The Power of Sustainability: Growing Climate Problem Solvers

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Abstract

This unit explores how students can grow skills to engage with a range of food, agriculture and natural resources sustainability and climate issues that are interconnected with each other and with many social and economic issues in complex ways by practicing design and systems thinking strategies.

urban agriculture, food systems, urban foodshed, sustainability, wicked problem, climate change, climate optimism, food security, food waste.

Unit Content

The world is on fire. The scope and scale of greenhouse gas emissions caused by human activity have created what is likely an irreversible change to our planet's climate. (Herring and Lindsey, 2020 p.1). Human action is incontrovertibly linked to this climate catastrophe. The enormity of the challenge to fully comprehend, and to fully share in the responsibility for a crisis of this scale, makes the work of teaching about climate change and climate change solutions difficult, yet essential.

The social, environmental, political and economic policies and practices that have led to, and will need to be changed, to tackle the climate emergency, can be considered what are called "wicked problems." Wicked problems are defined by John Kolko as …" a social or cultural problem that is difficult or impossible to solve [because of] … the interconnected nature of these problems with *other* problems. Don Norman prefers to call these sorts of problems as "complex socio-technical systems that are not isolated" (Wong, 2021 p.1). Big problems like food insecurity that intertwine with food processing systems and production systems, technological, social and legal systems, are hard to untangle and are not only challenging to solve - they are also challenging to teach.

This interconnectedness does provide an opportunity for educators seeking to engage students in complex real-world issues. One way to reach young people and engage them with issues like climate change, sustainability (or most anything) is to find a way to make the subject at hand relevant to them. Why should our students care about pressing environmental issues that are predicted to lead to doomsday? Environmental doomsdays exist in the future, while the big issues that our students grapple with day to day, such as gun violence and food insecurity are happening right now. When students are focused on their safety and their hunger, the immediacy of the now takes precedence, and rightly so. Uncovering evidence-based solutions to poverty, gun violence and hunger that align with saving our world from catastrophe, might be the easiest strategy for engaging young people to connect with sustainability issues.

In our seminar, we explored a wide range of urban sustainability topics from opportunities to mitigate unsustainable legacies of historic disinvestment and neglect which has led to heavy metals in soil now used to grow food, and buried streams with where homes were built on unstable waterlogged fill. We explored technical solutions, equity implications alongside political and economic challenges for implementing change. Our seminar leader curated and organized a huge collection of resources by which we could become conversant in a range of issues, policies, solutions and potential partners, not the least of which was the book she co-authored, *Reimagining Sustainable Citie*s. This book laid out specific and actionable strategies and policies along with attention to the questions of why people who know better don't do better that must be answered if needed change will happen. We spent class time discussing the various ways each of us, as educators, could have an impact, with an emphasis that there are key roles for everybody to find a useful path. We supported each other to consider how each of our classrooms would help launch students towards informed civic engagement. We looked at tools to measure and report about the impacts of green gentrification on displacement, how environmental justice could inform policy because planning for a climate resilient

and sustainable future may have unintended impacts on low income neighborhoods if these issues aren't considered.

From this seminar I decided to focus my unit on how students can engage with lessons and projects that simultaneously address pressing societal issues while focusing on the equally pressing climate crisis, and create an opportunity for them to put knowledge they are expected to gain during class together with problem solving tools and opportunities to serve their community. Understanding that "properly designed and maintained outdoor green space has the potential to reduce violent crime and gun violence, to make communities safer and keep residents healthier." (*Science Daily*, 2020, p.1) could motivate a student to join a tree planting team, or be willing to water our school garden regularly. Students might then make the connection to ways that urban greening and gardening also helps keep our drinking water protected, contributes to good air quality and captures and sequesters carbon, while reducing the urban heat island effect. We can dig into the issue of food waste and methane emissions from landfills from food that could have been eaten by hungry people, and organic matter that could have been composted to grow more food. There is power in exposing the range of social, economic and environmental problems that can be addressed by sustainability initiatives and practices.

Sustainability can be defined as a "process of continually and actively moving in the direction that promotes ecological health, social equity, quality of life, cooperation and compassion." (Wheeler and Rosan, 2021 p 13). Sustainable development was defined in the World Commission on Environment and Development 1987 Brundtland report ´Our Common Future` as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 2023 p.2). Imagining a future where humans cooperate on implementing decarbonization to share and use just enough and where everyone has enough is the realm of speculative fiction. This must also become the realm of business owners, policy makers, designers,

and all citizens - and as educators we have a chance to teach potential members of all those categories. Things need to change, and we need to grow changemakers. "To address our climate emergency, we must rapidly, radically reshape society" (Johnson & Wilkinson, 2021 p.xix), which will be easier done if young people gain the tools to conceive of and implement change.

How we move into a (hopefully very near) future where we have policies and practices that decarbonize and mitigate the human contributions to the climate crisis will involve making changes in how we produce and use energy; how we grow, process and distribute food; how and where humans live, and how think about sharing finite resources and expand our technologies to prioritize the infinite resources of the sun. It requires prioritizing and taxing and mobilizing and mitigating and any number of complicated conceptual interdisciplinary actions that overwhelm even ardent activists. As Wendall Berry said, "It is the destruction of the world in our own lives that drives us half insane, and more than half." (Berry, 2013 p.79)

Not wanting students to be either overwhelmed, or driven insane, educators can model proven methods of visioning and designing solutions, making ideas visual and collaborating, and can offer resources and opportunities on various scales for real-world problem-solving and community action. "Learners often learn facts and rote procedures with few ties to the context and application of knowledge. Problem solving has become the means to rejoin content and application in a learning environment for basic skills as well as their application in various contexts" (Foshay & Kirkley 1998, p.1). Students can be introduced to case studies of big problems that were addressed and solved. While there are still many people breathing unsafe air, the US passed The Clean Air Act in 1970 which has been a tremendous success. According to *A Success Story, with Many Chapters Still to Come* (2011 p.1) "In its first 20 years, more than 200,000 premature deaths and 18 million cases of respiratory illness in children were prevented." This

example of bi-partisan legislation that dramatically shifted public policy was quickly followed by The Clean Water Act (1972) "before this landmark legislation, America's waters were in crisis, often flooded and even on fire with toxic pollution and cancer-causing contaminants. Industrial waste and sewage threatened our drinking water, and wetlands disappeared at an alarming rate. The Clean Water Act met these challenges head-on, setting and enforcing national water quality standards, restricting pollution, and investing in wastewater treatment and better wetlands management" (*A Proclamation on the 50th Anniversary of the Clean Water Act*, 2022).

Students can be encouraged to join peer networks and organizations in what Christina Rosan and Stephon Wheeler call "communities of support" (Wheeler & Rosan, 2021 p. 45) and can be taught theories of behavior and social change. They can be invited to leverage their social media talent, their artistic ambitions, their scientific or math skills, or public speaking abilities to play some role in this work.

If we want students to engage with this hard work we must help them to connect issues that matter to them with success stories of changemaking, proven strategies that foster collaboration, and introductions and partnerships with changemakers. We need every solution and every solver." (Johnson and Wilkinson, 2021). This unit attempts to create the structure within which a group of students would gain expertise and motivation to create/join/staff a range of urban sustainability and climate change challenges.

Teaching Strategies

The U School offers a competency-based model that requires young people to demonstrate their learning through tangible performance tasks, and attempts to be transparent with expectations and to offer numerous opportunities for independent and self-directed learning. The U School Urban Agriculture, Food and Natural Resources (AFNR) CTE program is a unique one-year program for high school seniors which

combines traditional expectations of the CTE model within the specific context of urban Philadelphia. The U School AFNR team hope to engage and empower young people with challenging and scaffolded learning experiences - in the classroom, school based ag and food "labs," field trips, campus & neighborhood greening projects, internships and other real-world learning opportunities towards deep and meaningful engagement in big issues and green collar career pathways.

As we enter our fourth year developing our AFNR program, we have been seeking additional ways to highlight and recognize the essential skills and habits of mind that are not content specific, but are essential to teaching sustainability. At the U School we are adding several Cloud Institute Educating for Sustainability (EfS) competencies into the requirements of a student portfolio. "A systematic review of various frameworks that have been identified as those that educators need to face current sustainability challenges include: Critical Thinking, Connections, Participation in Community and Learning to Live Together" (Corres, et.al. 2020 p.3). These frameworks outline a general path. Interested educators can dig deeper into teaching sustainability resources from organizations such as Educators for Sustainability to discover a range of big ideas, benchmarks and resources to integrate the *Big Ideas* thought to be essential for humans and other life to flourish on Earth over time into lesson planning. The first three (of 39) EfS Benchmarks are:

- A healthy and sustainable future for human and other life is possible
- Adaptability helps all living things (including humans) survive (even thrive) over time
- Creativity (the generation of new forms) is a key property of all living systems and contributes to nature's ability to sustain life (Cloud, 2023).

These, and the remaining, benchmarks frame thinking, and will be used in assignment rubrics, and in evaluating and discussing solutions and ideas.

The goal of this unit will be to build on a collection of environmental science modules that students will have completed prior to this unit, which include urban growing basics, composting basics, urban air quality, urban water, tree care, and urban growing. Students will also have completed an interdisciplinary unit called The Power of Place (Teachers Institute of Philadelphia 2020) which provides context for many aspects of the intersectional wicked problems of poverty, gun violence, environmental justice and urban heat island that we will be looking to address around how our city can move towards an equitable sustainable future.

We will begin with establishing expectations for completion of their "Sustainability Portfolio." Students can opt to create a simple web-site, an organized Google folder or a combination of an "old school" three ring binder and Google Slide Deck to track their work through this unit.

We start every unit with a version of KWL where students consider what they already know, want to know and what learning connections they can see around the topic – which in this case is both sustainability and wicked problems.

There will be two interactive direct instruction lessons using Nearpod Slides and video to explore definitions of sustainability, sustainability issues, and wicked problems.

Next will look at what wicked problems students are interested in. They will do guided research on Philadelphia area sustainability initiatives, data and plans. They will identify and prioritize a number of issues, read articles and reflect on where they notice intersections with sustainability. Students will be introduced to research about Happiness and Sustainability and complete a Walking Audit Asset Mapping Assignment of two Philadelphia neighborhoods rating them on a scale of Sustainability Neighborhoods Happiness Index (SNHI), a measurement tool that demonstrates some connections

between sustainability initiatives and reported happiness of residents. (Cloutier et al., 2014 p.3).

Students will be introduced to the idea of wicked problem solving through a Ted Talk by Tom Wojac entitled *Got a wicked problem? First, tell me how you make toast* that shares strategies for mapping out and visualizing components of a system *(*Wujec, 2015*)*. This video introduces design thinking vocabulary (nodes & connectors) and offers a gateway into possible practices to use when addressing wicked problems. This video has been viewed over 3 million times, and will serve as background for activities including tools for design thinking and mapping out problems and solutions with post-its, whiteboards and group activities. Students will practice using these tools. They will be asked to detail their journey from home to school without words, and to review and reflect on their and their classmates' drawings. They will then explore the many systems within and adjacent to the food system, using these tools and other systems thinking stratagems and will simultaneously explore various tools with which problem solvers map out and try to understand systems that link the idea of food miles, urban food deserts with urban farming and food waste.

The capstone project in their sustainability portfolio will be to choose one or more part(s) of a wicked problem in Philadelphia and propose some way they will take action or engage with this issue. Students will document their work with some combination of artifacts such as: photos, photo-voice, weekly reflection/reports, screenshots of social media post.. Students will all be expected to present their work at an end of quarter exhibition, and some will be eligible to overlap the capstone portion of this project with an interdisciplinary service learning project. Students might also choose instead to write a speculative fiction piece about Sustainable Philadelphia 2060 which includes a vision of life of a teenager in a city that has adopted specific recommendations outlined in 2023. Some examples of this writing can be found in the appendix.

Students will be engaging in lessons and assessments around sustainability as it relates to the built environment and transportation in another AFNR course that overlaps these units with the timing of teaching this sustainability unit. Students will be invited to combine learning from both of these courses with various service learning internships through the year, and independent opportunities to earn various sustainability certificates. For example, after completing competency demonstrations on air quality, urban water, garden tools and tree care a student might intern on the Tree Philly team and earn a certificate as a Tree Tender from the Pennsylvania Horticultural Society.

Students will learn, engage, communicate and act as climate educators and activists within the school & wider community. By connecting the issues that matter to students: gun violence, poverty, litter, food insecurity to actions and advocacy related to greening and sustainability initiatives I hope to shift the narrative from fear to optimism - and more importantly try to engage students to recognize that their learning and action matters and is worth prioritizing.

Classroom Activities

Student Activities - Big Questions	Activity Type	Time to Complete	Learning & Assessment Resources/Tools
What do we know about Sustainability? **What is sustainability?** **What are basic human needs?** **How do the actions of one generation affect future generations?** **How do others define sustainability?**	Slide Sustainable Definitions Guided Notes Sustainability & wicked	90 minutes	Sustainability Defined & Explored Nearpod Sustainable City Guided Notes KWL Add to Sustainability

What are Sustainable Development Goals? **Are we talking about Sustainability or Climate Change?** **What is a wicked problem?**	problem KWL		Vocabulary What is Sustainability?
Review - Interconnections between Living (biotic) and Non-Living (abiotic) can be hard to see, and so changes can be hard to predict. Wolves change Rivers **Review How Life in Cities intersects with Environment:** How does life in cities intersects with Carbon Cycle: Food Systems, Housing, Transportation, Water, Air Quality Urban Heat Island (mini badge) effect with hand held digital thermometer & air quality data collection	Direct Instruction - Nearpod & Slide Deck & Guided Notes Jigsaw Web-Quest	How Wolves Change Rivers Food Waste, Compost, Bio Gas Review/Mini Lesson Air Quality-(exposome) Mini Lesson	Mini Nearpod lessons (review for some) on Air Pollution, Urban Water, Food Waste & Compost, Transportation Student contribution to shared slide deck for each topic with one pressing sustainability issue
Explore Economic & Social Aspects of Sustainability - Sustainability Happiness Index	Guided Research, Independent Reading/Viewing/Listening, Direct Instruction	90-120 minutes	Adapt this Sustainability & Happiness Lesson Plan using Philadelphia Case Studies (TBD) Rethinking Progress - Circular Economy Video Circular Economy Short Video EdPuzzle Complete the Greening Reduces Gun Violence Assignment

Explore what some of the Sustainability Issues in Philadelphia	Research with Curated Content		PHILADELPHIA CLIMATE ACTION PLAYBOOK Philly's Climate Change Progress Report Card. How Far Have We Come? Complete the Philadelphia Climate Issue Guided Notes
What are some examples of systems and what is systems/design thinking? **How do systems thinkers tackle problems?** **Explore Food System-Cascading Effects** **How Does Food Get Wasted In this System?**	Direct Instruction & Design Thinking Exercises		Systems Thinking Assignment & Assessment Food Span Food System Unit Plan **Food Waste Unit Slide Deck (Near Pod with Questions)**
Action Options: Choose one or more part(s) of one of the wicked problems in Philadelphia.. Identify one solution that seems possible to try or work on offered by each of the web-sites listed below. What Are the Solutions to Climate Change? | NRDC TerraCycle Bennett Compost GreenFutures – The School District of Philadelphia Write a proposal to start something, join something or report on something. What is important is to DO SOMETHING.	Independent and collaborative Work	1 hour/week 4 weeks	• Complete the Sustainability Project Proposal Form & Revise till Approved • Document your work with some combination of artifacts: photos, photo-voice, weekly reflection/report, screenshots of social media posts, flyers made etc. • Keep track of these in your AFNR portfolio and be prepared to

			share at least 10 artifacts after a 4-6 week engagement with this work • Completion & End of Unit Presentation •
Dream/Design/Describe a Sustainable Neighborhood "Philadelphia 2060" (Flash Fiction)	Writing	45 min	Use what you have learned to write a fictional account of an average day in the life of a teenager living in the thriving Philadelphia of the future. What might food, energy, transportation, building, neighborhoods, people
Career Exploration -list names of ten jobs/careers having to do with sustainability and sustainable city designing, creating, managing: Think about economics, social and environmental sector such as food waste reduction, composting, zero waste, cradle-to-cradle, education, advocacy, design, engineering, Choose one to dig into and describe.	Independent research- complete guided notes doc		Career Report-Back

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Resources For Teachers and Students

EcoLeaders -Campaign Badges - NWF EcoLeaders
Career Center - NWF EcoLeaders

@tinarosan | Linktree

America Has a Chance to Make Farming More Climate Friendly - The New York Times

Growing Stronger: Toward a Climate-Ready Philadelphia

Competences in education for Sustainable Development

Phila 2060 Sustainable Or Not?

Appendix

Competencies: CTE AFNR CIP 1.999

502 Analyze current agricultural environmental challenges.

706 Analyze the ways in which human needs and environmental considerations interrelate

303 Identify proper waste disposal and recycling methods

SUSTAINABILITY COMPETENCIES: THE CLOUD INSTITUTE

INVENTING AND AFFECTING THE FUTURE

The vital role of vision, imagination and intention in creating the desired future. Students will design, implement and assess actions in the service of their individual and collective visions.

Competencies: Habit of Success