Chapter 13
Why Science Education Mediates the Way We Eat

Michael P. Mueller

Abstract Neoliberalism is at the heart of the North American food system. This understanding drives food choices that are concomitantly embedded within education and not generally mediated by school. Neoliberalism's metaphors of competition, individualism, and the economic mindset drive conventional farming practices, which rely heavily on synthetic herbicides and pesticides and inexpensive labor. These metaphors influence how people in North America eat, how food is produced, and how much is wasted. Around the world, many farmers use culturally and environmentally responsible methods of cultivating their produce. These trends are breaking "new ground" in North America with local, organic, responsibly nurtured, fresh, farmers' market vegetables and fruits. This chapter explores organic market farming culture as a 'pocket of resistance,' a place/context for dynamic polysemic knowledge that evolves in social concert with change/adaptability, positionality/relationality, and ecological condition. The curricular trajectory of science education in the farmer's market is a site for children to investigate whether their cultural traditions and skills serve to protect them from hyperconsumerism or overreliance on the dominant types of produce. What we eat affects how we understand and the way we behave in relation to it. Our eating has the potential to transform school science. This transformation can be an activist force in our society.

Keywords Citizen science • Ecojustice • Farmers' market • Organic farming • Neoliberalism • Place-based education • Relational epistemology

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Introduction

> How much would you pay for your food? Would you reduce the size of your portions to eat more expensive food? Would you slow down your eating to mindfully think about the quality of your food and its impact on society?

Neoliberalism survives on the indulgence of society's understanding. This understanding involves the taken-for-granted metaphors of competition, individualism and an economic mindset. These metaphors are not challenged by the ways most people in North America eat, how food is produced and how much is wasted. We implicitly contribute to the status quo when we place oversized garbage bags in bins on the side of the road or in the dumpster for others to take away to places we cannot or do not want to see. We contribute to the status quo when we do not analyze the corporate stickers on fruits that describe how far our food comes from or how we get 'freshly picked' or 'natural' foods during the winter. We contribute to neoliberalism by not thinking mindfully about the ways that the food we eat harms people and ecosystems elsewhere.

It is clear that food choices are driven by a deeply embedded matrix of neoliberal cultural assumptions, which are concomitantly embedded within education and not generally mediated by school. Given the potential problems associated with commercial food systems and the ways food is connected to every aspect of science, it is problematic when we deemphasize the study of massive farm tracks or agricultural wastes from fertilizers, pesticides, soils and animal manure that travel in streams across major continents. Consider how prolific herbicides such as Syngenta's *Atrazine* can now be traced in most of the waterways in the United States and which have been linked with cancer (Mueller 2009a). What are the economic, health and social costs of participating in the high stakes policies of conventional farming? Do science educators stop short with the *economic* costs of participating in conventional food systems without delving into the real hardships of farmers, the shortcuts that many farmers have to take to minimize their costs associated with food or animal meat production, and the hidden costs for workers? Consider the many neighborhoods surrounding farmlands where toxic chemicals are driven by wind through windows of homes. Are these things talked about in schools, and if they are, where are they discussed, in what classes, and by which groups of children? Withstanding the ways that the market and industry influence food choices, many financially secure people have choices about how they live and eat, but they do not think twice about how these choices affect economically vulnerable people's access to responsibly grown food. "It follows that those who have more options for where they spend their money cannot escape some of the responsibility for other significant expenses associated with conventional food even they do nothing to bring them about" (Mueller 2009b, p. 1004). In short, organically (or responsibly nurtured) grown foods reduce air and water pollution, pesticide residual, and the loss of biodiversity. In general, organic farms use less energy for a given yield and the soil stores more carbon, which may offset emissions that contribute to climate change. There are also higher costs associated with the scientific research inculcated with genetically modified organisms (not used on organic farms), which are sold to conventional farms.

Many farmers around the world already use culturally and environmentally responsible methods of cultivating their produce. In Malawi, for example, these practices are incorporated into the science curriculum (Glasson et al. 2006). However these practices are still not widespread in the curriculum of schools despite the need. In North America, this results from the predominately middle class neoliberal cultural attitudes, values and assumptions that are largely taken for granted in science education. This chapter considers this connection between neoliberalism, food and science education. With an increasing human population worldwide, there are fewer agricultural and natural resources, and yet more choices with trade-offs, such as loss of biodiversity associated urban development and sprawl. Degraded ecosystems worldwide challenge science teachers to begin thinking about ways in which today's students face perils that their teachers did not confront. How do teachers collectively and science educators, more specifically, share some responsibility for cultivating, participating, and advocating for change within local communities? These actions might begin by addressing with student-generated research and solving problems, such as degraded stream systems or protecting indigenous species, or deciphering which species should receive community resources—perhaps already stretched thin.

Too much emphasis in school has been on 'consuming things.' We teach kids at a very early age how to consume things. In science education (National Research Council 1996), the notion of consuming things is reinforced through the *consumption of science as scientific literacy* ideology. Consider how high we hold in esteem the professional knowledge and technology of experts, which is presented to children through the process of schooling. The media concomitantly perpetuates an inherent faith in science and technology to solve the world's problems. Over time, children become over-reliant on science and technology to resolve all of their problems and accept the notion that there are experts who can and will deal with problems before they become too large. The neoliberal approach of allowing others-out-of-reach to deal with social problems does little to catalyze responsibility. It certainly does not create the best atmosphere for engaging youth in activism. While I don't want to be misunderstood as saying that this is the only approach to teaching science, it is the dominant approach that is undergirded by neoliberalism (Bencze and Carter 2011). Although the dominant talk about education and scientific literacy is situated with the means to make decisions using science, it is rarely, if ever, focused on agency and activism. More often this talk inadvertently perpetuates consumption as a *globalized* or standardized form of science learning. In other words, within the ideology of neoliberalism, 'consumption' consumes science education today!

Perhaps this neoliberalized story of science education is so deeply enmeshed within the fabric of society that it survives on the indulgence of society's understanding—that is, namely, *hegemony*. My chapter will explore this hegemony of neoliberalism by discussing organic farming and food in relation to it. My philosophy draws on over 2 years of my direct participation in a local organic market farming culture in Southern Appalachia, USA, which involves hundreds of hours working to raise animals (some for meat), growing plants, and providing

vegetables, fruits and flowers for an urban farmers' market in a major metropolitan city, Atlanta. My eclectic philosophical method is mostly aligned within the enthnomethodological and phenomenological traditions in ecojustice studies and science education (Mueller 2009b). To make sense of this organic market farming culture and my experiences, I took hundreds of photographs and used artwork, farming and seed journals, and my notes from participant observations. I argue for science education that mediates the way we eat. After all, what we eat affects how we understand and the way we behave in relation to it. Our eating has the potential to transform school science. This transformation can be an activist force for society's understanding.

Neoliberalism in Science Education, *In Brief*

I begin with a short description of neoliberalism in science education. Larry Bencze and Lyn Carter (2011) note how science education, especially in North American, emphasizes epistemology congruent with individualism, competition, economic superiority and consumerism. This *commodified* notion of teachers, students, grades, and knowledge "stands in stark contrast to notions of *social epistemology*, which posit that knowledge is historically and socially constructed and, in a sense, belongs to everyone past, present, and future" (p. 654). Bencze and Carter explain that neoliberalism commoditizes everything (desires, success, democracy) in terms of capitalism and economy. The commodities of professional products from science and technology are deliberately emphasized in school science—not by some accident—but by the advertent selection of particular social and political agendas. This means that the current curricular trajectory restricts students' abilities to critique, suggest revisions, and take action against business practices, goods, services, and media aligned with the 'science-as-a-god,' and I add, *our deepest cultural assumptions that support this*. Teachers and students 'police' themselves by adhering to strict regulation of best practices, testing culture, criteria and school governance. Further, teachers' subjugate their curriculum to the neoliberal and neoconservative elite, who act as governors and gatekeepers. Consider Jack Johnson's (2003) lyrics:

> "It wasn't me", says the boy with the gun
> "Sure I pulled the trigger but it needed to be done
> Cause life's been killing me ever since it begun
> You cant blame me cause I'm too young"
>
> "You can't blame me sure the killer was my son
> But I didn't teach him to pull the trigger of the gun
> It's the killing on this TV screen
> You cant blame me its those images he seen"
>
> Well "You can't blame me", says the media man
> Well "I wasn't the one who came up with the plan
> I just point my camera at what the people want to see
> Man it's a two way mirror and you cant blame me"

"You can't blame me", says the singer of the song
Or the maker of the movie which he based his life on
"It's only entertainment and as anyone can see
The smoke machines and makeup and you cant fool me"

It was you it was me it was every man
We've all got the blood on our hands
We only receive what we demand (*excerpt from Cookie Jar,* Johnson 2003).

Let's face it—we can't be saints. Most people oscillate between different positions based on what is known about an issue. Philosophically speaking, we may hold some positions longer than others, but our worldviews are not crystalized to the opinions and social influences of others. Consider the science teacher educator who uses as a rationale for educating teachers the way they do the high stakes pressures of testing and conformity to national standards: 'We must prepare teachers to survive in a world of standardized tests!' In this case, new teachers may be inadvertently prepared to exclude their students from tapping into diverse perspectives or building on the social strengths of the community. Bencze and Carter (2011) suggest that these things occur to the detriment of the local community, planet, and future sustainability.

How do youth even begin to resolve local problems when they do not even know what is wrong? Today's children have very little sense of the status or condition of their local cultures, commons, or habitats (Mueller 2009b). Recall that most children can identify more corporate labels than trees and plants in the local ecosystems (Louv 2008). Where are children taught to investigate whether their cultural traditions are degraded?—Think gardening, canning, preserving food, seed saving, and eating a meal face-to-face (the old way!). What about their community?—think talking with neighbors, creating a walking-safe path for kids to get to school without having to ride a car or bus, or bartering for materials or vegetables. What about their environment?—degraded habitats, species' movements in response to climate change, or youth who have never touched an insect or seen a bee. In fact, the grocery store is the closest that some children will ever get to pollinators.

My point here is that there is a lot to be gained when we begin to assess the hegemony of science education and critique how it is almost exclusively focused on students' future contributions to the economy. Withstanding some of the ways that science educators are challenging the neoliberal front, namely, by teaching with socioscientific issues, for ecojustice, or for sociopolitical action (Hodson 2011), the vast majority of science educators still have not considered what it means to teach in ways that contribute more fully to the decision-making processes implicated by science teaching standards. Wrestling with the larger ideology is one way to approach this problem, creating small pockets of resistance is another possibility. Below, I analyze one of these small pockets of resistance that I believe has the potential to transform science education worldwide.

One simple activity—how we eat—can change everything.

A Pocket of Resistance—Local and Organic Food

My interest in local and organic food grew out of my interactions with a vibrant food movement in a southern Appalachian town where I was teaching prospective science teachers. As part of a methods course, I decided to incorporate *farming as a way of life* that I wanted my mostly urban students to begin to appreciate and experience in an attempt to get them to think more fully about incorporating local farming into their teaching of biology, chemistry, earth science and physics at the secondary levels. We visited a local *community supported agricultural* project or CSA and helped the farmer plant garlic and harvest eggplant each fall. In exchange, the farmer provided his epistemological perspectives on the idea of local food and the science embedded in the farming.

This is where I learned with my students, again and again, that the term 'local' and 'fresh' have something to do with a *relationship*. It became apparent over several years that this relationship was between a farmer and his/her customers. (My students were given produce for their hard work each time they visited the farm, which helped to solidify the idea that eating locally is part of a larger relationship between persons who eat fresh food and their farmer.)

Five years of cultivating teachers' understandings of this local relationship led to a specialized course focused on ecojustice, in which graduate students would further investigate the 'relationship idea.' As part of this course, we invited guests who were part of the burgeoning local food movement in and around Atlanta: Slow Food Atlanta, Farm255 Restaurant, PLACES, etc. These people, representing these organizations, shared with us their ecojustice story, which often involved bringing people together around food. Students in the class developed food research and activist projects. It was through this work that I discovered many people in the community who were resisting the poisons of corporate farming through 'guerilla gardening,' school and neighborhood gardens, grocery cooperatives, charitable groups, non-profits, and clubs.

In the mean time, I was contemplating a move to a local farm with my family. After trying to cultivate small gardens in woodsy areas or in one case—on the land surrounding our home where home development ceased because of the economy—we decided that more land was needed (at least 2–5 acres) to raise fresh food. So, after several moves, we finally found a suitable place to farm. I decided to align my interests and begin a 2-year research project to understand local and organic food as well as conventional farming. I was also interested in learning Appalachian knowledge and skills, which occurred after developing trusting relationships with my neighbors—only accessible by living the farmers' market lifestyle. While hesitant at first, my family quickly became accustomed to this lifestyle and deeply embedded in their love for the farming culture. This immersion would allow me to experience science education as it is situated within an organic market culture in ways that I would never have anticipated or imagined before the project.

The next part of this chapter is written in present tense to capture the essence of epistemological growth in my farm journey.

Organic Farmers' Market Culture

Going into this project, I already understood and had begun to research further dangers of conventionally farmed food and devastating impacts of herbicides and pesticides such as Atrazine (Mueller 2009a). I understand the impacts of farming with harmful chemicals on the health and welfare of farm-field laborers. I understand that poultry farming is paramount to the Southeast USA and also that raising chickens in crowded chicken houses is inhumane. There are many times that I become faced with these ecologically destructive, socially unjust, and inhumane conditions nearby as a reminder that growing plants and raising animals in the most "natural" (without synthetic chemicals etc.) way possible is the most ethical way to engage this work.

As a result, we begin this project by adopting many of the adages of the organic farming movement without going through the expensive and lengthy process of getting certified 'Organic.' However, we do decide to go through the process of getting 'Certified Naturally Grown' (or CNG), required by most of the major organic farmers' markets to sell produce locally. Part of the process is having your soil tested by agricultural extension and completing an on-site inspection by a knowledgeable person. The soils report and inspection presents promising conditions for organic farming. We cultivate the fields and plant a cover crop of Crimson clover and rye for the winter months. We also repair an abandoned greenhouse on the property to begin our seedlings.

©2011 Michael Mueller, *Cover Crop of Crimson Clove and Rye: A Place to Relax and Play*

A Responsibly Nurtured Organic Place

While place-based education is an emerging trend in science education (Tippins et al. 2010), it is often critiqued for being unclear and relatively undefined in science education. When you live and work on a farm, the idea of *place* becomes much clearer. The responsibility that we have to the places where we live becomes evident. Small things influence your place. This farm is a place to relax, enjoy nature, and play. Crimson clover and rye cover the ground that we will begin to plant throughout the spring with seedlings from our greenhouse. The 'cover crop' protects the soil from eroding away during the winter, and adds and conserves nutrients such as nitrogen through its roots. The clover has deep roots and breaks up the hard red Georgia clay. Throughout the spring, we till the loamy soil and make beds for the new seedlings from the greenhouse. We water these beds by hand, which provides for time to think, experience the surroundings, and feel the cool weather of spring. Eventually it will get so hot that we will have to get up at the wink of dawn and work hard for 4–5 h before eating breakfast and working on other indoor tasks.

During the winter months, there are a lot of things that we have to prepare for the farmers' market, including repairing old baskets, crafting signs, and so forth. We begin scavenging the local antique stores for old farm baskets, unique glass jars and other artifacts that have been historically used to display produce at farmers' markets. We also take great care of our chickens and pigs, which eat our food waste and create manure that we compost for fertilizer. Our chickens roam freely on the farm and despite that we lose some of them to predators (foxes, opossum, coyotes, etc.), they seem happy when they can move freely around the fields grubbing for insects. We learn the hard way that pigs are great escape artists, but easily convinced to go back into their pen after they have their turn exploring the farm (we are lucky they never eat our vegetables!) We raise chickens for meat and eggs, and I learn to harvest them by hand, but this is never easy. In my mind, I wrestle with how to discuss 'harvest' with my children, but it becomes clear that they should understand where their meat comes from and they realize the significance of caring for animals for meat and to not waste it. We take many of the 'rejects' from the chicken farmer down the road, which are the grey and black chickens that would be normally culled as chicks. Industrial meat companies prefer white-feathered chickens and these chickens have been genetically modified to grow to full size in 7–9 weeks. My children adopt one of the chickens as their 'friend,' but we learn the difficult lesson that chickens genetically modified to grow with large breasts cannot support themselves into adulthood and their legs become dilapidated. In this part of the country, we are regularly faced with seeing chicken trucks loaded with hundreds of chickens in clear view cages on their way to the nearby meat processing plants. Because we know about the lives that these chickens live in the chicken house and the way they are confined to live in darkness and in their urine and feces, and the way they are grabbed by the wings or legs by factory workers, we cringe often at the sight or look away from the trucks. We have even witnessed chickens falling out of a moving truck, not to mention the ways they are treated when they get to a factory.

The animals with which we share this farm are as much a part of the memory-in-the-making as the vegetables, fruits, and flowers that I discuss below. They remind us to be constantly mindful that our meat comes from a relationship between humans and animals, and to never waste our food. Consider how much food is wasted in neoliberal-influenced-middle-class-homes, restaurants, or grocery stores, and then think about why it is possible to throw away food. Why is it possible for a chicken's life to be lived for nothing, only to end up in the garbage because of portion, package or plate size? These questions become vitally important to the person who has a relationship with animals or who understands the needs of animals. These relationships constitute food knowledge, but are lacking for many children in science education. Without the contextualization of human-animal relationships, it is difficult to imagine how meat would be considered inseparable from the place where it is raised. For many people, meat comes from the store. This is the first place they encounter it and where they get their education (Rowe 2011).

©2011 Michael Mueller, *Grey and Black-feathered Cornish Rock Chickens*

Local Knowledge

A small farm takes a lot of creative vision and the integration of plants in a way that will provide the most produce for the least amount of space. We can calculate how much food will be grown based on seed companies and conversations with local farmers, but we do not have the life-long experiences that many farmers have.

There are several farm supply stores nearby and these places prove to be a good source of information about what to plant, when, etc. Most of these stores are owned locally by elder gentlemen farmers, and in many cases, they share the responsibilities of the store with their children who have grown up in the business of farmer culture. There is much to gain by 'hanging around' the farm store: stories, sage advice and perspectives on raising animals and planting seeds. We also read books on organic gardening and companion planting, which include traditional knowledge about what to plant together. We draw many maps and design plans, chart planting dates, and use intuition to solve problems associated with late frost, insects, and other complexities associated with growing healthy local food.

Interdisciplinary Knowledge

The place where we live and work has much to do with the ways in which the knowledge, experience, narratives, traditions, and other plans come together in a synthesis of farming activity.

©2012 Michael Mueller, *Shards of Local History Tilled Up in the Soils*

The disciplines traditionally separated in schools and in classrooms cannot be separated in the farmer's field. They merge through the constant interplay or reciprocation of education and lived activity.

Reading the Farmers' Almanac, traditional anecdotal stories of companion planting, scientific reports, mathematic charts, and the lay of the landscape over time create the rationale and intuition for knowing when to evaluate and take particular actions over others.

Learning the cultural history, planting skills, Native knowledge, and playing in the present and future context of the farmer's field takes time, appreciation, and respect (and valuation) of knowledge. Working together as a family, cooking and creating meals with the vegetables and fruits of our labor, and preserving vegetables, is a bonding experience but also supports intergenerational knowledge. The human geography, physical geography, geology, climate and weather, sunlight, shade, runoff, dry and wet areas of the field are considered together with human exertion, fatigue, and excitement. Clothing is as significant as insects and these things are all placed in the context of the science education embodied within the farm. Consider the following journal entry (*personal journal 3/5/12*):

> Planted 100 tomatoes. Discussed how to identify one from the other by leaf, shape, coloration at [different places on the] stem, etc. Sunscreen always an issue, hats, shirts, increasing intensity of sun. Fire ants are a regular thing, easier for the adults to deal with, but our kids are new to them. [Our daughter] ended up in a [fire ant] mound. 20–30 stings later!!!

©2012 Michael Mueller, *The Effects of Shade on Part of the Row of Sunflowers*

Change and Adaptability

Another journal entry demonstrates how experience on the land leads to new explorations and knowledge about particular insects:

> Watering takes forever! One hose and water can. Find caterpillars on broccoli (*personal journal 4/6/12*).

The learning process occurs again and again on the farm as we encounter new problems and learn how to deal with them. The slow process of watering by hand allows for interactions that would easily be missed if we had a mechanical watering system—missed interactions with birds, rodents, cats, chickens, hawks, etc. More importantly, the slowing down of many of the processes on the farm allows for interactions with insects, disease, and so forth. The insect encountered on the broccoli turns out to be a cabbage moth—interestingly, we have hundreds of little white "butterflies" flying around the broccoli and their caterpillars are picked by hand. Chickens walking around the garden also help with insect control, especially with the caterpillars and other insects that rapidly destroy our vegetables. We learn that everything has its window to flourish but that all things will eventually succumb to local change. This increasing understanding of change and adaptability helps us to plant particular vegetables in succession knowing how long they will survive (or how long we will survive pulling insects off or treating diseases) before they become overwhelmed by change. Because we take risks with frost and early planting, we are able to beat the insects to productive vegetables and fruits in most cases. We learn that early planting is possible with the warming soils:

> Well, we didn't make it . . . but only a few, maybe 3–4 plants suffered from cold damage. Tonight we have another cool evening; we think maybe the warmer soils helped keep our plants warm and hay mulch; but two nights in a row could be different. My heal split (the skin) on the back—it's painful. No more bare feet for while to heal my sole (*personal journal 4/12/12*).

Change is more than what happens to a place, it is an embodied, lived experience that creates knowledge and reciprocal values. We change a place and it changes us in the process, it is an interaction.

In school science, we teach and learn about environmental change, but we may not *emphasize* the way it influences and is influenced by culture. While we explore it in a past or present context, we do not explore how it is lived and becomes part of our future lives.

Embodied Change and Positionality

Change occurs in the farmer's body. My body aches and I cannot stand up straight. I learn to crouch low to weed and work with soil. My feet need as much care as my brain and my body tells me about the conditions—the physics, geology, and biology—of the ground. I am also misled by my bias about particular 'pests,' and at times, reminisce about the misguided ways that I've changed the place.

> Today I killed a 5' Rat snake. I felt bad about doing it, but it was so close to our house, probably lives under the house killing rats, mice and so forth. Maybe I should have just scared it away. Rat snakes can be pretty aggressive (*personal journal 5/18/12*)

We strive to understand this place in terms of life and death, which is also a vital aspect of change on the farm. Plants spring to life and wrestle with each other to establish their place on the farm. The neighbor's dog kills our chickens and at one point I am faced with the hard decision of whether the dog or the chickens will live. We don't want anything to die; we love this place and all that belongs here but there are inherent tensions between the farm's inhabitants. The farm cats kill just about anything that moves—rabbits, rodents, birds, and drop them off on the farmhouse porch:

> Its amazing how our cats hunt around here. When they find a rat, mouse, bird, chipmunk, etc. and kill it, we either find it on the porch or somewhere in our field or garden. Its one way to see these animals up close and examine their characteristics or teach my kids about them. This time of year we can figure out how long animals have been dead by looking at the blowfly (a green fly) and its larva (*personal journal 5/16/12*).

Environmental Condition

The farm is a place where we are able to photograph and document the life of insects, animals, and plants and understand their interaction.

©2012 Michael Mueller, *Citizen Science is a Daily Part of Life on the Farm*

This environmental monitoring or citizen science (Mueller et al. 2012) provides valuable information about the changing seasons, weather, and periods of time within seasons. We learn, for example, that flowers are better for the farmers' market if they are harvested before the bloom fully unfurls. With organic produce, fruits and flowers, everything is about timing and within a few hours, things can change significantly. The variety of citizen science investigations that go on continuously on a farm are astounding. These experiments are bound by the questions derived through the contextualization of problems, issues and aspirations.

> Morning is a great time to photograph and explore pollinators. While the hummingbirds are already "humming," many bees and wasps have camped out over night in flowers remaining motionless until the sun warms them. This morning I found Mason bees, honeybees, wasps and many other solitary bees including an Eastern Carpenter (*personal journal 6/29/12*).

©2012 Michael Mueller, *Monitoring a Swallowtail Caterpillar on a Swath of Dill – They Eventually Eat It. There is a Fine Balance between Insect Control and Pollination – We Can Do This Because Dill is Planted in Different Places*

The weather, temperature, cloud cover and time of day play a large role in these daily investigations. We become very keen to the changes in the weather such as rain because it affects our work:

> Rain sweet rain! We see rain clouds creeping up in the distance. They're moving fast! "Let's get more glads [gladiolus bulbs] in!" So we push hard to get a whole row of glads. The rain is coming faster now. We have a great routine, Heather plants and I make a hole. We are about 2/3rd done and rain pours down, the sky gets dark—it's 5:15 PM. Heather uses a bucket at first to hold the bulbs but they go in the ground faster from her shirt! That's what a shirt is for on the farm. We run inside just as the rain has drenched our clothes. Heather says, "were we just out in the thunderstorm with a steal tool planting glads?" (*personal journal 3/3/12*)

While we laugh about it after the fact, the reality is that the soil, seeds, weather and people interacting in this place exert a science experience whether one realizes they are engaging in science learning or not. The ground is hard clay, so we plant in the rain. We plant as many gladiolus corms as possible because of the ease in which they go into the ground. They get watered at the same time. The rain feels good and is a bonding experience for two people who enjoy the experience of being in one place at one time.

©2012 Michael Mueller, *Our Children Regularly Walk Around with or Eat Vegetables—This is Our Son's Zucchini (That We Cannot Sell at the Market!)*

Probably the most profound characteristic of being part of a farm is that it inspires a "love-hate" relationship (or 'both/and' way of thinking-in-relation, see Thayer-Bacon 2003). There are many hardships faced by organic farmers—Fire Ant stings and scars, Red Wasp stings and allergic reaction, and tearing a fingernail of the finger. These things bring stories and memories-in-the-making to the significance of

farming. There is a constant question of whether 'this is all worth it?' As the body begins to heal, there is a continual renewal of analysis around our decisions and actions. It is also renewed continuously in the process of participating in a farmers' market where other people's choices and aspirations play a large role in the ways we justify some actions against others. Even the soil, weather, vegetables, fruits, flowers, and animals 'scream' at us so 'loudly' we cannot deemphasize or ignore them.

> This weekend we did very well with flowers and tomatoes. Can definitely see how different flower creating styles affect the buying decisions of our patrons. The weather has been slowly getting hotter each week and there are some vegetables and especially flowers that just can't take the heat. Glads looked really worn this week because of the heat. Sunflowers were not as full stemmed because of a different location in the garden. Peppers are growing in now, tomatoes needed stakes, and we are removing squash. People seem to be sick of squash now (*personal journal 6/23/12*).

A Market Creates a Relationship with Food

People's tastes shift throughout the farmers' market season. Their aspirations change with the variability of diverse weekly produce. We never miss a farmers' market, no matter how discouraged or sickened by weekly events, and neither do most of the regular vendors and patrons. It is a weekly gathering filled with the joy, love, and passion of people who are committed to organic farming. The market is a lively downtown metropolitan experience. For most patrons, the farmers' market is the closest they will ever get to a relationship with a farmer who grows their food or the soil and land that nurtures it. We bring photo albums and share stories with our regular customers who believe in the importance of local food. The farmers' market starts early in the morning and is filled with activity—exercise programs in the park, cooking demonstrations, weekly educational classes, cultural events, and lively music. People come to the farmers' market to renew their lives. Bartering, trust, and moral reciprocity are essential to this market experience.

> Wow, the temperature reached 106 degrees Fahrenheit at the farmers' market yesterday. After a busy morning, the market became quiet—the "dead" of summer and the heat was hard to bear. We often barter for our weekly supplies of vegetables we need for the family, by either trading with other farmers etc. or buying produce at reduced rates. Some customers come by the stand and want our produce but don't have enough cash to pay. Often we ask them to come back the following week and pay, many who do. This practice is a good way to encourage folks to come back each week and it's the sort of relationship that few places offer in the corporate world. Where could a customer walk away with produce or other items and not pay—or be trusted to pay later? Often a long week of work on the farm and frustration with 3 weeks of dry [weather] in Georgia, the farmers' market almost instantly revitalizes my spirit and desire to create produce so that I can participate in the experience the next week. I loved the "surf" "sublime" music this week at the market! (*personal journal 6/30/12*)

©2012 Michael Mueller, *We Know About and Care for Our Market Patrons*

The farmers' market is very diverse. We talk with people from all walks of life and learn about their stories, interests, aspirations, and personal circumstances. Many people have children, dogs, or other pets—one boy and his mother bring a different insect, lizard, or other creature they have caught in the park to share with us. We get to know people with diverse identities—student, pregnant, gay, mother, immigrant, and so forth—they all *share* affection with us. They participate in a social imagination surrounding a world filled with the air of romanticism for responsibly nurtured organic foods. Because of this acquired affection we have a unique opportunity to educate the people we come to care for about what organic food looks like (e.g., insect damage), seasonality, and the culture itself.

> The farmers' market really serves as a gauge about people's attitudes. It helps regenerate people each week. One customer [says that she]. . ..hasn't missed a farmers' market date since moving to Atlanta. We see a lot of the same people and the farmers' market becomes a place to socialize and get to know people as much as anything. These people return week after week to immerse themselves in a context because it is special to them (*personal journal 7/21/12*).

A Critique of Neoliberalism

The farmers' market is a place to reinvigorate the mind-and-body-in-relation-to-others. This idea of relationality comes from Barbara Thayer-Bacon (2000), who uses the quilting bee to illuminate a similar kind of world where people's

mind-bodies are constructed in the *social epistemology* also emphasized by Bencze and Carter (2011). The ideal philosophy of responsibly nurtured organic food is inherently social—it's a belonging metaphor of shared existence. Through my participation in the organic farmers' market culture, it becomes evident that it is a shared consciousness of context, local knowledge, interdisciplinary knowledge and experience, awareness of positionality and relationality, and environmental understanding. In contrast to the root metaphor of neoliberalism that shapes the ways most people participate in purchasing and mindlessly eating their food, this social epistemology embraces people's desires and democratic social imagination that transcend economic capitalism.

This praxis of individuals-in-relation becomes a source of resistance against neoliberalism whether fully recognized or not (Weinstein 2013). The practices associated with organic farming are 'policed' by and large—in the same ways that neoliberal factions watch over and ensure the practices of Bigbox superstores. Consider the absence of 'markings' that would normally indicate insect damage, normal scars, fruit and vegetable size, or packaging (and the ways that meat, fruits, vegetables etc. are preserved). Corporate personnel, supermarket owners and managers, and customers regulate the generally accepted (read neoliberal) produce practices that ensure prices are subsidized and so forth. Although there are small factions of people who gravitate to the organic sections of the Bigbox, or read the back of the packaging to look for ingredients such as corn syrup or to count calories, the vast majority of consumers do not consider how their education has contributed to or mediates the ways that they eat.

At our organic farmers' market the market manager hired by the city, farmer vendors, and patrons also play a large role in 'policing' the practice by attending the market weekly, knowing what can be legitimately grown during particular seasons and not others, and by asking questions and learning about what comprises an organic farming experience (what organic looks like and so on). As part of this project, I learn about farmers who are also violating the trust of patrons and discover that the market manager also knows about these breaches of trust. For example, one farmer sells produce that is purchased from another farmer not using organic practices, and another farmer purchases food from another region of the country. These farmers are quickly exposed by consumers and asked to never return. Breach of trust is a serious violation.

Farmers work hard to make a living in the organic market culture. They work very hard to connect with people who value highly the ways they protect farm workers, animals or ecosystems from being degraded—in many ways they revitalize these systems. Organic food is expensive if the comparison is superficially related with the Bigbox industry. Prices fluctuate at the farmers' market depending on availability, supply and demand for specific produce. Prices differ between farmers despite that we try to do a quick survey at the beginning of every market to get a sense of the 'going rate.' The point is that patrons have choices and some people do go from farmer to farmer looking for the 'best deal.' One woman asks us "where she would get some *normal* tomatoes!?!" She is surprised by the price of heirloom tomatoes, which go for about $1.00 per pound. Most people, however, understand that they are

buying more than meats, fruits, and vegetables—they are supporting a cultural livelihood and contributing to the improved welfares of farm workers, animals, and physical environments. They are supporting the livelihood of the market as a significant pedagogy (i.e., the market as a place, tool and site of learning).

Consider how children are led around the farmers' market with specialty cooks to learn how to select and purchase greens, or the special diet needs of individuals who have been instructed by their doctors to purchase organic vegetables, or tourists craving culture. People who say that they have a limited income visit the farmers' market as much as people who say that they do not worry about it. When asked about whether price matters, of course social and ecojustice issues come up, but more often patrons discuss the ways that purchasing fresh organic food from a farmers' market can be justified. They discuss smaller plate or portion size, and slowing down to enjoy their food with family and friends. We sold pansies and other edible flowers and herbs, which always were hot items!

Contrast these understandings with the hegemony of neoliberalism, which emphasizes individualism, competition, and the economy as the highest good. On the whole, people involved in farmers' markets from the city manager of the market to farmers and patrons understand that they are intimately involved in collectivism—the sharing of lives and experiences—or equity and fairness for others. They develop the capacity to resist neoliberalism because of a lived curricular trajectory implicit in the science education of the farmers' market that capitalizes on their ability to critique, suggest revisions, and take action against business practices, goods, services, and media that go contrary to their acquired affection for responsibly nurtured organic food. Through this science education, they develop the underlying cultural assumptions and understand the root metaphors of sharing, trust, moral reciprocation and so on, which mediate the ways they eat. This social epistemology creates the conditions for resolving local problems and issues that might come up even in a farmers' market such as fraudulent practices. A critical mass of resistance protects the livelihood because of the constant monitoring and in-depth immersion of the culture itself. This science education is highly contextualized. Interestingly, children who regularly visit the farmers' market are learning and teaching others around them about the status or condition of their local cultures, communities, commons or habitat. In many ways, these students' science education mediates the ways that they eat and vice versa.

Implications for School Science

The curricular trajectory of science education in the farmers' market incorporates an in-depth understanding of place/context, dynamic polysemic knowledge that evolves in social concert with change/adaptability, positionality/relationality, and eco-knowledge. This context for science education is a site for neoliberal resistance as children investigate whether their cultural traditions, narratives, events, and

skills serve to protect them from hyperconsumerism or overreliance on the Bigbox supermarket to meet all of their needs. They learn to garden, can, cook, preserve food, save seeds, and eat face-to-face with loved ones. They have not lost the art of talking with their neighbors (the old way!), they care about the community and the ways that people and animals are treated. They mindfully conserve physical environments—their *habitus* the commonplaces.

The conditions for science education are often discussed in terms of a science classroom. This emphasis on science classrooms creates a significant problem for the anthropology and phenomena of science education communities that serve to mediate knowledge and social action from within sites of resistance. In many ways, it is society's understanding that inadvertently perpetuates neoliberal forms of science education and the scholars who support this ideal. What is the right environment for learning? What environment motivates students to engage in particular conceptual or relation understandings versus others? What habitus creates social action? Rarely, however, are the conditions of science education discussed in the same way that farmers explore the rain, wind, sun and shade. Science education that mediates the ways we eat is rich with future sociopolitical action and ecojustice, withstanding its contributions to the status quo, or almost exclusive focus on economic capitalism (for more, see Derek Hodson's (2011) text, *Looking to the Future*).

The farmers' market is but another metaphor for the many ways that people participate in activities outside of the neoliberal push. These activities have the ability to mediate science education by creating a powerful inertia that activates people in social change and more importantly, science education for ecological nurturance. What we eat certainly affects how we understand and the way we behave in relation. Our eating has the potential to transform school. This transformation is an activist force for society's understanding, and when realized more fully it offers the imagination necessary to catch a glimpse of the world that would provide for future peoples.

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