

Growing Deep Roots In A Broken System



Making Connections

How can measuring a set of tiny prairie seedlings 12 times over a span of six weeks restore one of the rarest ecosystems on the planet? How can a 20-minute observation of 30 ninth-graders improve education? Does anything I do as an educator really matter? These are the questions I grappled with as a 22-year-old about to start student teaching and the same questions I still ponder as a 30-year-old experienced teacher.

Prior to entering the last year of my undergraduate degree, I worked in an ecology lab during the summer. One of my main projects was measuring, planting, and monitoring a small set of native prairie plants at a restoration site at one of the local high schools in Lawrence, Kansas. There were five different species of plants, some of which were planted in soil plugs that contained beneficial fungal associates from actual native prairies that I was in charge of planting in the larger site. These microscopic fungi live in the roots of prairie plants and help them collect soil nutrients that would otherwise be inaccessible to the roots. This symbiosis typically creates a win-win for both the plant and the fungus. I removed weeds and measured out the plots in the larger site and painstakingly planted each and every seedling. Then I monitored these seedlings by measuring them, counting leaves, and collecting qualitative data from them in the blistering summer heat. As the summer months progressed I grew attached to these tiny plants and was heartbroken when some of them were eaten by the animals that frequented the site. During some especially hot and miserable data collection

days, I wondered how the data I was collecting could possibly be useful to someone else. I knew many intimate details about each individual plant. The milkweed in plot 12 had been small to begin with and the soil in plot 6 had a high clay content that likely influenced the slower growth of the seedlings there. Another plot was in a lower spot of the field, and it often had more moisture than the others; the seedlings there grew at a faster rate, despite the deer that sometimes slept directly on top of the study plants. It felt like there were too many variables in this site. How could we possibly gain new information from this small study that could be applied elsewhere? At times, I secretly felt this way about all of ecology. How could ecologists take all the hundreds of little details from one field site and find patterns in the complex relationships between them? Beyond that, how did they apply these patterns to another ecosystem or biome?

Three years after that summer experience, I ended up getting a job at the same high school that housed the prairie restoration. The prairie site was a big incentive for me to change schools, and I loved having the opportunity to teach my students about the native prairie ecosystem by using the on-campus site I had helped build.

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Today when I look at the prairie plots with my students, I can usually find some of the tiny plants I previously planted, but they have matured and grown. Like me, these once-small plants have spent the last years of their life developing, changing, and finding their place in the ecosystem of which they are a part. One of my favorite big bluestem plants now measures about one and one half meters in diameter, and it is easily a foot taller than I am at the peak of its growth in the fall. As “my” plants grew and developed, I was also growing and changing as a teacher. One of the integral parts of my professional development was being accepted into the Knowles Teacher Initiative (“Knowles”), a program that aims to develop high-

quality math and science teachers. As part of my work with Knowles, we completed yearly inquiry projects which were informal studies about the ways that our own individual classrooms functioned. While I enjoyed this work, I sometimes felt the same way I did about learning ecology: how would all of this effort to understand my classroom in one year and one class period transfer to a different classroom with different students? I was worlds away from the measurements and spreadsheets I collected on plants, and I was working with complex and unique teenagers in my classroom. What could I learn about my second-hour biology class that would be meaningful for a different set of students?

During this time, I was elbow-deep in an inquiry project about status and student talk in my classroom. Through development at Knowles, I had learned to reflect on how my personal bias and cultural norms might impact students of different backgrounds. I chose to focus on student talk from data I collected during a class-wide discussion about the ethics of human cell research. I was looking for patterns in my data—did a certain type of student talk more than others? On the surface this seemed simple, but as I sat down to reflect I came across a lot of complexities. In one class, all students spoke only once (this was a requirement for participation), and three girls spoke twice. In another class, there were four students who spoke two or more times, but everyone still spoke once. In a third and smaller class, everyone spoke more than twice. In all of the classes, students wrote reflections about the conversations and I saw that several “quiet” students were thinking deeply about the conversation and expressed it through writing instead of speaking. How did class size factor into students’ willingness to speak up during the discussion? What might have been affecting one students’ participation but not others’? How was I biasing the data by only evaluating verbal “talk”? The chaos and specificity of my teacher inquiry projects felt shockingly similar to the close knowledge I had gained about my study plants during my undergraduate degree. How could this information translate to something bigger? How could all of these tiny nuggets of information add together to mean something more concrete?

The Winds of Change

I first made this connection between how I felt about ecology and teacher inquiry during a Knowles meeting in spring 2020. Weeks before the world shut down due to the COVID pandemic, I sat on the sunny patio of a Phoenix hotel reflecting about a meta-analysis I had done from multiple sets of inquiry data. These data were all focused on different data collections I did in my classroom focused around status and talk. While I did get a few tidbits of information that I felt could probably apply to a different class or year, the most important part of this data analysis was the revelation it led to. Prior to this event, I had been waiting for my inquiry to reveal some ground-breaking pattern or truth about teaching—an easy “aha” moment where I could solve all the problems that occurred in my classroom and suddenly fulfill the perfectionist standards which I was always trying to meet. I realized that I was hoping for something similar all those years ago when working in the prairie; I was hoping that the data I collected would provide hard-and-fast rules about prairie restorations. Inoculate your restoration site with beneficial microbes and the ecosystem will thrive! Habitat destruction solved—this simple trick would provide a groundbreaking way to restore one of the rarest ecosystems on Earth back to its original glory! Surely something similar exists in education, right? Project-based learning to solve all inequity! Utilize classroom management techniques to cancel out years of underfunding in public education!

Reflecting with my Knowles colleagues about my inquiry data on that patio in Phoenix, I realized that what I had learned throughout the year studying a specific question in my classroom helped me to better understand the dynamics that occurred in two of my classes but not in another. The mindset shift I had in that moment was that this was still a positive learning exercise for me and the students in my classroom. While the things I discovered didn't apply to classrooms across the world, they did apply to two of my classes and could help me to better foster a healthy learning environment for those particular students. Knowledge doesn't have to be groundbreaking or universally applicable to be useful. The changes I implemented from the observations I made during my inquiry did help the students in those classes, and that was enough to make the process useful. Learning the intimate details and functions of my classes and the students in them helped me to

make small changes to benefit those students, and it also helped to empower me to push for school policies that I knew would help how these particular classes functioned.

Figure 1

Happy hosta, summer 2021



A similar situation played out after my husband and I purchased our house. I was quick to establish many different flower and native plant beds around our yard. While not a native plant, I had always admired hostas for their large leaves and interesting flowers. I bought one and planted it in a location that I thought was suitable: a semi-shaded bed on the east side of my house. By the end of that first summer, however, the hosta had burnt, crispy leaves and did not bloom. A more experienced gardener could have quickly told me that this location was not appropriate for this particular plant, but it took me seeing the sad, crispy plant to realize there was a problem. At the end of that summer, I searched for a different location around my house where it would be better suited. I relocated it to the

north side of the house where it would be in constant shade thanks to a nearby oak tree. Since the relocation, this particular hosta has grown bigger and bigger, putting out massive leaves and large spikes of blooms (Figure 1). It has provided shade and retained moisture in the soil that has benefited the other plants in this shadowy bed. While I did not make a groundbreaking discovery about gardening or hostas, I did make very important observations and changes for that one individual plant. The observations I made were probably life-or-death for this particular plant, so in that sense the knowledge I had gained from observation was useful. I've since planted two more hostas in this location and now have a happy little bed in a shady location where many other plants have struggled to thrive.

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I have come to view my experiences with the hostas in a similar manner as my inquiry projects. I am not necessarily learning any single universal fact about plants or students, but I am accumulating many small observations that help me make better localized decisions. The cumulative information I gain helps me to build up knowledge that can make me better prepared to identify and respond to similar students or scenarios. I was not doing anything more than observing and tracking, but for some students (just like my hosta) these observations led to impactful changes. Just because the knowledge I have gained about my ecosystem at home or the dynamics of one particular class period is not necessarily transferable to other gardens or classes doesn't mean it is not useful. I can still cultivate the healthiest gardens and classrooms possible by asking critical questions and observing the outcomes. These local, intimate details about the systems I most closely interact with help me to do what I can to build the strongest communities possible.

A Grim Realization

I am now entering my sixth year teaching at Free State High School, the same campus that houses the prairie restoration site. The prairie was built on an unused practice football field and is halfway surrounded by regular-old Kentucky blue grass that is mowed weekly and has fertilizer and various chemicals applied each spring. The other half of the site is surrounded by a wooded area that is home to a small stream and many deer, turkeys, possums, bobcats, and various other wildlife that seem to enjoy the influx of insects and blooms in the prairie. In addition, this site is behind our football stadium and track and is adjacent to the baseball and softball fields. Due to its relatively remote location, many community members and students are unaware of the site. I always enjoy taking students there for the first time. The look of shock on their faces at seeing the head-height grasses, colorful blooms, and variety of insects is always rewarding to see. I really love this peaceful, educational, and beautiful natural resource I have made many connections with over the last nine years.

Sadly, the longer I have interacted with it the more I have noticed all of the things that are working against it. The woods behind the site are home to a large population of invasive musk thistles and it is a constant effort to keep them out of the prairie. When a local river advocacy group helped my students do a water-quality analysis of the stream behind the prairie, we found high phosphorus and nitrogen levels in the stream indicating moderate pollution that affects the invertebrates that live in the stream. After every home football, baseball, or softball game, hundreds of pieces of trash and single-use plastic blow into the prairie and become entangled in the thick grass. An even bigger issue are the cycles of drought and flooding, as well as the late freezes, brought on by global climate change. Despite the deep root system that prairie plants have adapted for the seasonal climate that we experience in Kansas, there is little they can do to quickly adapt to the rapid changes our ecosystem faces. These same issues affect my little hosta bed at home. A late freeze in the spring of 2021 would have killed the spikes just peeking out of the ground had I not covered them up with blankets. I have noticed similar patterns in my classroom at school. For example, I work hard to help students value learning over grades, to implement restorative practices,

and to build individual relationships with my students. All of that work seems futile when compared to the problems in our educational system. While I may devalue grades and shift focus to growth, students still have to take numerous standardized tests throughout the year that affect school funding as well as their ability to earn scholarships. I may focus on restorative justice in my classroom, but my students still attend a school with an armed police officer and a discipline system that disproportionately suspends students of color. My school faces large gaps in enrollment in upper-level courses for students of color as well as constant staff shortages. My colleagues and I function in an exploitative system that practically requires unpaid work time in order to assist the over 160 students we have every year. While I am fortunate to work in a well-resourced and progressive community that generally values public education, my school has consistently faced paraprofessional, bus driver, and custodian shortages due to the low wages offered in those positions over the last four years. Additionally, in Kansas we have state legislators who actively work to defund and devalue public education. I see myself and my colleagues quickly burning out due to keeping up with developing impactful curriculum, grading, contacting parents, building relationships with students, and dozens of building and district initiatives. I love teaching students, but that is strained by the way the educational system currently exploits its workers. There is simply too much for any teacher to do in order to meet the needs of all students, and every day kids fall through the cracks. Students entering my classroom are already marginalized by many different systems in a variety of ways. How can I make sure that my classroom and school do not add to that marginalization? It is exhausting to put so much effort into my classroom and students just to see them thrown into a broken system that continues chugging along despite my best efforts.

Just like global climate change and other problems facing our world's ecosystems, the problems our educational system faces can't be solved by individuals. These systems work for and are upheld by a small number of people who hold the majority of power and who are far removed from the specialized knowledge held by educators and scientists alike. While I am a dutiful recycler and do my best to

lower my personal carbon footprint in other ways, no change I personally make can compare to the damage and emissions caused by corporations that have long known about and caused the climate disaster we are currently facing. It makes me sad to put love and care into my garden and restoration sites while also knowing that the cumulative effects of hard freezes, flooding, or droughts keep them from ever reaching their full potential. This feels shockingly similar to the issues my students face. The education system may not be actively harming *all* students, but it often feels like *more* students should be blossoming and blooming in our system. These realizations are far from the story I told myself during the first 25 years of my life. Growing up, I hated group projects and rarely sought out working with other people. I felt the need to control everything I could so that often meant putting my head down and only worrying about myself. I told myself this was the best strategy because you can't control what others do. If I want something done the "right" way, I should do it myself. Likely due to my middle-class, midwest, and white cultural mindset, I have always had a very individualistic view of the world. Individuals working hard will eventually lead to collective change, and I should worry about myself first. If I am the *best* teacher I can possibly be, other teachers will follow suit and the system will become better for all students overnight, right? If I drive less, recycle every possible item in my home, and eat less meat, the cumulative reduction in my personal carbon footprint will make a difference, right? This view of my own responsibilities was focused on perfectionism and meant that any setbacks or failures I experienced could only be blamed on myself. After years of faulting myself and ignoring the larger picture, I started to consider that not everything is within my control or responsibility. Actually seeing and acknowledging that one good teacher probably cannot make a large change in the problems that my students face makes me feel helpless and like I'm failing them in more ways than one. Acknowledging that there is little I alone can do to improve the failing systems that I function within daily is a hard pill to swallow and something I am still working on accepting. While I don't think it is universally untrue that individuals *cannot* make a difference, I have come to understand that, in both ecosystems and education, the true power lies in strong communities.

Growing Deep Roots

Through my participation in many different rich professional communities, I have started to identify strategies that I can use to leverage my own strengths combined with those of others to work towards larger change. The large-scale problems that educators face won't be solved by one or two teachers working together, but by communities of educators flexing their expertise and demanding the changes that we know are best. I am still not entirely sure what this looks like, but I know that I have to work with others to see the change that is necessary. Just like the hosta in my front yard that is able to thrive because of the shade provided by the large oak tree and the prairie plants that have grown stronger because of their beneficial fungal associates, I am able to thrive because of the friends and colleagues I have who provide support on hard days. Without this "shade" from the oaks in my life, I leave work looking and feeling like my sunburnt and crispy hosta at the end of that first summer.

Another ecological principle that I've noticed in my new mindset is the benefits of diverse communities. In nature, communities made up of one or two similar species are less resilient because a single pathogen or event that affects both species can cause the entire community to collapse. In a biodiverse ecosystem, there are many organisms that fill various roles in the environment. If one species is affected by a pathogen or event, there are many other organisms to "fill in" or accommodate for the disruption. Different species play specific roles and have certain strengths in a healthy ecosystem, just like diverse groups of people have been shown to be more productive and show increased longevity (Pato & Umezaki, 2020). If my entire yard was hostas, there would be no tall oak trees to provide shade or nitrogen-fixers to maintain a nutrient-rich soil. In education, our ecosystems have long been a monoculture of white women, who often have a similar set of prejudices, strengths, and lived experiences. As I have worked to build more connections in my local "ecosystem," I have tried to connect with others who have different strengths and experiences from myself. Like my hosta bed, I know that variety is a strength that will provide stability and longevity to weather the difficult times I face professionally.

I have started to view teacher leadership in this same ecological way. I'm not a hosta living in isolation or a single prairie plant in a field of sod. I don't have to be leading a district-wide committee or win national awards to be a good teacher. Participating in real, genuine ways with my colleagues has started to cause incremental, yet lasting, changes in the way I see my school community function. Instead of looking for the big and flashy "one thing" that will transform education, I've started looking for the people who I can connect with and learn from. I need others who get it, who know the day-to-day exhaustion of teaching and the problems in our system, to grow deep, intertwined roots with. During my first year teaching, I was very optimistic but naive about all the positive changes I could make. While I do not think that I was wrong, and do think that I have had positive impacts on students in my classroom, I am done holding all of the responsibility for our broken system on my own. I did not single-handedly build this system, and I certainly will not be able to fix it alone. Letting go of guilt and perfectionism is easier when I know that there are others in my community who have strengths where I have weaknesses. I do not have to be perfect at everything because I am not alone.

While the prairie restoration site at my school does face some systemic changes, the majority of the species are thriving and the site has become better established each year (Figure 2). The site serves as a research location for several labs at the University of Kansas, as well as an outdoor lab for me and my students. There are several local organizations that all work to take care of the site through yearly burnings, seed collection, and general monitoring. It is a beautiful location that highlights a native ecosystem often forgotten, and illustrates how ecosystems can be restored when given the proper care and treatment. I think it is primarily in this way—building deep, resilient relationships with a diverse group of individuals—that our educational ecosystem can also start to restore itself to become a place where all individuals can flourish and bloom.

Figure 2

Prairie restoration site in full bloom



Sara Abeita, a Knowles Senior Fellow, teaches biology at Free State High School in Lawrence, Kansas. She loves spending time outdoors with her husband, Nathaniel, and dog, Reggie. Her interests include watching college basketball (go Jayhawks!), attempting to create a watercolor nature journal, and reading. Sara is the president-elect of the Kansas Association of Biology Teachers. She is on the advisory board for the Grassland Heritage Foundation, serves as a building representative for the Lawrence Education Association, and is a member of the League of Women Voters. Follow her at [@AbeitaBio](#) on Twitter. You can reach Sara at sara.abeita@knowlesteachers.org.