Making It Personal: Focusing on Food and Using Concept Maps to Promote the Development of Environmental Identities Among Elementary Teacher Candidates

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Abstract

This article explores the use of food as a focal topic in an environmentally focused curriculum course for elementary teacher candidates (ETCs) to help them personally connect to the content. Environmental topics are interdisciplinary; therefore, as we prepare ETCs to teach them, consideration of the social dimensions of science is imperative. This article discusses how the design and implementation of a unit on food allowed for exploration of elementary science and social studies environmental content with the goal of developing ETCs' environmental identities. A focus unit on food as a daily practice that connects ETCs to the environment is described to highlight the personal salience of environmental issues and how ETCs impact and are dependent on the environment. Concept maps of daily activities that connect them to the environment were used as initial and final assessments for the course, along with an oral reflection with the instructor on their final maps. Examples of initial maps, final maps, and comments from students' oral reflections show that ETCs deepened their understanding of how salient environmental issues were to their daily life activities, such as eating. Implications of the implementation on how to increase ETCs' explicit connections with their identity positions relative to their experiences of and responses to environmental issues and proposed solutions are discussed.

Introduction

What should I eat for lunch today? It's a question that many of us ask ourselves, and our answers will vary based on our intentions and values. Maybe we want to eat for weight loss or better nutrition. Maybe we have a goal to eat in a way that is less harmful to animals or to lighten our carbon footprint. Science answers questions such as: What types of foods are associated with weight loss, which foods are higher in certain vitamins or minerals, how is this food cultivated or processed before it gets to me, and how much water or energy is needed to grow, harvest, process, and transport it? Our values may dictate how we answer the question of what to eat, but science can help us decide.

This intertwining of values and science to answer big questions is not limited to our consumption of food. The impacts of global climate change and other human-driven environmental issues (e.g., habitat fragmentation, invasive species, and freshwater

availability) can also not be adequately addressed using science alone, although it is crucial to use such evidence to inform how we approach these dynamic situations. Environmental literacy, as a goal for education, considers this need for increasing students' awareness and understanding of how the environment works (knowledge) while also addressing attitudes toward the environment (values; Roth, 1992).

Just as many Americans advocate for society to address issues like climate change, the quest for social justice and equity is an important contemporary goal for educators. Environmental education has the potential to address both environmental and social justice issues. The communities that will experience the most impacts of degradation of environmental health are more likely to be low-income, nonwhite communities (Agyeman et al., 2016). Researchers have called for environmental education curricula to move away from narratives that focus on the experiences of white, privileged, suburban students to help more diverse students feel connected to environmental content topics (Blanchet-Cohen & Reilly, 2017; Tzou & Bell, 2012). This is an especially important goal considering that the overwhelming majority of public elementary teachers in the United States are white and do not reflect the diverse demographics of public school classrooms in the country (Hussar et al., 2020). Therefore, my goal as a science educator is to help my predominantly white teacher candidates reflect on their own roles as humans on the Earth (advancing their own environmental literacy) and consider and critique how their identity positions in society impact how they perceive environmental issues and proposed solutions.

Therefore, due to my own interest in how science can help us understand sustainability and environmental issues, I sought to design a course that promoted reflection on environmental identities through a personally relevant topic (food), used an interdisciplinary approach (science and social studies), and focused attention on the critical social dimensions of positionality in how we experience and relate to the environment. In choosing this course design, I hoped to explore with elementary teacher candidates (ETCs) important environmental issues (e.g., climate change) with an eye on increasing not only their interest and motivation to learn such content but also their ability to help diverse student populations connect to environmental topics so they can work as citizens towards a more just and sustainable world.

Course Design

Course Description

The environmentally focused curriculum class in the undergraduate elementary education program at our university comes before the formal subject methods courses. ETCs are typically in their second or third year in their programs. The course counts as a requirement for the elementary major, but ETCs can choose from a range of options provided by faculty in

our program based on instructor availability. Each course option is focused on different interdisciplinary subject combinations (math and social studies, social studies and language arts, or math and science) or on critical social issues related to education (linguistic diversity and emergent bilinguals, teacher leadership and citizenship). These courses were all designed to be service-learning courses to help ETCs think about how curriculum can connect learners to their communities. Our environmentally focused class has an interdisciplinary focus on science, social studies, and language arts. The course length is 15 weeks, and we meet face to face once a week for 2.5 hours.

Environmental Identity

Environmental identity is defined as “the meanings that one attributes to the self as they relate to the environment” (Stets & Biga, 2003, p. 406). Environmental identities are formed as people make meaning of their experiences related to the environment and their role in relation to the environment. This sociocultural perspective of identity is grounded in the idea that identity is continually constructed through the meaning-making of experiences and participation in practices within daily life (Holland et al., 1998). Identities change as a result of individual sense-making and discursive meaning-making in a community when learners have a boundary experience that pushes their comfortability with their perspective of themselves (Geijsel & Meijers, 2005). Kempton and Holland (2003) describe three dimensions that contributed to the development of environmental identities in environmental professionals: (a) personal salience of environmental issues, (b) identification of oneself as an actor in the environmental world, and (c) gain in knowledge about the environment through action (doing). These are not sequential stages that have to be achieved; rather, Kempton and Holland describe them as “mutually causal, more akin to positive feedback than to strict cause and effect” (p. 339). Each of these dimensions acknowledges the role of the person in learning about the environment and relating to it. In addition, the implications of these findings for environmental educators and teacher educators are that we need to do a better job of helping people find connections between themselves and the environment in which they live and on which they depend. If we do not acknowledge how people are positioned or position themselves relative to the environmental messages in our teaching, we may risk promoting environmental discourses of fear and privilege that result in nonenvironmental identities instead of encouraging agency (Tzou & Bell, 2012). These dimensions of environmental identity from Kempton and Holland (2003) of personal salience, actor in the environment, and knowledge through doing served as a framework for my course design. For a discussion of the service-learning aspect of the course (knowledge through doing part of the environmental identity design) and its influence on ETC science teacher identity, see Wilson et al. (2015).

Making it Personal: A Focus on Food

ETCs take the environmental course to fulfill a requirement of the elementary education program, but they often choose it due to scheduling convenience rather than their innate interest in the course topic. Although personal salience of the topics for the course would be important in helping students develop environmental identities, I felt it was equally important that students feel a personal connection to content, which would make them more likely to intellectually engage with the topics.

Educational researchers have documented how a focus on food in various educational settings can be used to explore and critique food systems to problematize how large-scale agricultural systems position both producers and consumers as well as structure our food practices (Swan & Flowers, 2015). Thus, in using food as a focus topic for learning, instructors can explore “power, culture, bodies, gender, class, race, status, identity, pleasure, pain, labour, health, morality, our place in the world” (Flowers & Swan, 2012, p. 423). Food and food practices provide a unique context in which to explore sustainability issues, various cultural traditions around food, personal experiences, memories, and emotions as well as how food can “reflect and reproduce social hierarchies (Freedman, 2011, p. 82)” (Swan & Flowers, 2015, p. 158).

Although a focus on food can lead instructors to shepherd students along various pathways such as those described above, in our course, we focus on the cultivation, transportation, preparation, and consumption of food as well as how technologies, structures, and policies that shape the food pipeline from field to plate impact environmental health and, by proxy, human sustainability. This focus on the food pipeline allows us to question how we make decisions about sustainable eating that take into account science, cultural practices of eating, and how our identities (in part due to gender, race, ethnicity, and class) inform our thinking about food practices and proposed environmental solutions.

Finally, science educators have called for more science and social studies integration in the curriculum to promote the critical thinking needed to address complex environmental issues and solutions for a democratic and pluralistic society (Feinstein & Kirchgasler, 2015). Because of the importance of the cultural and social dimensions of food practices and how it has the potential to help ETCs reflect on their relationship with the environment and their identity positions, in the course design, I intentionally set out to weave together elementary science and social studies curriculum standards using food as a content focus.

Personal Environmental Activity Mapping

In addition to choosing course topics to help students personally connect to environmental topics and the science and social dimensions of these issues, I wanted students to explicitly acknowledge their individual role within the environment, which is a critical factor in

developing environmental identities (Kempton & Holland, 2003). I asked ETCs to create a personal environmental activity map to prompt them to reflect on how they interact with the environment daily to address. Other researchers in environmental education have called for the development of more curriculum activities to help students make explicit their mental models of the environment (Shepardson et al., 2007). Instead of making a mental model of the environment explicit to themselves and their instructor, I wanted students to make a model of how they personally interacted with the environment using a concept map.

Concept maps have been used in science education as a tool to organize and track conceptual understanding over time, most notably to document conceptual change (Novak, 2002). Hay et al. (2008) advocate the use of concept maps with students in higher education settings to help them reflect on changes in their understanding of course topics. Using repeated concept mapping, instructors and students can reflect on how their conceptual learning is developing (Hay et al., 2008; Kandiko et al., 2013) and use concept maps as a learning tool rather than a one-time assessment (Kinchin, 2014). I wanted to use student production of concept maps as a metacognitive activity, using the map as a representational tool to require ETCs to show their understanding and then reflect on that understanding and how it changed over time, which has been shown to promote the learning of science content (Thomas, 2012). Pre- and post-unit maps of student understanding of environmental topics (watersheds) have been used with high school students to evaluate student learning (Zimmerman & Weible, 2017) but not with a focus on metacognitive thinking or a personal role in the environment.

In addition to promoting metacognition with the goal of increasing learning of science content, having ETCs create personal environmental activity maps reinforces the dimensions of their environmental identity (Kempton & Holland, 2003). By grounding the maps in their own daily activities, it supports the personal salience of environmental topics. Furthermore, by having the first set of nodes coming off from their names on the maps, it makes explicit how their actions form the foundation of their relationship with the environment. Finally, by creating the map as a repeated course activity, they are organizing and constructing their understanding of environmental topics and how it connects them with the larger world.

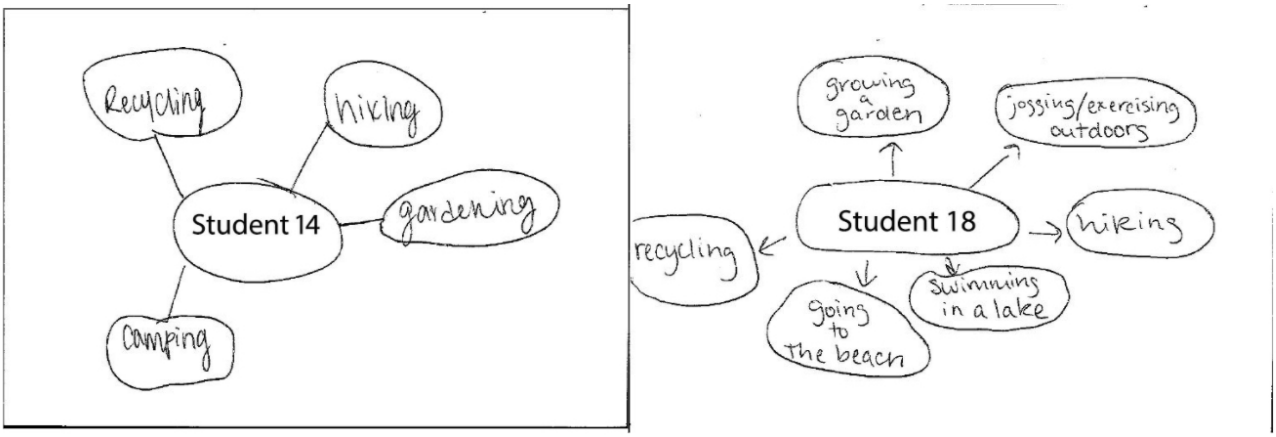
Course Implementation

Precourse Personal Activity Maps

I was interested in using the concept map as a tool to investigate ETCs' initial understanding of how their daily activities connect them to the environment. On the first day of class, I ask ETCs to write their name in the middle of the index card in a circle, which becomes the hub of their wheel. Coming off from their circled name, I ask them to list activities that they engage in on a daily basis that connect them to the environment (see Figure 1).

Figure 1

Example Initial Maps



Because of the course's focus on how a daily activity such as eating connects them to the environment, I am interested in what they already know about how they interact with the environment. Asking them to do this as a concept map provides a visually simple way for them to represent their activities. This mapping activity is not designed to be a measure of their knowledge of environmental topics (due to its open-ended nature) but rather to serve as a window into their awareness of how much they interact with the environment in their everyday lives.

ETCs' initial maps most commonly show that when they first think about how their daily activities are related to the environment, they think about nature-related leisure activities (see Figure 1). For example, in one semester with a class of 20, all ETCs included a nature-related activity on their maps, typically, more than one. Examples of these activities included hiking, camping, fishing, gardening, swimming, kayaking, and other activities situated outside (e.g., reading, time on a porch, and being in nature). Eleven ETCs included waste-related activities (e.g., recycling), and seven included a transportation activity (e.g., driving or taking public transit). In contrast, only two ETCs included personal needs (both food), two included jobs (both camp counselors), two mentioned resource use (electricity), two mentioned consumerism (thrift sales and farmers market), and two mentioned service activities (adopt-a-street). These results are similar to the responses of ETCs in other semesters when I taught the course.

In addition to helping students begin to reflect on their own roles within the environment, the personal environmental activity map at the beginning of the course informs my practice as an educator. Based on trends in their maps, such as the overwhelming focus on nature-related leisure activities as the way they are connected to the environment, I make sure that our

course highlights how personal needs, consumerism, resource use, and service activities connect ETCs to the environment. A focus on food allows us to explore these other categories for personally relating to the environment.

Overview of the Food Unit

I use the young readers edition of the book *The Omnivore's Dilemma: The Secrets Behind What You Eat* (Pollan, 2009) as an anchor for the food unit because it is a multimodal text with diagrams, graphs, and other visuals and because it is an example of a text that a teacher could use with older elementary students. Table 1 shows the food unit design and how its organization connects to each part of the four different approaches to eating explored in Pollan's (2009) book. Our reading of the text and associated course activities typically span 4–5 weeks of the 15-week semester. For each section of Pollan's (2009) book that ETCs read outside of class, we investigate environmental science topics in our state K–6 science curriculum connected to the reading through hands-on science activities appropriate for elementary science learners. Woven into the science-focused activities are discussions of the social dimensions of those topics that often connect to social studies standards in the state curriculum for K–6 learners. These activities are connected to state science and social studies standards as well as the *Next Generation Science Standards*' disciplinary core ideas, science and engineering practices, and crosscutting concepts (NGSS Lead States, 2013). In Table 1, I have also included questions that guide our discussions of the reading and class activities and help ETCs make connections between the science topics, sustainability issues, and how these impact people differently based on how institutions and large-scale agriculture position them in society.

Table 1

Overview of Food Unit

Part of Pollan's (2009) book	**Elementary Science Topics and activities--** *connecting to state science curriculum standards*	**Social dimensions of the science topic--***connecting to state social studies curriculum standards*	**Questions that guide our discussions of readings and course activities--** *exploring environmental food issues and how positional identities impact our food practices*
1-Industrial Meal: Food from Corn	What are the parts of a plant? Which parts of plants do we eat? What conditions do different food plants need to grow? Why do people eat food?	• Comparing various cultural food pyramids • Exploring international food diaries and staple crops • Cultural food-staple crops (geography/environment/history)	What similarities and differences can we find in what people eat around the world? What factors influence the foods we eat? How do industrial food systems in the US affect food availability? How do environmental conditions affect food availability? How does wealth shape food availability? How do political conflicts shape food availability?
2-Industrial Organic Meal	What are the parts of a flower? What is pollination and what role does it play in agricultural production? How does the introduction of an invasive species (honeybees) impact local biodiversity (native bumblebee pollinators)?	• Food labels and meanings • Organic as a legal term • Historical and current use of pesticides • Cultural impact of *Silent Spring* (Carson, 1962) • Clean Water Act of 1972 • Colony Collapse Disorder (CCD)	Who can afford to buy organic foods? Who can afford to grow and get food products labeled as organic? How does growing and buying organic foods contribute to water quality or biodiversity? Which communities in the United States are most impacted by the use of pesticides/herbicides and how are they impacted?
3-Local Sustainable Meal: Food from Grass	What is a symbiotic relationship and what are examples related to agricultural practices? What is the general life cycle of a plant? How does the life cycle of annual plants inform our understanding of seasonal availability of food plants? What is the generalized life cycle of animals? How does the life cycle of animals inform our understanding of meat production?	• Local food movements compared to globalization • Regional and seasonal foods for our state/region • Impacts of technology (refrigeration/freezing) and large-scale agriculture on food availability	What are the impacts of globalization of food on greenhouse gas emissions? How does a local diet impact the carbon footprint of eating? Where is fresh/local produce available for purchase and who has the most/least access to purchase it? What are food deserts and where are they located? How are food deserts related to the population incidence of food-related disease (Type-2 diabetes, heart disease)?
4-The Do-It-Yourself-Meal: Hunted, Gathered, and Gardened Food	What is a food chain/food web? What is the source of energy in ecosystems? How does human activity (overharvest, changing land use due to farming/ranching) impact ecosystems?	• Historical food ways (hunting, fishing, home gardens) • Hunting as a cultural food practice and population impacts (Native hunters/fishers vs. white/settler hunters/fishers) • Competing interests related to reintroduction efforts of apex predators (ex. gray wolf in Yellowstone--conservationists, local ranchers)	How does the amount of animal vs. plant products in the diet impact the carbon footprint of eating? What are the implications for household labor for the individual gathering/cultivation/preparation of food (historical/gendered/racial/ethnic)? What are the benefits and consequences of hunting for meat on local ecosystems? Who gets to hunt and how? (historical/ethnic/cultural food ways)

An Example of the Implementation: Part 1

After they have read the first part of Pollan's (2009) book about industrial food meals based on corn, we engage in a series of activities to explore food ingredients, how these relate to the parts of plants, cultural food practices, and how food practices have historically been

shaped by the environment and the biological needs of food plants to grow (for resources supporting the unit, see Table 2). Before we begin our unit on food, I ask ETCs to complete a 1-day food diary recording the ingredients that they eat. I make sure to tell them that they should not include calories, amounts, or serving sizes. If they eat any kind of packaged food, they can simply snap a photo or cut out the ingredient list from the package; and if they make a meal, they make a list of the ingredients they used.

As in each class, I strive to anchor our activities through questions related to elementary science curriculum topics and information from Pollan's (2009) book. ETCs first discuss these questions in small groups and then as a whole class. These questions are also designed to support ETCs in recognizing how culture, history, and geography shape our food practices. This is especially important to me because I teach at an institution with a predominantly white student body; thus, the ETCs themselves typically do not bring significant diversity in their own food practices. Therefore, the 1-day food diary becomes an important starting point for a discussion of their own positionality. Through taking this inventory of the ingredients they commonly eat, they begin learning about their own personal food practices. By reflecting on food practices as a group and then comparing them across other cultures, my intention is that they find similarities and differences across all the examples while also recognizing how they themselves are situated in society and how that shapes their own food practices in similar and different ways from people in other identity groups.

Table 2

Description of Activities in Part 1 of Food Unit

Topic focus	Description of activity (ETCs in small groups)	Description of activity (Instructor-led, whole group)	Reflecting on pedagogy
Parts of food plants: What are the parts of a plant? Which parts of plants do we eat?	*Adapted from Wilson & Bradbury (2016):* Observe a tray of 5 food plants and a photograph of each plant. Draw and describe plant examples, then predict how each example would be classified as a plant part. Use elementary-appropriate informational text, *The vegetables we eat* (Gibbons, 2007), to determine whether their prediction was correct.	Discussion of similarities and differences between the photographs of the 5 different plants and a labelled diagram of a plant to talk about representations and variations across food plants. Name the five parts of plants in their examples, describe their function, and additional food plant examples for each of the five parts discussed.	How does this activity connect to state curriculum topics? How does this activity connect to students' lives? How could we modify this activity to be more relevant for students from different cultural/ethnic/economic backgrounds? In what time(s) of year would this activity be easier/less expensive to source (due to availability of food plants)?
One-day food diary analysis: What similarities and differences can we find in what people eat around the world?	Compare and contrast one-day food diaries in small groups. Make a list of all of the food ingredients they have eaten, classifying food ingredients as plant or animal, and highlighting commonly consumed ingredients.	Make a list of commonly eaten foods (plant and animal) Discussion of how one-day food diaries reflect cultural tastes in food, personal choice, convenience, availability, and affordability.	How does this activity connect to state curriculum topics? How does this activity connect to students' lives? How might you use this activity with elementary-aged students? What are some considerations to think about for students from different cultural and economic backgrounds? (for example, students in food insecure situations)
Comparing various cultural food pyramids: How are diets culturally influenced?	Compare and contrast American food pyramid with our class list of commonly eaten foods from one-day food diaries. Compare and contrast USDA food pyramid with food pyramids from other cultures (such as Mediterranean, Asian, and African Heritage food pyramids).	Discussion of similarities and differences of cultural food patterns and how groups of foods are situated differently across cultures (for example, meats/proteins).	How does this activity connect to state curriculum topics? How does this activity connect to students' lives? How might you modify this activity to inclusive of all students in your classroom?

For example, I ask students to consider food ingredients that are on our class list but are not found across the international food diary examples. Students often notice and comment on types of meat, or lack of meat, or notice that the examples are predominantly plant-based. We discuss what influences there might be for our consumption of meat in our state, and for certain parts of the state, as compared to internationally. ETCs note that in our state, hog farms are prevalent in one part of the state, and beef farms are more common in another part of the state. We discuss how geography plays a part in where these types of farms are located (Piedmont or coastal plain vs. mountains). I also ask students to think about what it

means that the United States provides federal subsidies to corn farmers. Where is that corn going? How does the existence of a subsidy for corn influence the availability of meat in our country and state when compared to other countries where such a subsidy does not exist? Finally, we also contrast our consumption of meat with cultures and traditions in which pork or beef is not eaten for cultural or religious reasons (e.g., India).

These course activities are intended to address several dimensions of environmental identity and help ETCs reflect on how their identity influences their practices. The ETCs' 1-day food diaries are an opportunity for them to reflect on their own individual food practices and situate them within familial and cultural food practices. Their personal values and attitudes towards food ingredients are an important place to start our conversation about food practices, and then we compare and contrast their practices to the practices of others. Through these comparisons, we develop understandings of how food practices are influenced by agricultural methods (large-scale industrial farming), geographical locations (environmental conditions), political conflicts, and cultural traditions.

Finally, as a part of every class, we discuss how these activities could be used to address environmental content (science and social studies) with elementary learners to help students personally connect to curriculum topics. For example, I always ask students to reflect on how the activities we engage in as a part of our course could be used to address state curriculum topics and what we need to think about to modify these to be used with elementary learners (as opposed to college students). Table 2 includes questions that I use to help ETCs reflect on the activities they have engaged in to learn this content and how to develop a teacher perspective on those same activities. Sometimes we reflect on these questions at the end of each activity, and sometimes we have a longer discussion at the end of class about all the activities we have engaged in that day. These discussions reflecting on pedagogy are meant to help ETCs consider how the student makeup of their classroom (cultural, ethnic, and economic backgrounds) is an important consideration for their selection of curriculum materials in addition to the age of students, curriculum standards, and availability of resources.

Summary of Other Units in the Course

In addition to the food unit, we spend 2 weeks at the beginning of the course exploring and developing our understanding of climate change and how it helps us put into context many of the other environmental issues we discuss in the semester. We anchor our discussions of climate change by using newspaper articles about relevant current events such as hurricanes, wildfires, and flooding. We transition into a 4-week unit in which activities are connected to the book *The Birchbark House* (Erdrich, 1999), including ecosystem components, needs of plants and animals, watersheds, and migration. In addition, the social dimensions of our discussions of the book include wilderness as a sociocultural construct,

science and environmental contributions to our understanding of white European interactions with native peoples in the Americas, and how cultural values and philosophies related to the environment shape environmental behavior (i.e., preservation, conservation, and indigenous uses of the environment). We spend 2–3 weeks connecting the use of the book *Hoot* (Hiaasen, 2002) to explore ecosystem roles for animals, adaptations of owls, biodiversity, and biomes with the social dimensions related to development, industry (tourism, logging), recreation and nature-related leisure activities (birding), and wildfires. Our unit on food typically occurs in the middle of the semester.

End-of-Course Assessment: Revisiting the Personal Environmental Activity Map

To promote metacognition about what they learned in the course, I ask the ETCs to complete the same map of their relationship with the environment through daily activities after the food unit (informal, formative assessment) and again at the end of the course (summative assessment). In lieu of a final exam, they make an individual appointment with me and bring their final personal environmental activity map with them to reflect together on what they have learned (see Figure 2). I bring out their initial precourse personal activity map to place alongside their final map, and we look for ways in which their understanding of their personal relationship to the environment has changed over time and how this knowledge and awareness influences what they think about their future roles as elementary teachers and citizens of the planet. Speaking with each student individually allows them to discuss their understanding in a multimodal format that foregrounds their oral communication, which is relevant for their future practice as teachers.

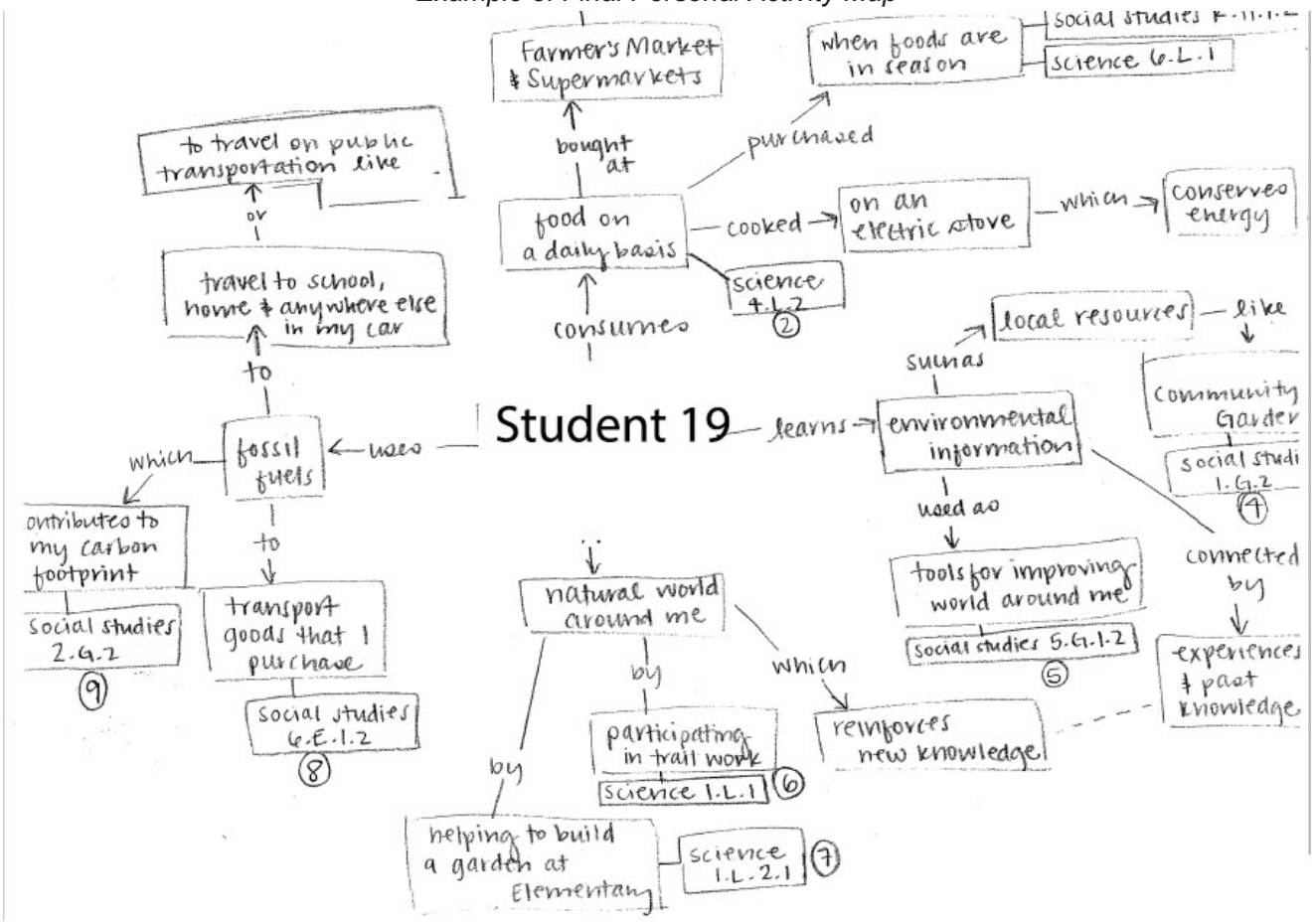
ETCs' maps and oral reflection on the changes in their maps are used to help them see how much they have learned about environmental content, as well as whether or how their attitudes towards environmental topics and science teaching have changed. ETCs' maps are a way to help me (and them) see if they are aware of how their everyday activities connect them to the environment and other people with a critical perspective on the social dimensions of environmental issues and solutions. As they construct and organize their thinking in creating their final maps, my hope is that they have had time to process our course activities and synthesize information. In our oral conversation about their maps, I can ask probing questions related to their maps to help me understand the thinking that went into the construction and ask for more information if ETCs do not include details about specific activities. In addition, if ETCs do not provide a social perspective of the activities provided on their map, we can have a conversation about it in our discussion.

The main reason for me to formally assess their final map was to emphasize to students the importance of the task within the course and to promote spending adequate time and energy on constructing their maps. In creating a rubric for their final personal environmental activity map (see Appendix A), I used principles from research on the use of concept maps in higher

education settings. Hay et al. (2008) argue that simple spoke and chain arrangements for concept maps are associated with rote learning in which students merely tack on concepts to an already existing structure. However, in creating networks of concepts with multiple levels out from the central topic idea, students show connections between topics and a greater depth of understanding (Hay et al., 2008; Kinchin, 2014). Therefore, to receive full credit on their maps, they were required to use a network structure on their maps (which was outlined for them as a minimum number of levels and branches per level) and show connections between nodes on their map. The addition of the inclusion of state science and social studies standards on their map was to promote their understanding of how class environmental topics and their personal activities connect to curriculum ideas they are expected to teach and to promote their inclusion of the science and social dimensions of environmental topics. However, I also did not want to overly constrain the construction of their maps with too many directions because the map was meant to accurately reflect their own personal understanding. Given that the map was intended to be a personal environmental activity map, I only assessed students on the three elements discussed above and not on the inclusion of any particular topic from our course, as one might in using concept maps as an assessment of conceptual understanding of science topics.

Figure 2

Example of Final Personal Activity Map



Discussion of Student Work

ETCs' final maps are naturally more in-depth than their initial maps because I ask them to create their final maps in preparation for their oral reflection with me as an outside-of-class assignment. The rubric for the assignment asks them not only to consider the activities that connect them to the environment as the first level in the hierarchy of their maps but also to explain how they are connected (Appendix A). For example, in the same semester, all 20 ETCs chose eating or food consumption as an activity on their final maps. In contrast to their initial maps, on their final maps, only six ETCs included nature-related activities, and seven included waste-related activities (recycling or reusing items). For the other categories of activities, fifteen included a personal care activity (eating or hygiene), nineteen included a transportation activity, eighteen included resource use (mostly water and electricity), fifteen included a consumerism activity (some food, some clothing), and three included service activities. No ETCs included job-related activities on their final maps.

In reflecting on what ETCs gain from the final map-making and reflection, I transcribed a semester of oral reflections and used quotes from various students (with their consent). A list of the questions I used as a guide for the oral reflections can also be found in Appendix B. In my analysis of student reflections, I highlight the themes that I found particularly useful for my thinking as an instructor of the course, but these themes are based solely on my own analysis of one group of students and, therefore, are not generalizable. The common themes that we discussed in our oral reflection are their process of constructing their final maps, how they are connected to the environment, and what those connections mean to them personally. It was fulfilling when they admitted that the process of creating the map was helpful in their thinking about their connections to the environment. Some ETCs spoke about how long it took them to complete their final map because they kept thinking of things to add to it and then had to reorganize where things were placed. "Actually, when I was sitting down and doing this project, I know it took me a long time to actually organize it because I was like there [are] so many things that connect to each other" (Student 4).

> I was going to do like one little piece of paper, and maybe two pieces of paper at most, but then when I started doing it, I was like, this is not enough space! …It kind of opened my eyes, I guess, just to see how much I'm connected. (Student 8)

Others mentioned that they chose not to show all of the interconnections they thought about on their maps (as lines) because they felt it would make it overwhelming for me and them to look at.

> In reality, when I was doing this, I was like, they all connect like no matter what. So it's just going to be a big blob, so I didn't know what to do…. I didn't really realize how connected all the different parts of my life [were]. (Student 3)

Other ETCs mentioned that in the process of creating their final maps, it helped them to become more aware of how daily actions connect them to the environment (regardless of where they are physically) and are interconnected to other environmental issues.

> I almost used to think, when you were inside, you weren't interacting with the environment, but I think you still interact with aspects of the environment, like you still interact with water because your water has to come from somewhere which is piped into the building. But you don't think about that when you turn the faucet on. (Student 15)

In the construction of their maps, most ETCs showed that they reflected on course themes and unit topics (food, water, ecosystems, and climate change) and felt that the process of creating the final map helped them to connect these issues to each other.

When I set their initial and final maps side by side, we would talk about what changed during the semester related to how they felt they were connected to the environment. As mentioned above, all 20 ETCs in this semester included food (either as a personal care activity or a consumer activity) on their final maps. When asked how their ideas changed over the semester, ETCs talked about how they felt their view of their interactions with the environment had gotten more complex and mentioned specific examples, often related to food, of how they realized how connected they were. Many ETCs also mentioned that they had not considered food or eating an environmental act, much like Student 1: "Definitely not the food, I didn't even think about the food…. Everybody kind of talks about the carbon emissions from the cars, and I knew water, my dad is a big water conserver, and so I knew those two."

Other ETCs mentioned that even though they had some initial knowledge about how eating was an environmental act, they deepened their understanding:

> You know, I feel like I knew that trucks ran on oil, and they went to the grocery store, and the food came there, the grocery store didn't grow it. But I just didn't, I just didn't think about it…. I feel like making this [the map] and just this whole course in general has made me really put all of that stuff into perspective…like I'm just buying some lettuce, and then you are like, whoa, where did this come from? (Student 2)

The final maps of these ETCs show evidence of how the unit on food helped them connect their daily activities to the environment and think about how environmental issues connect to them personally.

In addition to discussing the topic of food, most ETCs mentioned feeling more comfortable talking to others about environmental impacts. "Corn is in everything! I'm like, look, there is corn in this newspaper, on the cover of this magazine, and all of these different things. I was like telling my friends, oh, did you know this about corn?" (Student 7). Other ETCs mentioned that they felt a responsibility to share such information with others because they were planning to live for a while on the planet and have children of their own who would be impacted. A few other ETCs went further and discussed specifically how such a focus on how the content connected to their own lives impacted their perspective about the importance of teaching environmental topics in their future classrooms: "It's something that we definitely need to teach like in the classrooms because I wasn't even aware of it, and I am like 21" (Student 14). "Like I can do my very best, and I can talk to my friends, and they can help, do their very best. But I saw the children in the school; they were really receptive to this" (Student 17). Finally, another student discussed how teaching environmental content through personal activities helped her to think about how she might use the same approach to impact future students outside of the classroom:

> Now I feel like I have, I could do this, and they [elementary students] could also take it out, like they could actually take it out into the environment, and I feel like I've, yeah, really kind of opened my eyes to that. (Student 2)

I designed the final map project to help ETCs connect their daily activities to the environment to help them realize that they are inextricably connected to the world through their daily activities and needs. My hope is that such a realization would propel them to recognize the personal salience of environmental topics and thus care more about environmental issues and also provide an impetus to include science and social studies topics related to the environment in their future classrooms. Out of 20 ETCs during the semester, 10 ETCs only included connections between environmental issues and science curriculum topics, and 10 ETCs found connections between their environmental activities and both science and social

studies topics. Of the connections the 10 ETCs noted between environmental topics and social studies, they most commonly mentioned (1) the need for people to use resources provided by the environment for survival (whether in the context of food, water, or other raw materials) and (2) how people positively and negatively impact the environment. Both social studies standard themes highlight the dependence of humans on the environment and, therefore, support the idea of the personal salience of environmental topics for ETCs. Only two students mentioned the influence of any other social dimension on environmental topics and practices, and both were in the context of lessons they imagined teaching with elementary students. For example, in discussing how the class has shaped her ideas about how to teach environmental topics in elementary school, Student 16 proposed the idea of a class on consumerism and globalization by having products from different parts of the world around the classroom and have students count how many steps it took to get the product and equate it to fuel use. In all of these cases, about half of students are making connections between environmental topics, science, and the social dimensions of the issues; however, they did not discuss how their own identity positions (aside from geographical location) or the identity positions of others shape our responses to environmental issues.

Conclusions and Implications for Practice

To summarize, most ETCs were able to express how the content connected to their own lives, how it helped them connect their daily activities with the environment, and how their perspectives about the relevance of environmental topics to their lives shifted during the course. Focusing on food has been a successful way to help ETCs recognize the personal salience of environmental topics, and the use of the personal environmental activity map has helped ETCs reflect on how their daily activities connect them to the environment and reinforce that they are an integral part of the environment in which they live. Therefore, I have been successful in helping ETCs develop their environmental identities through these changes to the environmental literacy course.

I would advocate that other science educators addressing environmental topics in their courses think about how to incorporate Kempton and Holland's (2003) dimensions of environmental identities to help ETCs personally connect to the content. ETCs expressed how the course (and food in particular) helped them connect environmental topics to their daily life, highlighting the personal salience of environmental issues. Furthermore, ETCs showed on their final personal environmental activity maps how they connected their actions to positive or negative impacts on environmental elements. In terms of helping ETCs develop their environmental identities, I see the positive effects of using daily activities as a focus for exploring environmental issues (in this example, food) and using the personal environmental activity map as a way to promote ETC reflection on their personal relationship with the environment and environmental issues.

In reflecting on how well the format of a concept map worked for students to continually reflect on what they were learning about their personal relationship with the environment, I plan to continue my use of this learning tool and would advocate that other environmental teacher educators try it in their own courses. ETCs were able to show the interconnectedness of our environmental content, how they understood the topics we discussed in the course, and how it was connected to their own lives. Based on our oral reflections on their map-making processes and the organization of their final maps, I believe that the construction of the map promoted most ETCs to synthesize course information and think about how it related to their personal lives in ways that showed a change in their depth of understanding (Kinchin, 2014). To encourage this synthesis of information throughout the course, in future course offerings, I plan to make time for students to reflect on revising their personal environmental activity map after every major unit focus in the course. This will allow students to reflect more often on the development of their thinking about their own environmental identity and give us space to reflect as a community on how they are thinking about the topics and how to represent their ideas on their concept maps.

Many ETCs did not include any explicit references to identity positions or indications of a critical perspective on the social dimensions of environmental topics on their final maps, which could be due to a number of factors. To see if it was partly an artifact of the assignment guidelines, for the next iteration of this course, I would like to explicitly have ETCs address the social dimensions of various environmental issues based on various identities. As we know, ETCs often prepare assignments based on the grading criteria given to them. By making these aspects of the critical social dimensions of environmental topics an explicit part of the assignment, I hope that the final assessment becomes a part of their synthesis of how the social dimensions of environmental topics position people of various identities differently related to environmental issues and proposed solutions. I plan to revise the final map assessment rubric (Appendix A) by adding a fourth category related to embedding the social dimensions of environmental issues—specifically how their own culture, gender, and race or ethnicity position them related to their daily activities and relationship with the environment. In this way, the assignment can still focus on themselves (personal connection) but also requires them to demonstrate their understanding of how their own identity positions shape their relationship with the environment in similar and different ways from diverse others. Specifically, my hope is that in asking ETCs to think about the critical social dimensions of their environmental relationships, they will consider how their own life experiences, personal consumption habits, and daily practices impact the environment in similar and different ways from the diverse students they will encounter in their classrooms. I also hope that our community discussions as we revise our maps throughout the semester will help students do the challenging work of seeing how certain identities are privileged or disadvantaged related to environmental issues and various proposed solutions.

Finally, many ETCs did not explicitly mention teaching environmental content on their final maps. In reflecting on why this may be the case, it could be that even though they are enrolled in a teaching program, they do not see this as a significant part of their identity yet. Another possibility could be that the prompt for the final map is for students to reflect on activities that they do on a daily basis, and as students, they are not yet engaged in teaching on such a frequent basis. Although ETCs do engage in a teaching-related service-learning activity in the course (for more information, see Wilson et al., 2015), I would also like to incorporate more small planning activities for students as an extension of our discussions of pedagogy. In this way, I hope to encourage ETCs to make connections between their environmental identities and their developing identities as teachers.

The focus on food as a topic to explore science and the social dimensions of environmental sustainability is one that I plan to continue to implement, along with the use of personal environmental activity maps. ETCs consistently included food as a personal activity on their maps and discussed how it affected their thinking about their relationship with the environment. In his reflection on the past 25 years of environmental education research, Scott (2020) calls on educators to not lose sight of our ultimate goal of helping teachers and students realize the importance of addressing sustainability topics for "learning about our dependence on the biosphere" (p. 1687) can help us recognize our need to act. Although my own instruction and curriculum design for my work with ETCs continues to develop as I engage in cycles of implementation, reflection, and revision, I do not want to lose sight of the importance of encouraging, inspiring, and motivating ETCs to understand how they are connected to the environment and to develop their environmental identities.

Supplemental Files

Wilson-Appendices.docx

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