1e)**

Table of Contents

Lesson 2: Water

Time: 75 minutes | **Setting:** Classroom + Outside

Curriculum Expectations
Overall: A1, B2, B3
Specific: A1.5, A1.7, A1.10, A1.11, B2.2, B2.3, B2.5

Success Criteria:
- ☐ Describe the injustice to indigenous communities in Canada
- ☐ Map the potential garden area
- ☐ Obtain soil samples for the lab tests
- ☐ Draw conclusions from soil texture results
- ☐ Determine if your native plant is local to the school yard

Materials
- ☐ Projector + Computer
- ☐ Activity worksheets
- ☐ Items from page 11 from From the Ground Up
- ☐ Field guide(s)
- ☐ Notebook + Lab Handout

Minds on: Humans Rights and Sustainability (~20 minutes)

- Show the video clip: ***There's something in the Water.*** Discuss environmental racism and how is this a Canadian human rights issue. Take input in popcorn share method while students take notes. Talk about Autumn Peltier,15-year-old Anishinaabe girl from Wikwemikong First Nation. Ask students to scroll through her Instagram to learn about her impact
- Organize students in groups (towns in Ontario). Provide students with a detailed information card on their region including population demographic (race). In their groups, they will discuss why an ecologically detrimental factory should not be built in their community. Following, they will have 1-minute to lobby to the government (the teacher). Regardless of their argument, the government will build the factory in a specific region based on economics
    - ***See Appendix for details for Water Inequality activity (2a)**

Action: Urban Gardens and Sustainable Agriculture (~45 minutes)

- Discuss homework and take notes. Organise 4 groups (political, economic, social and environmental). Ask students to discuss the following question depending on their title:
    - *If local food is more sustainable, why would one purchase more non-local food?*
    - Groups will some ideas to the rest of the class
- Using edited flow chart from lesson 1, conduct Lab #1: Testing school yard conditions
    - Part 1: Map the garden in groups of 3-4 students
    - Part 2: Collect 3 soil samples from the school yard
    - Part 3: Conduct *Squeeze test*, *Jar test* and *Earth Worm test*
        - ***See Appendix for details of lab (2c)**

Consolidation: Connecting and identifying local ecosystems (~10 minutes)

- Collect homework, complete a medicine walk to identify and take notes on local plants
- At the beginning of the walk pose the question:
    - *What 2 edible and medicinal plants are in this school yard?* (Dandelion and Plantain, check *Common Edible and Medicinal "Weeds" You Need to Know* for details)
        - ***See Appendix for medicine walk (2d)**

Safety Guidelines:

- Students will use gloves for part 1 and 2 of the lab
- Same co-created rules of the classroom lab apply to the rules outdoors **(1c)**
- **For the Medicine Walk: Students are not to eat unknown plants as some can be lethal**

Formative Assessment:
Conversation: Presentation, Popcorn answering
Product: Homework, results for lab #1

Homework:
Study notes from lesson 1 and 2. Complete field trip forms and return for lesson 3.

Supporting Resources (2b)

Accommodation Opportunities (2e)

Table of Contents

Lesson 3: Soil

Time: 75 minutes | **Setting:** Classroom + Computer Lab

Curriculum Expectations
Overall: A1, B2
Specific: A1.6, A1.7, A1.8, A1.9, A1.12, A1.13, B2.2, B2.3, B2.5, C1.1, C1.2

Success Criteria:
- ☐ Define sustainability
- ☐ Draw conclusions from Archive and Jar test results
- ☐ Determine pH, nitrogen, phosphorus and potassium levels of soil
- ☐ Draw conclusions from soil chemistry results
- ☐ Write and post 3 statements for the KWL activity

Materials
- ☐ Water, Sponge, liquids
- ☐ Planting materials
- ☐ Seeds
- ☐ Soil Test Kit
- ☐ Jar test results
- ☐ Notebook + Post-its
- ☐ Lab Handout

Minds on: Environmental Connection to Potential Health Hazards (~10 minutes)

- Perform a plant demo using in a 3 clear glasses of water. Place a plant shaped sponges into the separate glasses. Tell the students that the water represents the liquid that the plant soaks up through their roots. There will be 3 clear liquids (vinegar, saltwater, lead), have the students try to identify them. Pour the 3 separate liquids in the 3 separate glasses. Present results:
  - Glass 1: Plant survives but does not appear healthy (low levels of vinegar)
  - Glass 2: Plant dies (saltwater)
  - Glass 3: Plant survives and kills anyone that eats it (lead particles on surface of plant)
- Ask students to draw conclusions in small groups. In conclusion, plants absorb their environment and affect their ecosystem. Take the right precautions by testing soil before planting.
- Students will plant and label their seeds and record plant observations in chart format

Action: Investigating School Soil Health (~55 minutes)

- Using flowchart from lesson 1, continue lab #1: Testing school yard conditions
  - Part 4: NPK test, PH test, check archive results from local lab
    - ***See Appendix for details of local lab** (3a)
  - Part 5: Record jar test results
- In the computer lab, provide a lesson on Microsoft Excel
  - Part 6: In Microsoft Excel, record *Squeeze test*, *Jar test* and *Earth Work test* results
- Rest of computer lab will be to complete lab #1
    - ***See Appendix lab details** (3c)

Consolidation: Addressing Lab Report Concerns (~10 minutes)

- Using post-its create KWL chart to assess understanding of success criteria for lab reports
    - ***See Appendix for KWL chart details** (3d)

Safety Guidelines:

- Use gloves, goggles and lab coat for part 4 of the lab
- Use the co-created rules of the classroom lab (1c)

Formative Assessment:
Conversation: Discussion
Product: Completed results for lab #1, KWL Chart, planted seeds

Homework:
Finish lab #1, due lesson 6. Read pages 48-51 & 61-62 in *Grown in Mississauga Training Manual*.

Supporting Resources (3b)

Accommodation Opportunities (3e)

Table of Contents

Lesson 4: Growth

Time: 75 minutes | **Setting:** Classroom + Outside

Curriculum Expectations
Overall: A1, B3
Specific: A1.1, A1.2, A1.3, A1.4, A1.9, A1.10, A1.11, B2.1, B3.1, B3.2

Success Criteria:
- ☐ Create detailed observation of plants and vermicomposting bin
- ☐ Describe cellular respiration and phtotosynthesis
- ☐ Create a garden plan using conclusion drawn from lab #1
- ☐ Practice active listening and respect in the community circles

Materials
- ☐ Handout + Notebook
- ☐ Projector + Computer
- ☐ Chart paper
- ☐ Markers

Minds on: Observing and Predicting (~10 minutes)

- Students will care for their plants, record results and draw conclusions using these questions:
  - *Does the plant look as you expected? Are you caring for the plant correctly? How are you feeling today, are you caring for yourself?*
- Using the Person- Environment- Occupational Performance (PEOE) model, seal a Ziplock bag around a leaf. In small group discussions, students will predict this question the outcome

Action: Communicating and Managing a School Garden Plan (~50 minutes)

- Use a PowerPoint to cover topics such as bioaccumulation, biosphere, diversity, ecosystem, equilibrium, protection, watershed, biotic, abiotic factors, cellular respiration, photosynthesis and disruptive human activities large-scale farming. Use signal technique
- Revisit the plant with the Ziplock bag. Small group discussion and/or TPS of ideas
  - *Why is there water on the inside the bag?*
- In a large class circle, begin early discussions on how to organize a garden as a school community. When addressing ideas, students will be encouraged to use the prompting discussion phrases:
  - *"I agree because…", "I wonder if…", "I disagree because…" and "Can you please explain…"*
  - Students should be mindful of how they are feeling throughout discussion
- Students will formulate a simple garden plan on chart paper in groups of 3-4 students using the *Grown in Mississauga Training Manual.*
  - ***See Appendix for details about the 3 sisters** (4a)*
- Gallery walk to view all plans
- Facilitate an anonymous vote to determine the garden plan

Consolidation: Building Support in a Class Community (~15 minutes)

- Relocate classroom outside to garden area. Ask students to sit quietly in a circle in the grass for 5 minutes and practice relaxation breathing while they think about the question:
  - *How is my heart doing today? How does it feel about the garden plan selected? Now that you're outside, how do you feel about the garden plan that was chosen? Picture some of the ideas that other groups had. Can you see the value of other people's ideas?*
- Students will share with a classmate **(4c)**

Safety Guidelines:

- Students must show respect towards others, especially in sharing during consolidation
- Use the co-created rules of the classroom lab **(1c)**

Formative Assessment:
Conversation: Discussion
Product: Signal technique, garden map

Homework:
Finish lab #1, due lesson 6. Prepare 10 qualitative questions. Study for quiz, in class lesson 6. ***See Appendix** (4d)*

Supporting Resources (4b)

Accommodation Opportunities (4e)

Table of Contents

Lesson 5: Ecosystems

Time: 75 minutes	**Setting:** Classroom + Outside

Curriculum Expectations
Overall: B3
Specific: B3.4, B3.3, B3.4

Success Criteria:	**Materials**
☐ Define invasive species ☐ Explain the predatory prey dynamics in an ecosystem ☐ Describe the interconnectedness of species in an ecosystem using terms such as: limiting factor, and carrying capacity	☐ Projector + Computer ☐ Handouts ☐ Beads + Blue cards ☐ Coloured clothes (3 kinds)

Minds on: Creating Sustainable Soil (~10 minutes)

- Individually, students will draw or write an explanation of how they think soil is created
  - With their desk buddy, they will Think-Pair-Share their ideas
- Show videoclip: ***How Soil is Created***. Ask students to Think-Pair-Share with their desk buddy:
  - *How can we manage soil responsibly?*

Action: Balancing a Sustainable Ecosystem (~50 minutes)

- Teacher explains the benefits of vermicomposting as a solution to creating sustainable soil
- In groups of 3-4 students, they will build a vermicomposting bin
  - ***See Appendix for vermicomposting details** (5a)*
- Through a lecture and note taking, students will be introduced to other factors that affect ecosystems such as earth's four spheres. Students will be taught limiting factors and factors affecting the carrying capacity of ecosystems
- Play a *Garden Predator and Prey* game. Use a story as a hook for the game
  - ***See Appendix for a Garden Predator and Prey story and rules** (5c) (5d)*
- Play as several rounds, time permitting
- After the game, form a circle discuss predator-prey dynamics in a garden ecosystem. Ensure to include invasive species, limiting factors and carrying capacities specifically about the Asian lady beetle. Notes taking and small group discussion and/or TPS of ideas for the question:
  - *What was the result of the Asian lady beetle?*

Consolidation: Ethical Practices (~15 minutes)

- In a circle discuss organic farming and natural pesticides. Ask students:
  - *How is industrial farming detrimental to the environment?*
- Reassure students that they are contributing to their community and environment through self-sustainable/sustainable practices

Safety Guidelines:

- Students must wear secure shoes
- Before class and before the *Predator and Prey* game, ask students to help check for potholes, large sticks and create boundaries in the area far from road
- Ensure that the boundaries are within view
- Use the co-created rules of the classroom lab **(1c)**

Formative Assessment:	**Homework:**	**Supporting Resources (5b)**
Conversation: Think-pair-share, Discussions Product: Vermicomposting bin	Finish lab #1, due lesson 6. Prepare 10 qualitative questions. Study for quiz, in class lesson 6. ***See Appendix** (4d)*	**Accommodation Opportunities (5e)**

Table of Contents

Lesson 6: Land Connection: *Field Trip*

Time: 215 minutes	**Setting:** High Park Gardens Montessori + High Park Forest area

Curriculum Expectations
Overall: A1, B2
Specific: A1.5, A1.7, A1.10, A1.11, B2.2, B2.3, B2.5

Success Criteria:	**Materials**
☐ Pose 10 quality questions to a High Park staff, record answers ☐ Map all plants from the High Park garden ☐ Obtain soil samples for the lab tests ☐ Draw conclusions from soil texture results ☐ Become more aware of the local wildlife in silence	☐ Notebook ☐ Lab Handout ☐ Camera ☐ Voice recording (for interview)

Minds on: Gratitude and Land Acknowledgement (~20 minutes)

- Make a circle and welcome students to the space. Lead a song of your choosing.
    - ***See Appendix song details** (6a)
- In a large circle begin by personally sharing gratitude (i.e. gratitude for land acknowledgement). Students will be asked to practice gratitude. The gratitude must be current. Then pass it around the circle, allowing people to pass but encouraging participation. Commence a discussion on human activity and the impacts that humans have on terrestrial and aquatic ecosystems. Pose the question:
    - *Why do we need to create a community garden?*

Action: Urban Gardens, Forests and Sustainable Agriculture (~180 minutes)

- Students will pose their 10 qualitative questions to the High Park community garden staff
- Lab #2: Testing and note taking of community garden conditions (disturbed area) and forest (undisturbed area)
    - Part 1: Map the garden in groups of 3-4 students
    - Part 2: Collect 3 soil samples from the school yard and 2 soil samples from the forest
    - Part 3: Conduct *Squeeze test*, *Jar test* and *Earth Worm test*
        - ***See Appendix lab details** (6b)
- In a circle discuss and compare the intention of a park and the purpose of a community garden.
    - *How is High Park maintaining the health and balance of ecosystems?*
    - *How might parks negate or increase human impact?*

Consolidation: Reflection and Awareness (~15 minutes)

- Under the trees, lead students into a sit spot (a quiet state)
    - ***See Appendix for sit spot details** (6c)

Safety Guidelines:

- Students should use gloves for collecting soil samples
- Students must stay within view of teacher or supervision
- Use the co-created rules of the classroom lab (1c)

Formative Assessment:	**Homework:**	**Supporting Resources (6e)**
Conversation: Discussion, Rubric (6d) Product: Results for lab #2, ***Lab #1***	Prepare Poster draft #1 assignment, due: lesson 7. Study for quiz, in class lesson 7.	**Accommodation Opportunities (6f)**

Table of Contents

Lesson 7: Sprouts

Time: 75 minutes	**Setting:** Classroom + Computer Lab

Curriculum Expectations
Overall: A1, B2
Specific: A1.6, A1.7, A1.8, A1.9, A1.12, A1.13, B2.2, B2.3, B2.5, C1.1, C1.2

Success Criteria:
- ☐ Draw conclusions from Archive results
- ☐ Draw conclusions from Jar test results
- ☐ Draw conclusions from soil chemistry results
- ☐ Mark a peer's Poster draft #1 using rubric

Materials
- ☐ Quizzes
- ☐ Soil Test Kit
- ☐ Jar test results
- ☐ Rubrics
- ☐ Notebook+ Lab Handout

Investigation and Observation of Sprouts (~5 minutes)
- Students will care for their plants and vermicomposting bins, record results and draw conclusions using these questions:
  - *Does the plant look as you expected?*
  - *Are you caring for the plant correctly?*

Investigating High Park Garden and Forest Soil Health (~60 minutes)
- Write Quiz. Distribute completed quiz, student peer evaluation. Use *signal**** technique for students to evaluate their comprehension of quiz material.
- Lab #2: Testing and note taking of community garden conditions (disturbed area) and forest (undisturbed area)
  - Part 4: NPK test, PH test, check archive results from local lab
  - Part 5: Record jar test results
  - Part 6: In the computer lab, use Microsoft Excel to record *Squeeze test*, *Jar test* and *Earth Work test* results
- Rest of computer lab will be to complete lab #2
  - ***See Appendix for lab details** **(7a)**

Peer Assessment and Feedback (~10 minutes)
- Students will exchange their poster draft #1 with a peer for peer feedback using a rubric

Safety Guidelines:
- Use gloves, goggles and lab coat for part 4 of the lab
- Use the co-created rules of the classroom lab **(1c)**

Formative Assessment:	**Homework:**	**Supporting Resources** **(7b)**
Conversation: discussion Product: ***Quiz***, Results for lab #2, ***edited poster draft #1***	Complete lab #2 for lesson 9. Poster draft #2 due: lesson 8.	**Accommodation Opportunities** **(7c)**

Table of Contents

Lesson 8: Trans-plant-ation

Time: 75 minutes	**Setting:** Classroom + School Garden Area

Curriculum Expectations
Overall: A1
Specific: A1.2, A1.4, A1.8, A1.9, A1.10

Success Criteria:	**Materials**
☐ Use respectful communication to merge ideas ☐ Organize into a group and participate in transplanting ☐ Record notes in chart format of observations of school garden ☐ Take 5 photos of plants transplanted from your group ☐ Participate in the song and drawing the story of the 3 sisters	☐ 60 Ping Pongs ☐ Planting materials ☐ Projector + Computer ☐ Camera ☐ Worksheet + Notebook ☐ Review sheet

Minds on: The Delicate Process of Transplanting (~15 minutes)

- Students will be grouped into 3 large groups. Each group will have 20 ping pongs. The aim of the game is to get all 20 ping pongs from one corner of the classroom (the class) to the other (the garden). The team that drops the least amount of ping pongs wins the game. The challenge is that the ping pongs can only be carried on the back of two fingers and above one's head. While playing the game, make sure to tally each time the ping pong drops per team
- After the game, remind students to be mindful of the delicate process of transplanting and that care should be taken when transferring plants, regardless of the amount of time it takes

Action: Application and Advocacy for Sustainability (~45 minutes)

- Organize the class into teams for transplanting
- Relocate outside, transplant into garden and record results and draw conclusions using these questions:
    - *Do the plants look as you expected?*
    - *Are you caring for the plants correctly?*
        - ***See Appendix for transplanting organisation details** (8a)*
- Form a circle. Ask students to note ideas that their classmates share with this question:
    - *How do you predict everything will grow?*

Consolidation: An Indigenous Story (~15 minutes)

- Form a circle near the 3 sisters (corn, beans and squash). Read ***Clan Connections***, while students draw the story. Allow for pauses so that students may draw at their pace. Ask:
    - *How does gardening link to sustainability?*
    - *How is this clean water a human rights issue?*

Safety Guidelines:

- Follow same safety guidelines as Lesson 6: **Land Connection**

Formative Assessment:	**Homework:**	**Supporting Resources (8b)**
Conversation: Small group discussion Product: ***Poster draft #2***, transplanted garden, drawing of the 3 sisters	Complete lab #2 for lesson 9. Prepare for jigsaw **(8c)**	**Accommodation Opportunities (8d)**

Table of Contents

Lesson 9: Growth

Time: 75 minutes	**Setting:** Classroom + School Garden Area

Curriculum Expectations
Overall: B1, B2, B3
Specific: B1.2, B2.1, B2.5, B3.1, B3.2, B3.3, B3.4, B3.5

Success Criteria:
- ☐ Become an expert in section to share with the group
- ☐ Understand the answers to the questions on your section's cube
- ☐ Teach your section of the review and refer to notes for answer
- ☐ Note observations of vermicomposting bin and plants from the garden

Materials
- ☐ Markers
- ☐ Chart Paper
- ☐ Lecture notes
- ☐ 5 *Cube templates*
- ☐ Notebook

Minds on: Connecting Food and Mental Health (~10 minutes)
- Tend to vermicomposting bins. Students will read ***Emerging Link Between Food and Mental Health*** and journal their thoughts in a notebook including answers to the question:
    - *What is the link between food and mental health?*

Action: Student-Led Unit Test Review (~50 minutes)
- Facilitate a jigsaw to review for the Unit test
- Take 20 minutes for the first portion of the review unit notes, take notes, students will use the *Cube Template* to add review questions onto a cube and take notes on chart paper with their section's group
- Give 25 minutes for the second portion of the jigsaw, students will teach their section or take notes of someone's presentation to a group of students using chart paper, review cube and class notes
    - ***See Appendix for jigsaw details** (9a)

Consolidation: Sharing Gratitude for one's community (~15 minutes)
- Record observations of vermicomposting bin. Relocate outside, record observations and draw conclusions using these questions:
    - *Do the plants look as you expected?*
    - *Are you caring for the plants correctly?*
- In a circle express gratitude for participation in jigsaw, for reducing test stress and remind students to be mindful of their mental wellness during times of stress. Then pass the gratitude around the circle, allowing people to pass but encouraging participation

Safety Guidelines:
- Use the co-created rules of the classroom lab (1c)

Formative Assessment: Conversation: Discussion Product: Mental health journal	**Homework:** Study for unit test. Unit test: lesson 10. Edit Poster draft #2 for final poster due lesson 11.	**Supporting Resources** (9b)
Summative Assessment: Product: ***Lab #2***		**Accommodation Opportunities** (9c)

Table of Contents

Lesson 10: Sunshine

Time: 75 minutes	**Setting:** Classroom + School Garden Area

Curriculum Expectations
Overall: B1, B2, B3
Specific: B1.2, B2.1, B2.5, B3.1, B3.2, B3.3, B3.4, B3.5

Success Criteria:	**Materials**
☐ Complete the Test ask best you can ☐ Ask questions if unclear of the questions ☐ Review answers if there is extra time ☐ Take observations on your group's plants and the garden	☐ Tests ☐ Pens ☐ Pencils ☐ Notebook

Testing Knowledge (~75 minutes)

- Students will complete the unit test to the best of their abilities. Students with accommodations or requiring a quiet area will have arrangements made prior. Revisit Ontario Student Records to understand the needs of all students

Scientific Investigation

- Outside of class hours, students should record final results and draw conclusions of vermicomposting bin and garden using these questions:
    - *Do the plants look as you expected?*
    - *Are you caring for the plants correctly?*

Safety Guidelines:

- Use the co-created rules of the classroom lab **(1c)**

Formative Assessment: Conversation: discussion **Summative Assessment:** Product: ***Unit Test***	**Homework:** Create the final copy poster due lesson 11 using the feedback from poster draft # 2. ***Note*** A lab period could be added between lesson 10 and 11 for a work period on final poster. Prepare speaker notes for the presentation due lesson 11.	**Accommodation Opportunities** Students may require the test questions to be read aloud. Students may require the resource room for a quiet space and extra support to write the test. A lot additional time to students. **(10a)**

Table of Contents

Lesson 11: Support

Time: 75 minutes | **Setting:** Classroom

Curriculum Expectations
Overall: A1, B1, B2, B3
Specific: A1.11, B1.1, B1.2, B2.1, B2.2, B2.3, B2.5, B3.3, B3.5

Success Criteria:
- ☐ Present poster for 5 minutes to a classmate
- ☐ Present social, environmental, politic issues and sustainability
- ☐ Explain scientific inquiry and results from lab # 1 and lab #2
- ☐ Answer the question: is my community self-sustainable/ sustainable?

Materials
- ☐ Computer + Projector
- ☐ Lyrics
- ☐ Whiteboard
- ☐ Marker
- ☐ Mini Rubrics
- ☐ Notebook + Public Speaking Handout

Minds on: Presentation and Public Speaking Icebreaker (~15 minutes)
- Tend to vermicomposting bins
- In a circle share and take notes on public speaking reminders/tips with students
- Hand out lyrics and show ***Mercy, Mercy Me*** by Marvin Gaye. (Or Joni Mitchell - Big Yellow Taxi, etc) Students must underline ecological messages that resonated with them
- Break out of the circle and find a partner who underlined the same message. Give time for pairs to prepare an enthusiastic and animated presentation of choice (speaking, singing, dance)
- A pair will share their presentation with another pair and vice versa

Action: Organisation and Public Speaking Practice (~50 minutes)
- Watch and take notes on ***TED's secret to great public speaking***. On the white board write down the follow questions:
    - *What is your presentation idea? How will you stimulate curiosity? What are you teaching your listener? Who does your idea benefit?*
- After watching the video, ask students to brainstorm answers to the questions in a journal
- In pairs, students will practice presentations for the symposium
    - ***See Appendix for presentation practice details** (11a)*

Consolidation: Self- Reflection on Presentation (~10 minutes)
- Reflective Journal exit card: Ask students to revisit the questions from the start of class:
    - *What is your presentation idea? How will you stimulate curiosity? What are you teaching your listeners? Who benefits from this proposal?*

Safety Guidelines:
- Use the co-created rules of the classroom lab (1c)

Formative Assessment:
Conversation: Discussion
Product: Journal, speakers notes, exit card

Summative Assessment:
Product: ***Final Poster***

Homework:
Practice presentation for the symposium. Edit speakers notes.

Supporting Resources (11b)

Accommodation Opportunities (11c)

Table of Contents

Lesson 12: Garden

Time: 75 minutes	**Setting:** School Garden Area

Curriculum Expectations
Overall: A1, B1, B2, B3, C1
Specific: A1.7, A1.8, A1.9, A1.10, A1.11, A1.12, A1.13, B1.1, B1.2, B2.1, B2.2, B2.3, B2.5, B3.3, B3.5, C1.1, C1.2

Success Criteria:
- ☐ Present poster for 5 minutes to two separate experts
- ☐ Present social, environmental, politic issues and sustainability
- ☐ Explain scientific inquiry and results from lab # 1 and lab #2
- ☐ Answer the question: is my community self-sustainable/ sustainable?

Materials
- ☐ Poster
- ☐ Speaker notes
- ☐ Rubric
- ☐ Notebook

Welcome the Local Community (~10 minutes)
- The symposium will be held in the school garden
- Parents, family, faculty and experts will be invited to the symposium
    - ***See Appendix for expert details (12a)***
- Welcome guests, present the unit and the school garden

Effective Science Communication (~50 minutes)
- Guests will volunteer to be judges
- Each judge will evaluate 3 students using rubrics provided
- Each student will be evaluated 2 times by two separate experts
- The culminating projects will present the findings to the following question:
    - *Is my community self-sustainable?*

Garden Celebration (~15 minutes)
- Have a garden party with snacks and refreshments
- Encourage students to show their guests their school garden
- Thank all guests for their attendance and close the celebration

Safety Guidelines:
- Use the co-created rules of the classroom lab **(1c)**

Summative Assessment: Product: ***Symposium Presentation***	**Accommodation Opportunities** If students have a fear of public speaking, encourage them by prompting their ideas, assisting in breathing exercises, assure them that there is only one person listening to them at a time. If they have an IEP to avoid public speaking, students can practice with the teacher one on one. Students may choose to pre-record their presentation and present the video at the symposium.

Table of Contents

Professional Development
- Wilderness Awareness School: eCourses - Canadian Wildlife Federation: Project WILD Workshops - FoodShare: Teaching Teachers about Good Food - Ecoscource: Sustainability Education and Nature Play

Table of Contents

Prior to Unit and Lessons
- Before lesson 1: Research native and nutritious plants that they would like to plant in the school. Use *Grown in Mississauga Training Manual* and the links for *Ontario Native Plants* and *The Old Farmer's Almanac* for ideas. Plant the plants that require more than 7 days to sprout. This way there will be sprouts in time for transplanting. - Before lesson 2: Soil samples of school garden, High Park garden and forest will be sent to a local lab for analysis. This way, students Assist students where needed. - Before lesson 3, ensure to purchase seeds, pots and any plant maintenance materials. Refer to the *Grown in Mississauga Training Manual* and *From the Ground Up* for a list of supplies. - Before lessons 5, have a vermicomposting bin prepared as an example. - Before the unit, purchase all the materials needed for the Minds On activities and games

Table of Contents

Appendix: Lesson 1: Sustainability	
1a: Topics Possible issues for exploration: - Nutrient deficiency (add fertilizers) - Limited lateral space (use plants that don't require sunlight) - High land values (use less land) - Contaminated soils (elevating the garden into beds) - Theft and vandalism (these are important to discuss in consolidation) - Pavement (elevating the garden into beds) - Loss and damage of crops from birds and rodents - High costs (water, infrastructure, permits, housing, etc.) - Lack of experienced skilled labor and management	**1b: Online Resource list** - Ron Finley: Urban Gangsta Gardener in South Central LA Game Changers - Grown in Mississauga Training Manual - From the Ground Up - Acting Today, Shaping Tomorrow* - Toronto school teaches students to grow produce - Ontario Native Plants - The Old Farmer's Almanac - Grown in Mississauga Training Manual
1c: Safety Guidelines Prior to the unit, co-create student safety guidelines for the classroom and outdoor lab. Ensure that the safety guidelines include: - No eating, chewing gum in the lab - No running, pushing or play in the lab - Use appropriate protective equipment (gloves, goggles, lab coat) for experiments - Secure long hair prior to experiment	

- Understand emergency procedures before an experiment
    - Know how to use the eyewash station
- Dispose of broken glass in the broken glass bin
- Do not start an experiment without the permission of the teacher
- Stay with the class for the entire period whether in the classroom, computer lab, outdoors or on a field trip

1d: Homework

Research native and nutritious plants that they would like to plant in the school. Due the following class. Ask students to check pages 23 and 42-43 of *Grown in Mississauga Training Manual* and the links for *Ontario Native Plants* and *The Old Farmer's Almanac* for ideas. Bring drawings or a printout of 3 plant in addition to one question about each plant for lesson 2. (This homework can be completed, seeds ordered, and plants planted in pots a few weeks prior to lesson 1 as some plants, such as arugula, require more time to sprout.) Complete page 5-6 from *Grown in Mississauga Training Manual* for lesson 2. ***Teacher homework***: enroll in *eCourses* to learn more about sustainability, nature connection, edible plants and plant identification.

1e: Accommodation Opportunities

Closed caption will be available for all videos for the benefit of every students, especially students with hard of hearing. ELL students will be given an English word bank so that they may translate specific words to their native language. Accommodations for students with IEPs and IPRCs will be given keen attention and students who are not participating will be approached to find the best way to accommodate that individual. There may also be a student who prefers to work alone on projects. Group work will be encouraged as it is an important skill to exercise, however, if the wellbeing of the student is challenged, support individual work. All materials, instruction and homework will be posted to Google classroom daily so that students may have access.

Table of Contents

Appendix: Lesson 2: Water

2a: Water Inequality Activity

Create information sheets to specific regions in Canada. Suggestions for items to include population, population demographic, average household income, rural/urban area cover, number of schools, languages spoken, community events, agriculture production, environmental damage, etc. The most important information is economic information.

Use information from websites such as *Ending long-term drinking water advisories*, to choose a region that have already been affected by polluted water. The purpose of this game is to demonstrate the inequality of clean water access to all Canadian citizens.

2b: Online Resource list

- Ending long-term drinking water advisories
- Autumn Peltier
- Autumn Peltier's Instagram
- From the Ground Up
- Planting Calendar for Toronto
- Ontario Native Plants
- Grown in Mississauga Training Manual
- 5 Common Edible and Medicinal "Weeds" You Need to Know

- Wild Plant Identification eCourse
- External Resources

2c: Lab: Testing disturbed land

Part 1: The Map. Use page 17 in *Grown in Mississauga Training Manual* under *Spring sun-shade map*, to draw a map of the garden. Ensure students include measurements. Use page 20 as an example for the sketch.

Part 2: Chemistry. Ask students to form groups or assign groups of 3-4 students for the final poster assignment. Explain that results from lab #1 and lab #2 will be used in the culminating project. To determine the chemical composition of the soil in the school yard, use the methods from pages 11-14 from the manual *From the ground up* to collect soil samples. Some soil samples will be "sent" to a qualified and local lab (i.e. Standards Council of Canada or the Canadian Association for Laboratory Accreditation) and others will be kept for lesson 3. Soil results will have already been received for school yard soil samples prior to lesson. Assist students where needed.

Part 3: Soil Texture. Use pages 31-32 in *Grown in Mississauga Training Manual* to perform the *Squeeze test, Jar test* and the *Earthworm test*. Records results. Assist students where needed. Leave jar in classroom at the end of the day and do not disturb for 24 hours.

Tell students that they will be performing the same experiments in an upcoming field trip to High Park and will be comparing the school soil samples (disturbed land) with that of the park's garden's soil (disturbed land) and forest area (undisturbed land). Soil and water samples will be collected from different parts of High Park.

2d: Medicine Walk

Complete the *Wild Plant Identification eCourse* check *External Resources* from the Pine Project website to find field guides to identify local Ontario plants. Tell students that indigenous communities would take a medicine walk in search of medical and edible local plants. Students will take the photo/image of the plant from homework and try to find it on the walk. **Warn students that eating unknown plants can be lethal and that they are not to eat unknown plants for their own safety.** Students are not allowed to eat anything without asking. At the beginning of the walk pose the question:

- *What 2 edible and medicinal plants are in this school yard?* (Dandelion and Plantain, check *Common Edible and Medicinal "Weeds" You Need to Know* for details)

At the end of the walk, collect the plant photos of all students. If time and budget permits, purchase the seeds of the plants that the student's request. Make sure to include the 3 sisters (corn, beans and squash). Otherwise use students' documents to decide which seed to give to which student and reference *Planting Calendar for Toronto*, *Ontario Native Plants* and pages 42-43 when deciding which plants to purchase. Assign homework.

2e: Accommodation Opportunities

Ensure that all students have cell phones to scroll through Autumn Peltier's Instragram. If all students do not have access to technology, share her page on the projector instead. During the story outside or sit spot, students may feel the urge to walk around, break sticks and make noise. Encourage silence but welcome movement. Create a comfortable and quiet environment. Some students may require technology to assistant in their creative process. Include a tablet or laptop for drawing a map of the garden.

Table of Contents

Appendix: Lesson 3: Soil

3a: Local Lab
Archives results. Students will take information from the archives and use page 8 of *From the Ground Up* to support their conclusions of whether the soil in their garden area is safe.

3b: Online Resource list
- From the Ground Up
- Grown in Mississauga Training Manual
- Soil Test Kit

3c: Lab #1 Testing disturbed land
Part 4: Archives results. Students will take information from the archives and use page 8 of *From the Ground Up* to establish if the soil in their garden area is safe. Take notes in their notebook. Additionally, students will use *soil test kits* to test pH, nitrogen, phosphorus & potassium levels in their soil samples.

Part 5: Jar test results. Records results from the jar test in chart from lesson 2. Assist students where needed.

The class will move to the computer lab. Teach a lesson on Microsoft Excel to display use results for lab #1 and final project.

Part 6: Chemical results. Students will transfer chemical soil sample results into a spreadsheet.

The rest of the computer time will be given to students to finish their **Lab #1** report. The is due lesson 5. In groups, students should set up a Google document. Check in with each group assuring that all experiments are completed and that conclusions are drawn.

3d: KWL Chart
On a white board, write the title *Lab Reports* and draw a KWL chart below: "what I know" (K), "what I want to know" (W) and "what I learned" (L). All students will be given 3 sticky notes and will place one sticky note under each column. The teacher will select sticky notes to address to the entire class. Ask students to communicate confusion on the topic of lab reports.

3e: Accommodation Opportunities
If students require a break from the screen time a water break or bathroom break may be encouraged for these students.

Table of Contents

Appendix: Lesson 4: Growth

4a: The 3 Sisters
The plan must ensure that the 3 sisters (corn, beans and squash) are planted together. The story of the 3 sisters will be told in lesson 8.

4b: Online Resource list
- Grown in Mississauga Training Manual (pages 48-51 and 61-62 under Beginner garden planning)
- Signals

4c: Building Community
After, they will pair with a classmate with whom they never speak and share as much or as little as they want about how they are feeling. One student will listen to another student for two minutes without interruption. Then the roles will switch. Students are encouraged to be supportive through active listening. This activity is an activity, addressing the wellness of one's heart, is an activity from professor Nastassia Subban.

4d: Homework
Prepare 10 qualitative questions for the High Park community garden staff. Topics will include gardening advice and how human activity affects soil composition or soil fertility and the impact of this activity on the sustainability of terrestrial ecosystems.

4e: Accommodation Opportunities
Multiple laboratory sessions will be available to accommodate for students in low-income areas. Extra assistance will be provided for the students with IEPs who require proximity to the teacher and additional reminders to stay on task. One student per group will be responsible for taking observational photos in the case that everyone doesn't have technology.

Table of Contents

Appendix: Lesson 5: Survival

5a: Vermicomposting
Show students an already built vermicomposting bin and explain that it is a method of managing the soil responsibly. Using *Vermicomposting bin*, in their project groups, assist students in creating their own vermicomposting bin by combing soil, bins and worms. They will feed their worms and observe the change in the bins daily in addition to observing their plants.

5b: Online Resource list
- How Soil is Created
- Vermicomposting bin
- Aphids Infesting Lettuce and Celery in Ontario
- Aphids
- Asian Lady-beetle
- 10 cool facts about dragonflies
- Grown in Mississauga Training Manual

5c: Garden Predator and Prey Story by Saya Szparlo
It's the 1970s and two Canadian farmers, Cindy and Mohammed notice that all their crop seems to be disappearing! Upon close observation, they can tell that their celery and lettuce is slowly being eaten away by some sort of animal. Cindy plants a stake out and plops herself down right beside the largest patch of lettuce. 5 hours later, Mohammed checks on her. "Mohammed…… Nothing has come to eat our lettuce, but it continues to disappear," said Cindy, "I've been staring at this lettuce for so long, that it seems like IT'S moving." Mohammed leans in to take a closer look at the lettuce. "That's because, it IS!" exclaimed Mohammed. He quickly runs off and returns with a magnifying glass and identifies the tiny culprits, the green peach aphids. "What are we going to do?" asked Mohammed, "our lettuce is covered in these aphids! After a long pause Cindy remembered: "didn't our neighbours, Shahadah and Katherine, just order 1000 of those Asian lady-beetles? Don't they prey on aphids?" "Yes, but isn't that ethically irresponsible? Stealing a foreign insect and bringing it to Canada? It may become an invasive species," said Mohammed. "What's an invasive species," asked Cindy. (Turn to the audience and ask, *can anyone answer Cindy?*) Cindy replies: "*ohhh, don't believe what those scientists are saying, Mohammed. It's fake news."*

5d: Garden Predator and Prey Story

Assign students into the green peach aphid (student will be given a green cloth), Asian lady beetle (student will be given a red cloth) and Green Darner or dragonfly (student will be given a black cloth). The aim of the game is to survive do not get tagged. If you are an aphid, you must collect as many beads (beads represent lettuce and celery) for food, lady beetles must tag aphids for food and dragonflies must tag lady birds. When you tag your prey, you collect their cloth and hold it in your hand. Additionally, all insects must collect water (blue cards) to survive. Beads and blue cards should already be in place for the game. Play several rounds time permitting. On the final rounds, add elements such as salt from winter that eliminate fresh drinking water and a disease that eliminates in the predators 2 minutes after they've preyed.

5e: Accommodation Opportunities

Change the names in the story based on the community of your students. Include pictures of where this farm may be for context of the story and maybe magnified pictures of the organisms for the game. For students with differing mobility needs, they will manage the game, they will appoint the different species and add elements to the game. ELL students will be given an English word bank so that they may translate specific words to their native language.

Table of Contents

Appendix: Lesson 6: Land Connection

6a: Songs

Songs can be a great way to build self-esteem of students while creating community in the classroom. Outdoor education camps such as the Pine Project encourage singing as a creative and fun outlet for students. However, age appropriate online "repeat-after-me" songs are difficult to find for secondary school age groups. The best way to find a good outdoor education song, is by asking around to your local outdoor education organizations such as the Pine Project.

Please do your due diligence when selecting a song to share with students. It is important to give credit to the artist of the song by mentioning their name before sharing a song. Alternatively, students can share a song that they created into the circle.

6b: Lab #2: Testing disturbed land

Part 1: The Map. Use page 17 in *Grown in Mississauga Training Manual* under *Spring sun-shade map*, draw a map of the garden. Ensure students include measurements. Use page 20 as an example for the sketch.

Part 2: Chemistry. Ask students to form groups or assign groups of 3-4 students for the culminating assignment. Explain that results from lab #1 and lab #2 will be used in the culminating project. To determine the chemical composition of the soil in the school yard, use the methods from pages 11-14 from the manual *From the ground up* to collect 3 soil samples. Some soil samples will be "sent" to a qualified and local lab (i.e. Standards Council of Canada or the Canadian Association for Laboratory Accreditation) and others will be kept for lesson 3. Soil results will have already been received for High Park soil samples prior to lesson. Assist students where needed.

Part 3: Soil Texture. Use pages 31-32 in *Grown in Mississauga Training Manual* to perform the *Squeeze test, Jar test* and the *Earthworm test*. Records results. Assist students where needed. (**B2.2**) Leave jar in classroom at the end of the day and do not disturb for 24 hours.

Lab #2: Testing undisturbed area.
Each group will find another group with whom to partner and repeat lab #2, part 1, 2, 3 in two undisturbed areas in the forest. Use a smaller area to collect results.

6c: Sit spot
Ask students to find a comfortable seated position. Speaking slowly with long pauses for students to think:
- *Observe your surroundings. Can you see any wildlife? Can you hear any wildlife? Notice the air. Is it moving? Feel the air. What can you smell? What has been here before you? Is our land being used sustainably?*

End the sit spot with a long moment of silence.

6d: Rubric
Explain the rubric for the final Poster. The poster will be renamed by the students and present findings to the following question:
- *Is my community self-sustainable/ sustainable?*

Students must include results from: vermicomposting bins, disturbed areas (school garden area and high park garden area), lab #1 & #2 and undisturbed areas (two High Park forest area), lab #2 as well as research on political and social conflict on the topic of sustainability.

6e: Online Resource list
- Grown in Mississauga Training Manual pages 17, 20, 31-32
- From the Ground Up
- Sit spot

6f: Accommodation Opportunities
High Park is physically accommodating for students with low or no vision and students who require wheelchair accessibility will be accommodated for as the circles will be close to the path.

Table of Contents

Appendix: Lesson 7: Sprouts

7a: Lab #2: Testing disturbed and undisturbed land
Part 4: Archives results. Students will take information from the archives and use page 7 from *From the Ground Up*. Take notes in their notebook. Additionally, students will use *soil test kits* to test pH, nitrogen, phosphorus & potassium levels in their soil samples.

Part 5: Jar test results. Records results from the jar test in chart from lesson 2. Assist students where needed. Use results for disturbed and undisturbed area in the forest and repeat lab #2, part 4 & 5. Record results.

Relocate to the computer lab. Part 6: Chemical results. Students will transfer chemical soil sample results into a spreadsheet. Use disturbed and undisturbed samples to observe results. Record results.

The rest of the computer time will be given to students to finish their **Lab #2** report. This is due lesson 8. In groups, students should set up a Google document. Check in with each group assuring that all experiments are completed and that conclusions are drawn.

7b: Online Resource list
- From the ground up

7c: Accommodation Opportunities
Students may require the quiz questions to be read aloud and/or may require the resource room for a quiet space and extra support to write

- Grown in Mississauga Training Manual - Signals - Soil test kit	the quiz. If students with IEPs that require additional time to write assessments are in periods 1 or 3, they will be welcomed 30 minutes before the start of class to start writing their quiz. If they are in periods 2 or 4, they will be welcomed to stay 3 minutes after class to continue writing their quiz.

Table of Contents

Appendix: Lesson 8: Trans-plant-ation

8a: Transplanting

Organize 4 groups. Appoint 4 leaders. These will be the transplanting teams. Group 1 (small group) will organize half of the garden. Group 2 (larger group) will prepare the plants for planting. Group 3 (small group) will organize the other half of the garden. Group 4 (larger group) will prepare the plants for planting. Ensure that the 3 sisters (corn, beans and squash) are planted together. Relocate outside. The class will proceed outside to the garden area and plant according to the plan outlined. Photos and observations will be taken for their experiment to follow.

8b: Online Resource list	**8c: Homework**
- Indigenous garden removed from humber river banks by city of toronto workers - Clan Connection - Sing the water song	Hand out review sheets and assign numbers 1-5 for students. In the review sheet, students will become experts and be prepared to teach their number's section to a group of 5 students. Prepare 5 questions for your section.

8d: Accommodation Opportunities

If some students cannot play the transplanting game, they can tally the amount of times a team drops the ping pongs. If there are some students who would rather not play or physically this game is not accessible to them, they may prefer to tally the amount of ping pongs dropped per team.

Accommodations will be made for students with differing mobility needs, instead of digging the holes they will be responsible for organizing the signage for the plants, that they remain in the correct order.

If a student is wary, they do not have to sing in the circle however they are encouraged to hum along with the melody and be present in the circle to encourage the community in the circle.

Table of Contents

Appendix: Lesson 9: Growth

9a: Jigsaw

Jigsaw. Students are numbered 1-5. Students group themselves into groups of 5 of the same number. For 15 minutes they will discuss details of their lesson, choose the 6 most challenging questions and

transfer them onto the *Cube template* and created into a cube to be used as a teaching tool later on. Important notes for their section will be written down on chart paper and posted onto the wall.

Student teaching. Students will then organize themselves into a new group of 5, where every student has a different number (1-5). Every group will be standing in front of a chart paper, the expert on the subject will present their material and students will roll the review cube for review questions. Each student only has 5 minutes to present each. Students are encouraged to ask their peers questions, take photos of the chart paper and compare their notes with the speakers' notes. The cube could be organized into a game: students can break up their group into two teams, roll the die and see which team gets the most correct answers. After 5 minutes, all groups move in a clockwise motion to the next chart paper. Repeat 3 times.

9b: Online Resource list

- Emerging Link Between Food and Mental Health
- Cube template

9c: Accommodation Opportunities

Students who have IEPs that require additional time to write papers may come in before class in the morning or during lunch to start their quiz early. If the period is 2nd or 4th period, the quiz will be at the end of the period. Students with high levels of social anxiety do not have to participate in the jigsaw sharing portion. However, they must take notes of their section and have them prepared for someone else to present their ideas. They will be paired with someone in a specific group that will present the material for them both.

Table of Contents

Appendix: Lesson 10: Sunshine

10a: Accommodation Opportunities

If students with IEPs that require additional time to write assessments are in periods 1 or 3, they will be welcomed 30 minutes before the start of class to start writing their test. If they are in periods 2 or 4, they will be welcomed to stay 3 minutes after class to continue writing their test.

Table of Contents

Appendix: Lesson 11: Support

11a: Presentation practice

Students will make 2 large circles. One circle on the inside facing outwards, the other on the outside facing inwards. For the first-round students on the outside circle will have 5 minutes to present their presentation for the symposium. While they present, their classmate takes notes on a mini rubric. When time is up, round two, students swap roles. After the first 10 minutes students will exchange their mini rubrics and then switch places. Repeat. Continue this process until time runs out. The teacher should ensure that all students are participating and are supported throughout this process.

11b: Online Resource list	11c: Accommodation Opportunities
- TED's secret to great public speaking - Mercy, Mercy Me	If students have a fear of public speaking, encourage them by prompting their ideas, assisting in breathing exercises, assure them that there is only one person listening to them at a time. If they have an IEP to avoid public speaking, students can practice with the teacher one on one. Students may choose to pre-record their presentation and present the video at the symposium.

Table of Contents

Appendix: Lesson 12: Garden
12a: Experts Experts in gardening should be invited to the symposium for objective opinions. Experts from Ontario universities, the Ontario Science Centre, the Toronto Zoo, the Toronto Botanical Garden, FoodShare, Eastdale Collegiate Institute and Don Mills Collegiate Institute can be invited to evaluate poster and presentation.

Table of Contents

This concludes my submission for the Don Galbraith Preservice Teacher Award of Excellence.

Article: The Implementation of School Gardens in Ontario

Saya Szparlo[i]

York University

Earth is entering what scientists call the 6th mass extinction (Anthropocene mass extinction) (Wagler, 2011), resulting in an increasing need for young environmental advocates. However, as Canadian society changes, youth have started decreasing their time outside. It is progressively difficult for students in urban areas to appreciate nature, as the landscape is slowly being appropriated for urban development. This separation of youth from nature can gradually create an unconscious divide between the world of humans and the natural world (Krosnick, Baker, & Moore, 2018). To avoid the disconnect imposed on our students and their future, educators must develop programs to show Ontarian students the importance of a positive symbiotic relationship between humans and nature. This proposed project of self-sustainability in an Ontario curriculum for grade 9 science unit plan, has been designed to address these alarming issues. This paper addresses the question, can a school garden be a successful pedagogical tool in Ontario? While the practice of self-sustainability requires an array of skills and ideas (Giles, 2017), the purpose of this project will focus on teaching students to become self-sustainable citizens who have a positive impact on their environment/ ecosystem by means of school gardens in Ontario. Gardening and all its acquired wellness benefits will engage students with methods of connecting with the land and living by communicating a sustainable lifestyle. This paper presents the argument that in addition to mental and physical wellness benefits, school gardens are powerful and timely pedagogical tools to show an Ontario grade 9 Science class the significance of nature in our present day and future.

As a point of departure, consider that students are no longer engaged with or adopting nature into their daily routine and thus do not understand the consequences and importance that sustainability possess (Krosnick et al., 2018). This necessitates a new and overdue initiative, to connect students with nature (Krosnick et al., 2018). Krosnick et al. (2018), have defined this disconnect as *plant blindness* as many people are unaware of the necessity of plants in our world. They outline tangible strategies to cure *plant blindness*. First, they suggest educators understand/ adopt plants as relevant and constant in students' daily work and lives. Second, they maintain that educators create interesting lessons such as practical outdoor lessons, that are not exclusively lectures. Finally, educators are encouraged to build on students' prior natural world knowledge and creativity to make new connections instead of exclusively trying to present them as novel ideas.[1] While there are many activities that aim to address all three strategies discussed here, Krosnick et al. (2018), exemplify their cure to *plant blindness* through the 'Pet Plant Project': a project which requires students to nurture a seedling to a mature plant. In this, students are guided with clues to ensure their plants thrives in optimal conditions based on their education and understanding of plants and nature. The 'Pet Plant Project' provides students' with tools for deductive reasoning to determine what plant they are growing and allows students to use the skills they possess in a realistic processual situation.

[1] Student ideas should be actively supported to create and developed original ideas in making connections with nature.

Krosnick et al. (2018) found that 73% of students who took part in the 'Pet Plant Project' became more aware of plant life and its importance. The data supporting the authors' claim were collected from 209 students over a period of 5 semesters. Additionally, 73% of students told researchers that they were planning on growing more plants in the future, demonstrating that students gained the desire and ability to care for plants and the environment. The data also shows that by participating in the project, students had a greater interest in academic content relating to plants. The relevant knowledge and nurturing skills gained from the project increased students' interest in plant-based science lessons. Their data posits that many students are likely interested in the topic of biodiversity and sustainability. However, due to several societal factors, including the lack of daily connection to nature and structured lecture-style classroom lessons, these issues are deemed as personally inapplicable. The data and 'Pet Plant Project' reveal that a large majority of students had a positive experience, both personally and academically, which solidifies the argument that gardening is as a useful pedagogical tool and is critical to the relationship between nature and humans.

Once students are exposed to the benefits of nature, Krosnick et al. (2018) have supported that they are typically willing to work towards its protection. This caring may be the key to creating sustainable communities. The impact of this statement extends towards students who live in urban environments. Lack of exposure to nature is significant among urban youth result in health issues including weight gain due to inactivity, unbalanced diets, and an over consumption of processed and unhealthy foods (Fischer et al., 2019). Fischer et al. (2019) conducted

a 2-year study where students cared for their own garden and eventually utilized the fresh produce in the school cafeteria. Students benefited by learning a valuable lesson: the land can sustain you if you care for it. At the end of the study, it was found that students responded well to the school gardens and that the gardens had become an informal source of education, nurturing students' minds and bodies alike (Fischer et al, 2019). Fischer et al. (2019), posits that the reason weight gain and health risks are linked to the environment is that students are becoming increasingly unaware of the sources of their food, how to garden and the importance of nutrition. Consequently, reconnecting students to their communities through food can reduce these risks while increasing their health benefits.

The work of a garden creates awareness of food sources while fostering a balanced and sustainable living by intersecting several disciplines: food, health, and the environment. Several schools have opted to create a school garden, as the best choice in rectifying and educating their students on the health and environmental benefits of whole foods. These gardens are collaboratively created by students and teachers working together to design, build, and maintain growth, exemplified by the school garden at Crawford Bay School in the West Kootenay region of British Columbia (Giles, 2017). Educators in this school found that this project supported student creativity and gave authentic feedback, in the form of plant growth, to students' investigation as plants such as arugula sprouted within 7 days of being planted (Giles, 2017). Developing such skills can be applied to the scientific investigation skills in the Ontario Ministry of Education's (2008) science curriculum specifically "initiating and planning, performing and recording, analysing and

interpreting, and communicating." (pg. 48, Ontario Ministry of Education, 2010) In Giles' (2017) short film, Crawford Bay School teacher Matthew Winger shared his personal challenge of giving students freedom to conduct their gardening experiments: an intriguing investigative academic experience. In addition to gardening satisfying the investigation section in the Ontario science curriculum (Ontario Ministry of Education, 2008), gardening also addresses the grade 9 biology sustainable ecosystems unit. Evidence of this connection can be seen in the grade 9 unit plan[2] included before this paper. The big ideas covered are (1) the dynamics of ecosystems, and (2) sustainably supporting these ecosystems. Lessons included in the unit include: testing ecosystems by assessing soil nutrient contents, assessing the land, researching organic gardening practices, creating a sustainable ecosystem, planting sustainable local vegetables and caring for a garden. Not only does gardening address the curricular needs of the biology and chemistry units (Ontario Ministry of Education, 2008), it is an excellent communal, practical, investigative and an academic tool that can be embraced in Ontario grade 9 science classrooms.

School gardens can be successful implemented as long as there is the support of motivated and keen educators. The experience is a collaborative investigative experiment with failures and successes that should be supported regardless of the outcome (Giles, 2017). As previously mentioned, growing and nurturing plants can improve students' interest in sustaining nature and academic skills, as well as school gardens create connections between the land and the human body. Students' commitment towards a sustainable system could be the foundation to continue to eat

[2] See page 10 for the Biology: Sustainable Ecosystem unit plan

fresh and healthy whole food. If students could sustain themselves through a garden, they may choose to not rely on large-scale farming, but rather grow their own food or support local sustainable farmers. The purpose of the unit plan provided is that learners will be motivated to create their own sustainable food sources through the nurturing of a garden and will be able to communicate their acquired knowledge to their friends and families. Gardening could be especially beneficial for people who do not have access to nutritious food (Finlay, 2013).

This program should be actualized throughout the province of Ontario as research shows it allows students to become empowered physically and mentally by gardens. Students gain environmental knowledge to such a degree that implementing gardens fulfill multiple requirements designed by the Ontario Ministry of Education. Schools in British Colombia (Giles, 2017), Toronto, Ontario (Field, 2013) and California and have demonstrated that gardens can successfully be implemented in urban and rural environments. Schoolyards are ideal spaces for school gardens as they are frequented daily and typically have some green space available. An example of this was the Crawford Bay School garden in Crawford Bay, a rural school in British Colombia as space was plentiful (Giles, 2017). In an urban environment, schools may choose to construct a garden on their rooftop. Such a project has been exemplified by Eastdale Collegiate Institute located in Toronto, Ontario, where they have effectively addressed the issue of space. Eastdale Collegiate is a success story in the Toronto District School Board partnering with FoodShare, an organization that partners with urban gardening projects, to fund a school garden in Ontario (Field, 2013). Only 10 students built the garden, they exhibited 100% attendance and showed initiative throughout the process

as they became counsels for the project (Field, 2013). The success of their plant yield has supplied summer farmers markets, restaurants and Eastdale's hospitality program, creating income that funds the maintenance of the garden (Field, 2013). The project continues during the winter months with 'hands on' learning as students nurture seedlings indoors (Field, 2013). In lieu of a rooftop, school gardens in cities such as Toronto can be placed in the large grassy areas where power towers are located as these spaces are otherwise unused. An example of this is York University Maloca Community stationed in Toronto, Ontario. The garden was originally created by a community concerned with the food deserts, areas without access to fresh food (Finlay, 2013), in the York University area(York University, 2015). Finlay (2013), founder of L.A. Green Grounds, proved that strong leadership is essential to such projects, as he refused to waste hospitable green space in the food deserts of South-Central Los Angeles, California. His perseverance to educate and feed nutritious foods to local communities has created 20 gardens around Los Angeles where volunteers contribute to and sustain these projects (Finlay, 2013). These rural and urban projects convey that with inventiveness and dedication, gardens can be built anywhere.

An alternative approach to this learning for communities with nearby forests could be forest gardens. Forest gardens are simply a garden planted in a nearby wooded area instead of school property (Almers et al., 2018). These forest gardens are designed to be self-sufficient as they are planted and left unsupervised, requiring limited human interaction and resources. This eliminates most limitations that could prevent the building of a garden such as space, maintenance and resources. The research by Almers et al. (2018), tested the efficiency of forest gardens to inspire the

understanding of student's position and role on Earth. After a three-year study, observing student engagement in forest gardening, data suggested that students viewed themselves as involved members of the natural systems contrary to thinking of themselves as separate existences (Almers et al., 2018). It was also found that students actively sought out opportunities to create a more sustainable and biodiverse environment both at home and in the community after completing the forest garden activity (Almers et al., 2018). Students becoming more concerned with topics such as global environmental sustainability while they work towards ensuring the sustainability of their own communities demonstrates the use of gardening as a pedagogical tool. Forest gardens can be an idyllic school garden in rural areas where forests are plentiful.

This discussion has addressed research papers, specific school and community gardens and has presented the grade 9 science Ontario curricular connections to answer the question, can gardening be used as a pedagogical tool in Ontario? The data and case studies presented support the idea that gardening is indeed an effective pedagogical tool for a variety of reasons including an increase in environmental justice, the participation in environmental laws (United States Environmental Protection Agency, 2018), students' investigative academics, and desire of students to protect the planet. It is imperative to seek the opinions and work of sustainability experts to further justify gardening a pedagogical tool. The first expert lens to look through is that of Shiva (2005). Shiva (2005) denotes that it is important to have a living economy that rejuvenates the livelihoods of citizens. Shiva (2005) describes livelihood as sources of sustenance, meaning, and purpose. As the research of Fischer

et al. (2019) exhibits, gardening allows for students to create their own living economy that can rejuvenate livelihoods by giving students sustenance and by giving students the purpose of nourishing themselves.

The next expert lens to look through would be that of Orr (2004). Orr (2004) posits that, for a sustainable planet, there must be a shift in pedagogy towards creating a deeper connection to the earth and says that demonstrating a love of nature may be a possible solution. The work by Krosnick et al. (2018), follows this same solution and conceptual framework. Krosnick et al. (2018), used plant growth as a tool to teach students content relating to science but also to show them how one must care for plants, by tending to their growth so that they may care for us, through feeding us. It was also shown that observing and caring for plants promoted love, a presented solution, since a majority of students gained a fondness for growing plants and planned to continue the practice. Orr (2004) additionally proposed that in order to foster a sense of *biophilia*, "the urge to affiliate with other forms of life" (Wilson, 1984, p. 85), there must be more natural spaces created by which children can engage with the social change required for environmental justice. The idea of creating a school garden, in the schoolyard or in the forest, is related to this principle. School gardens allow students, especially those who live in urban environments, an opportunity to experience the power of nature. As the research has demonstrated, students who are involved with a school garden gain an affection for plants. This affection towards plants can be seen as the *biophilia*, a connection Orr (2004) seeks, as a way to create awareness for the need of sustainable practices.

School gardening should be implemented across Ontario as it has been proven to promote wellness, foster creative and critical thinking that relates to the Ontario Ministry of Education Science curriculum, and can be accommodated with limited space. Using gardening as a pedagogical tool compliments the educational reforms many environmental sustainability experts are looking for in our educational model. Research has been addressed and alternatives have been provided for educators who may be concerned that it requires too much work, a concerning opinion as the climate crisis affects all living things. School boards such as Toronto District School Board thoroughly encourage school gardens (Toronto Food Policy Council, 2012) and successful examples of these projects continue to exist in the Greater Toronto Area. Crawford Bay School garden demonstrates the ability to pass along the drive for sustainable practices through passionate and motivated collaboration of students and teachers. (Giles, 2017) Motivation coupled with online gardening resources such as FoodShare (FoodShare, 2014), LifeLab (LifeLab, 2020) and YouTube are the simple foundational tools one requires for a successful school garden. To the teachers hesitant and unsure of how to integrate gardening into the curriculum (DeMarcco, et al., 1999), refer to the attached Ontario grade 9 science biology and gardening unit plan. It offers ideas for a science unit that embraces critical thinking, project-based learning. This paper has demonstrated how students who deepen their connection with nature through meaningful action have developed an understanding of the significant role humans play in the long term sustainability of our environment and thus are able to speak out on environmental justice issues. This type of learning is demonstrative of the change our society requires to support local and global

environmental sustainability; and to work towards slowing down the damage humanity imposes on the earth.

Table of Contents

References

1. Almers, E., Askerlund, P., & Kjellström, S. (2018). Why forest gardening for children? Swedish forest garden educators' ideas, purposes, and experiences. *The Journal of Environmental Education, 49*(3), 242-259. doi:10.1080/00958964.2017.1373619
2. DeMarco, L., Relf, D. McDaniel, A. (1999). Integrating Gardening into the Elementary School Curriculum. *American Society for Horticultural Science*. *9*(2), 276-281. doi: https://doi.org/10.21273/HORTTECH.9.2.276
3. Finley, Ron. (2013, February). *A guerrilla gardener in South Central LA*. [Video File]. Retrieved from https://www.ted.com/talks/ron_finley_a_guerilla_gardener_in_south_central_la?language=en#t-74888
4. Fischer, L. K., Brinkmeyer, D., Karle, S. J., Cremer, K., Huttner, E., Seebauer, M., .Kowarik, I. (2019). Biodiverse edible schools: Linking healthy food, school gardens and local urban biodiversity. *Urban Forestry & Urban Greening, 40*(Complete), 35-43. doi:10.1016/j.ufug.2018.02.015
5. Giles, G. (2017). *Growing Education in The Crawford Bay School Garden*. [Short Film]. Retrieved from https://vimeo.com/212677142

6. Krosnick, S. E., Baker, J. C., & Moore, K. R. (2018). The pet plant project: Treating plant blindness by making plants personal. *The American Biology Teacher, 80*(5), 339-345. doi:10.1525/abt.2018.80.5.339
7. Ontario Ministry of Education. (2008). *The Ontario Curriculum Grades 9 and 10 Science*. Queen's Printer.
8. Orr, D. (2004). Earth in Mind: On Education, Environment, and the Human Prospect. Washington: Island Press.
9. FoodShare. (2014). Demonstrating a sustainable & accessible food system for all. Retrieved from https://foodshare.net/
10. Field, R. (2013). Rooftop garden a bountiful experience for Eastdale CI. Retrieved from https://www.toronto.com/news-story/4164218-rooftop-garden-a-bountiful-experience-for-eastdale-ci/
11. Life Lab. (2020). Gardening Education. Retrieved from https://www.lifelab.org/for-educators/schoolgardens/
12. Shiva, V. (2005). Earth Democracy: Justice, Sustainability, and Peace. Boston: South End Press.
13. Toronto Food Policy Council. (2012). School gardens. Retrieved: http://tfpc.to/to-food-policy-archive/school-gardens
14. United States Environmental Protection Agency. (2018). Environmental Justice. Retrieved: https://www.epa.gov/environmentaljustice/learn-about-environmental-justice
15. York University. (2015). Students and community members dig in at York U's community garden. Retrieved from

https://yfile.news.yorku.ca/2015/08/05/students-and-community-members-dig-in-at-york-us-community-garden/

16. Wagler, R. (2011). The anthropocene mass extinction: An emerging curriculum theme for science educators. *The American Biology Teacher*. *73*(2), 78-83. doi: 10.1525/abt.2011.73.2.5
17. Wilson, E.O. (1984). *Biophilia*. Cambridge: Harvard University Press.

Table of Contents

Supporters

[i] The original work was a collaboration with Richard Kelbert. I have received permission to submit the edited version of this assignment for the STAO Don Galbraith Preservice Award. Thank you to the following educators, mentors, academics and friends: Andrea Thykootathil, Annie Dearden, Bianca Foo, Edward Scherer, Eric Johnston, Gabriela Mattos, Dr. Graham Giles, Gordon Brett, Lisa Szparlo, Molly Short, Oliver Smelt, Robyn Cheung, Shathi Eshaque and Stefanie Hall, who supported this work with their careful edits.