In introducing this chapter, I must first explain that what follows has a different catalyst than most other work described in this book. I did not return to the high school classroom with the intent of becoming a better teacher educator. I returned to the classroom with the intent of divorcing myself from higher education and to take a different task on improving the educational system. My experiences at Urban Charter High School are part of a larger narrative about the demise of my belief in the system of schooling and the demise of my calling to serve through teaching and through work to improve teaching.

I wish the story was one that followed the journey of a basic mythic hero as described by Joseph Campbell, in which the central character ventures forth, has fantastic adventures, conquers an enemy, acquires self-knowledge, and returns safely home again bearing newfound wisdom (Campbell 2008). All but one of those elements is there—the enemy is unconquered. Of course that also means I’m no hero, but I am heavily laden with wisdom from my adventures. And it has made me a better teacher educator and a better educator more broadly. The ultimate lessons learned from the experience leave me still grieving over the loss of my love of teaching and the loss of a, maybe the, central part of my identity. Teaching, and improving the schools, was what I was about. That’s no longer true. Now I seek not to improve schools but to help make something better than schools that will lead ultimately to the end of school.

In 2007, I returned to high school teaching after more than a dozen years in academia. I’d spent nearly 20 years working within schools, struggling to improve them while countless others around the nation were striving toward the same ends.
I had concluded, like Moe and Chubb (2009), that decades of constant reform had yielded no substantial improvement in the system of schooling. Asking fellow science educators to provide evidence that science education research had improved the outcomes of schooling (at a scale beyond an individual school or district) highlighted this problem and continues to each time I raise the question. Pause and consider the question yourself: Have school outcomes improved in any demonstrable way at the national level as a result of science education research? Without a satisfactory answer to that question, and without serious prospects for change in schools or teacher education, I called it quits on academia. I joined the faculty of a new, urban charter high school thinking that a school started from scratch would avoid many of the obstacles that come with changing cultures and practices in existing institutions. I was naïve.

My range of experiences within the formal education system have led to my stepping back from that system, but not abandoning education. In June of 2008, I began working at the Paleontological Research Institution (PRI) and its Museum of the Earth. PRI has recently effectively merged with the Cayuga Nature Center. My work is primarily in educator professional development and curriculum materials development, and I also work in public outreach. The Museum and our outreach programming are built around the interplay between the histories of life and Earth, with focuses upon Earth system science, evolution, and climate change.

This chapter provides an overview of how, through a series of steps, I came to abandon the school paradigm. My voluntary exit from academia was an indicator of my frustration with the failed use of teacher education and educational research as a lever for change. My return to high school science teaching was the straw that broke the camel’s back—the experience that switched my understandings of the associated issues from academic to visceral. Most of the first two decades of my career, I worked to improve schools. My “return” to the high school classroom wasn’t to be a return, not a going back but rather a venture into something new—joining a team who were working not to make schools better but to make better schools by starting from scratch. That work brought me to the realization that, if we are to make substantial improvements to educational outcomes, we must do more than make schools better or even make better schools. We need to make something better than schools.

An Overview of This Chapter

While the story of my year in a start-up charter high school has interesting aspects as a standalone tale, it makes far more sense and the takeaway lessons are more meaningful within the context of my broader experiences in the edusphere. A sketch of my career intertwined with my shifting professional goals sets the stage for why I traded the life of the academic for that of an urban high school teacher. This is followed by an overview of the most difficult year of my adult life. As the stress of that year made its lessons more clear in hindsight, discussion of the lessons
learned mostly follow the story instead of being intertwined within it. Parallels are drawn between my experience and the loss of religious faith and to the difficulties of teaching climate change and evolution. Connections are also made to the economic concept of sunk costs. This chapter concludes with a summary of lessons learned coupled with questions about what might come next.

A Thumbnail Sketch of My Career

Beginning as a Teacher

I began college with the intent of being an engineer and left with a physics degree and a teaching certificate. Education courses seemed far easier than physics courses and playing with toys in front of an audience was fun—and I didn’t want to be an engineer. Student teaching was more challenging but also more rewarding. There were days when I felt born to teach. I’d get that special spine-tingling rush when a student seemed to “get it.” That sensation would emerge often enough throughout my career to keep me going (and perhaps keep me deluded) for the next two decades, and it’s a part of what keeps me in education today (Fig. 5.1).

I’d left student teaching thinking I knew how to teach science and I was quickly disabused of that notion. While the position was unpleasant in a great many ways, I learned a great deal very quickly. I did finish the year, and, in spite of a student setting off a fire extinguisher during an observation, was told I did well. I quit unsure of what to do next, spending the summer in the frat house and then moving back in with Mom and Dad.

Not knowing what else to do, I began to substitute teach. This led to a long-term subposition working with academically focused students which reminded me that I liked teaching when it, well, was easy. From there, I went to a longer-term substitute Earth science position in a small city in Upstate New York where I filled in for a teacher with leukemia. Through sad means, the position became permanent and I stayed for 7.5 years.

In that little town, I fell in love with teaching. After a year or two, I’d found my stride and got that rush from sensing student connection in fairly regular doses, though I also began to recognize that that rush was provided by a minority of my students and that many still struggled to understand what I wished that they would. The nature of what I wanted them to understand was changing too. Initially I wanted them to pass the New York State Regents Examination in Earth Science. It seemed I could do well enough at that, but I sensed that they weren’t really gaining understandings about how the world worked, and, if they were gaining such understandings, it wasn’t spilling over into how they lived their lives. It also didn’t seem like connections were made between ideas, and the understandings didn’t seem to stick around much beyond the end of the class.
## The Evolution of Don’s Professional Goals: A simplified account

<table>
<thead>
<tr>
<th>When</th>
<th>Where</th>
<th>Goals</th>
<th>Considerations or Approaches for Meeting Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>Undergraduate + student teaching</td>
<td>Be a better teacher than most of the ones I had/Drink a lot of beer</td>
<td>Work hard/play hard/amuse my students and maybe teach them something</td>
</tr>
<tr>
<td>1986</td>
<td>First teaching job</td>
<td>Survive my first year teaching</td>
<td>Work hard to come up with ideas that will keep kids under control</td>
</tr>
<tr>
<td>1987</td>
<td>Mom &amp; Dad’s</td>
<td>Figure out what to do with my life</td>
<td>Ultimately, remember that student teaching was rewarding and I could probably get a job doing that.</td>
</tr>
<tr>
<td>1988</td>
<td>Small City High School</td>
<td>Get my kids to pass the Regents Exam</td>
<td>Teach to the test. Rely too much on the academically motivated kids. Sprinkle in some fun, but motivate with the terror of the test.</td>
</tr>
<tr>
<td>1989</td>
<td></td>
<td>Be a better teacher than most of the ones I had</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>Graduate School</td>
<td>Make schools better</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>Small Liberal Arts College</td>
<td>Make schools better</td>
<td>Makes schools better by working to help teachers be better prepared to teach for understanding. Engage teachers and students in meaningful inquiry about science and about the nature of schools.</td>
</tr>
<tr>
<td>2000</td>
<td>Ivy League University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>Elite Liberal Arts College</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td>Make better schools</td>
<td>Pursue the question: <em>What makes complex systems change?</em></td>
</tr>
<tr>
<td>2007</td>
<td>Urban Charter High School</td>
<td>Survive</td>
<td>Basically freak out.</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td>Find a new profession.</td>
</tr>
<tr>
<td>2009</td>
<td>PRI &amp; its Museum of the Earth</td>
<td>Make something better than schools</td>
<td>Develop resources and practices that offer potential to improve existing schools and serve non-school educational environments. Pursue the following: <em>What makes complex systems change?</em> If the desired outcome of education is a citizenry that uses evidence-based understandings of the social and natural world to inform their actions, what should the educational system be like?</td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I began to work for change outside of my own classroom, serving on district-wide committees, co-chairing the school’s site-based decision-making team, visiting Teachers’ College and Central Park East (see Meier 1995) with a team from our school, and much more. There was a great deal of talk of school reform, and I was attracted to the metaphor of the act of school reform being like redesigning and rebuilding a jetliner while in flight or a bicycle while you’re riding it. Yes! It really is that hard, I thought. Change didn’t really seem to come.

**Moving to Higher Education**

I was also noticing a pattern—each year new teachers were hired and each year I saw at least one of them in tears (as I had been more than once in my first year). This added to my frustration. I thought I could do better in preparing teachers than what seemed to be common practice, so I decided I wanted to become a professor. I aspired to better prepare teachers and find a different leverage point for improving schools. At the end of the 1991–1992 school year, I’d decided the next year would be my last before grad school. Plans were delayed by a year when I fell in love with one of those crying teachers, Katy, the following year. At the end of Katy’s second year, we married and were off to East Lansing.

In graduate school, I continued to teach, not science per se, but future science teachers, and I supervised their work in classrooms. I was also learning to be more systematic in my study of my own teaching and that of others. Graduate school was the best-designed educational experience of my life. That’s not to say it was the most educative experience, but rather the most educative by design. It was starkly different from any formal education I’d had prior to it, and I enmeshed myself in the study of the educational system.

The metaphor of rebuilding the jet in midflight hung on for a while too, as did the more general idea of schooling being something mechanical and therefore fixable. Seeing the school as factory also informed my thinking. As my studies progressed, the mechanistic model began to fail me and I came to understand that schools are not broken. I eventually understood that schools are more organismal than mechanismal. And as far as organisms go, they are quite healthy—they are self-replicating, resilient, and deeply connected to other systems in society—but we still attempt to manage them as though they are machines. The educational system, like industrial agriculture, is simultaneously remarkably successful and deeply troubled. My dissertation, *Scientists Are From Mars, Educators Are From Venus: Relationships in the Ecosystem of Science Teacher Preparation* (Duggan-Haas 2000), traced some of my changing conceptual models for the educational system, and Fig. 5.2 highlights an important realization that comes from the work.
My Attraction to Dysfunctional Systems

In 1999, I was ABD and I started teaching in Little Liberal Arts College’s Education Department, in a temporary position. This was the first of three academic positions after leaving MSU; the first two (Little and Ivy League—pseudonyms) were temporary positions. The third at Elite Liberal Arts (pseudonym) was a tenure track position. Each of these positions was in a struggling department, two of which have since closed, though they both maintain some sort of teacher education program. The Education Departments at both Ivy League and Elite Liberal Arts were at the time of my hiring, on orders from the university administration, under the tutelage of a committee of outside experts with the goal of regaining the department’s former vigor. I went into each of these situations aware of the problems but believing that chaos breeds opportunity.

At all three of these institutions, graduates tended to be very successful by most measures. However only at Little, the least competitive of the lot, did outcomes exceed what would be predicted based on the characteristics of incoming students. I attribute that to the fact that only at Little were aspects of the school paradigm broken. It had unusual strengths stemming from college-wide programming that included a portfolio expectation woven into coursework across all 4 years and a study abroad program that engaged the overwhelming majority of students. At Little, we were a department of two freshly hired full-time faculty offering certification in 15 different secondary areas. The two of us worked to reshape the program and improve its poor reputation both on campus and off with some success.

In my 4 years at Elite, the program never graduated more than eight in a given year. I advocated for an expanded role for subject specific pedagogical courses, and

\[ \text{Fig. 5.2 Two examples of tightly controlled ecosystems that assume a monoculture.} \]

(a) Rows of corn outside Parma, Michigan. (b) Rows of seats in B108 Gilmour Hall, the classroom for BS111.
this advocacy was dismissed by my colleagues as vocational and indicative of my failure to understand the nature of a liberal arts college. While the department’s grades were the highest of any department on campus—57% As in one semester—the response rate on the Career Services Office survey of graduates 1 year after graduation was fairly low. In one of my years at Elite, five Educational Studies alum responded to that survey. They were a bartender, two professional athletes (playing outside the USA), a health-care representative for a pharmaceutical company, and a teacher in a private school. And though the GPAs were routinely high, the tiny teacher education program each year had at least 20% of the students being told by my senior colleagues that they were not prepared for classrooms of their own and that these deficiencies were their own faults.

By the start of my last year at Elite, I saw tenure as a club with high dues and a membership I didn’t much care for. My departmental colleagues did not much care for me, but the university’s president very much liked the new programming and partnerships I’d developed. I knew I’d not published enough, but I’d been successful in procuring more grant funding than most on campus, and both publications and grants were in the pipeline. But I resigned a year ahead of my tenure decision and went off to teach at Urban Charter High School (pseudonym).

While Little and Ivy League have closed their Education Departments, Elite soldiers on. I don’t think the closing of departments behind me is a reflection of my deathly touch, but rather my attraction to dysfunctional systems and my desire to come and fix them. At all three institutions, I knew I was joining departments in trouble, and I wanted to take advantage of the chaos that was there to build something new. But in all three of the cases, while I was able to make improvements to the programming, as a junior faculty member, I was not in a position to make the kind of change I saw as necessary. And, especially at Ivy League and Elite, I was working against my colleagues rather than with them.

My Brief Return to High School Science Teaching

The School Setting of Urban Charter

Urban Charter High School is an Expeditionary Learning (EL) School, which is a model of schooling inspired by Outward Bound. See http://elschools.org/. The school is a public charter school in one of the nation’s poorest cities, where the general public school population is very poor (80% free or reduced lunch) and majority minority (57% African American, 25% White, 15% Hispanic or Latino). While Urban’s student population was determined by a lottery open to any student in the city, the demographics differed from the city substantially. Urban was 57% White, 33% African American, and 7% Hispanic or Latino with 33% eligible for free or reduced price lunch. The demographics of public school populations are also not representative of the larger city as many within the school attend private schools.
EL schools feature interdisciplinary instruction built around what I describe as “conceptual expeditions.” These expeditions are intended to focus instruction for a trimester upon a theme ideally connecting several, if not all, disciplines for a grade level, though one discipline or a pair of disciplines may take a leading role. The Expeditionary Learning Core Practices describe how students and teachers engage in active interdisciplinary learning, public performances of understanding and where performance expectations are high (Felton 2011).

I started reading and hearing about EL Schools years before I left my last academic post, and I very much liked what I read. My favorable impressions grew as I participated in their professional development (PD) programming the summer before I started at Urban. The quality of the face-to-face PD programming was second in quality only to the Outward Bound Teacher Practicum Katy and I had done years before, and the schools were inspired by Outward Bound as well. I had led professional development instruction informed by the literature (Garet et al. 2001; Kaser et al. 1999; NSTA Board of Directors 2006, for example) and reflecting understandings of the research on how people learn (Bransford et al. 2000; Donovan and Bransford 2005; Donovan et al. 1999), and the EL schools resonated with these. Moreover, involvement with this program was fun and collegial.

The school had started the year before Katy and I joined the faculty, and they were using rented space in a private school for disabled that was facing declining enrollment. The school was an extension of Urban Charter Lower School, a K-8 school that started a few years earlier. The lower school had impressive outcomes on standardized tests—among the best not only in the city but also in the county, besting a number of wealthy suburban schools. The lower school had just 24 students per grade and, while diverse, drew far more heavily from middle and upper-middle classes than was typical for other public schools within the city. Several of the graduates went off to the city’s selective admission high school.

The curricular specializations seen as necessary at the high school level made logistics very challenging for 24 students per grade, so the high school opened initially with 50 ninth graders and added classes of 75 students per grade in subsequent years. The smaller starting class was essentially (and thoughtfully) a pilot group. Our teaching colleagues were diverse in experience and perspective, though mostly White middle-class folks like us. Many had years of experience in a range of school settings including traditional urban and first-ring suburban public schools, private schools, the Peace Corps, and a few just out of college.

I taught tenth grade Regents Earth Science and Katy taught ninth grade Regents Living Environment (aka biology). The science teacher from the previous year was now the Instructional Guide for the school. Our classrooms were not built for science—Katy’s had one sink, and my room was smaller with no sink. Equipment was exceptionally minimal, though we were given the opportunity to determine what was needed and had some budget for ordering equipment and supplies. We found little time for this process.

While we’d participated in effectively structured PD, we were also told we’d have ample time to prepare in the final weeks before school began. Much of this time disappeared into tasks like assembling scores of student desks. Indeed, the year started very roughly. While things improved marginally over time, the level of stress was overwhelming for both Katy and me. To put it bluntly, it sucked.
Highlights and Darker Moments

The year began with what many of the staff saw as chaos—we were told that the programming for the first few days was in place and was to be run by the Instructional Guide, and we were told repeatedly not to worry. We had no time for worry. In the first days, there was very little structure, and, unlike in most of my prior teaching experience, I felt from the start that I didn’t know what I was doing, and so did Katy. And our students picked up on this feeling of incompetence. While I’d hoped to spend the summer engaged in developing a workable curriculum grounded in big ideas and well connected to other disciplines, I instead found myself trying to pull my act together day by day. However, I took some solace in the fact that at least I was no longer working against my colleagues in a dysfunctional collegiate teacher education department. I really did.

While I am not especially proud of my work at Urban, I do believe I occasionally (only occasionally) helped students see the world in new, richer ways, and I did get the occasional rush that comes from sensing students’ epiphanies. Aspects of my work that I am proud of include the concept of the Industrial Revolution as the first expedition for the tenth grade year, where we drew meaningful connections between social studies, English, and science around the ideas that the Industrial Revolution would have not been possible without new understandings related to the extraction and use of Earth materials and that the changes kicked off by the Industrial Revolution are now being felt in myriad ways, not least of which is our changing climate.

One of the few clear moments when a lesson worked well for a particular group of students grew out of a lesson that went exceptionally poorly. That the lesson went more poorly than most was not clear until after the school day had ended and students came to see me for help with an assignment involving mapping. In discussions with a pair of students, it became clear that neither really understood the abstraction that is a map. They were unable to locate either the city they’d lived in all of their lives on an unlabeled map of the state, nor were they able to locate their state on an unlabeled map of the USA. Of course, I knew academically that this was not terribly uncommon, especially for students who had not travelled far from home. The discussion led me to use the then new software Google Earth to recreate the classic science education film Powers of Ten (Eames and Eames 1977) but centered upon our recognizable schoolyard instead of some distant park. This seems to be a teaching tool that works, and I have used some version of it within the professional development programming I have run for the last several years. See: http://virtualfieldwork.org/Your_Own_Powers_of_Ten.html.

Another point of pride is that one of my best students at Urban is now a junior geology major at a highly selective liberal arts college.

But the day-to-day work is much harder to write about than the scattered successes. The typical class started with a mini-assessment or other activity that was intended to engage students and provide me some feedback about what they understood. The rumble of conversation that began when students entered the room
generally neither subsided nor refocused on matters of science. Students were nearly on top of each other in the small classroom, and the activities of my students seemed to generally have little to do with Earth science. While I found the students to generally be kind and intelligent, their intelligence was often not of an academic sense. Many of them were figuring out how to get by as poor kids in a poor city. Part of that meant they were working toward high school graduation at a much higher rate than their peers in more traditional public schools, and that’s a mark of honor for Urban. But it was a hard slog. While my students passed the Earth Science Regents Exam at a higher rate than their peers in other city schools, a majority still failed.

**Quite a Year, Even If It Wasn’t Quite a Year**

About half of us, as is common with urban charter schools, didn’t make it past the end of the year. That was true of both Katy and me. Katy quit at Thanksgiving. I stuck it out almost until the end, but I had lined up my current job before the school year was quite over. I am embarrassed that I did not hang on until the very end, though I did my best to help with the transition. I was very glad to be on my way to something different.

Why did so many of us move on, and why is it so common? Katy and I quit as the work was simply overwhelming—emotionally draining and requiring more hours to do marginally well than any job either of us had ever experienced (and we’d both been successful in jobs requiring far more than a 40-h workweek). Many of us simply did not understand the amount of time required for, and the amount chaos inherent in, a start-up. We were also frustrated with the nature of how the school was run; at the same time we were impressed by the intelligence and motivation of the administration. That motivation led to the crossing of certain lines, like claiming a 100% graduation rate by graduating 50 students 4 years after starting with 50 students even though they weren’t exactly the same 50 students or trumpeting a 100% college acceptance rate when the school required and paid for application to the local (open enrollment) community college for any student who had not been accepted elsewhere. Practice also didn’t seem to live up to rhetoric related to shared decision making and to high academic expectations.

**The Key Lessons Learned Along the Way**

**The Epiphany**

I’d left academia thinking I knew how to teach. I was quickly disabused of that notion. While the position was unpleasant in a great many ways, I learned a great
deal very quickly. Though it didn’t feel like my students at Urban learned what I wished they did, I learned a great deal in a cascade of realizations. I also had flashbacks to the start of my career, where I’d inherited the legacy of a professor with 17 years of experience who couldn’t handle teaching middle and high school science, thus opening the vacancy that led to my first teaching job. I became that suffering soul.

Like most epiphanies, the signal moment came on the heels of a long time of thinking. I’d long noted that there was no *On the Origin of Courses* authored by some educational equivalent of Charles Darwin that laid down a set of fundamental natural laws on how to structure educational systems but that understanding was still really only of the academic sort. One day in late September—much earlier in the year than I would have liked—it hit me. It was more of an “Ah, shit!” moment than an “Ah ha” moment. It was also a realization that I’d come to as a junior high school student some 30 years earlier and managed to suppress for most of the intervening years—schools suck. My class was out of control, and my mind was racing through two decades as an educator to bring it back to a place of control and it hit me. I was engaged in fool’s errand of gigantic proportion. To put 25 teenagers into a room with a single adult who is tasked with teaching them about a topic with which they have virtually no interest (I believe the topic of the day was convection) is a ridiculous notion.

We’re so stuck in the paradigm of schools that we can’t see that schooling is an essentially insane thing to do. The standard practice of putting 2,000 teenagers in one building is crazy. Asking kids to sit in rows and listen to somebody talk about the Battle of Hastings for 45 min or an hour and then move down the hall and listen to somebody else talk about the Pythagorean Theorem for another 45 min or an hour? Well, that’s loony. That we expect kids to do this hour after hour after hour and day after day after day for years on end is the craziest thing of all. It’s as if the people who designed schools didn’t know or didn’t care anything about how kids (and people more generally) actually learn. It’s not that schools are broken—it’s that they do something fundamentally different than what we pretend they’re designed to do!1

As a science educator, I’d been working to use evidence-based practice in a setting with no evidence base! The classroom and the class period, the size and shape of the classroom, and student to teacher ratios are all structures—aspects of the “grammar of schooling” (Tyack and Cuban 1995; Tyack and Tobin 1994)—that are not grounded in research, or at least not research of the twentieth or twenty-first centuries. While I really already knew that, I suddenly knew it in a fundamentally different way. It was no longer simply an academic idea, or an academic problem, but something that was making my life, the lives of my students, and the lives of students around the country pretty miserable.2

---

1 Some of the description of the epiphany was published on Slate.com in the author’s contest entry for imagining the classroom of the future.

2 Note that I’m not claiming that the misery is universal, but it is most certainly widespread.
While clearly schools work for certain things, it certainly is reasonable to suspect that there’s a ceiling effect for the outcomes of this approach. And, really, most of the positive outcomes of schools are measured against the absence of school, not against a different orchestrated attempt to educate. In other words, trying to educate someone is better than not trying to educate someone. Decades of NSF research costing hundreds of millions of dollars have made no discernable improvement in the outcomes of school-based science education.

Really. We’ve not budged the needle on school outcomes since school completion rates leveled off decades ago. Yet, there I stood, trying to carry out evidence-based practice within a superstructure that had no evidence base. I felt like I was losing my mind, but really I was just crossing an evidentiary threshold. Crossing that threshold was something akin to a religious conversion. Unlike with my actual religious conversion (from liberal Presbyterian to atheistically leaning agnostic), I had been actually very deeply committed to this belief system. And now it was gone.

**Schools Do “Work” in Certain Ways and EL Schools Work Better Than Most**

Schools, of course, “work” for certain things—almost certainly the overwhelming majority of the readers of this essay are school graduates. Perhaps the most compelling evidence that schools improve lives is that life expectancies bump up in correspondence with amounts of schooling (Cutler and Lleras-Muney 2006). More education seems to lead to a longer life. At first glance, that’s an impressive argument for lots of compulsory schooling, but (as noted above) it’s comparing the absence of education to the presence of education, not comparing school-based education to some other kind of education.

Has Urban found the right way to do the wrong thing? Or are they just straight up doing the right thing? I continue to believe that EL Schools serve their students better than traditional public schools, and this was decidedly true of Urban. Urban’s students have an experience superior to their peers in the city’s traditional public schools, but that bar is low indeed. I also believe that EL Schools are still too school-like to be truly effective at building the kinds of understanding society needs.

**On Sunk Costs and Coping with Lost Faith**

“Sunk costs” is a term used in economics and business that refers to past costs that have already been incurred and cannot be recovered, and the “sunk cost effect” is

---

“...a maladaptive economic behavior that is manifested in a greater tendency to continue an endeavor once an investment in money, effort, or time has been made.” It is predicated on a desire to not appear wasteful (Arkes and Ayton 1999; Arkes and Blumer 1985). Expenditures include not only money but also time and effort. In all of these ways, becoming the educator I am today cost a lot. And, more importantly, the cost for society is great as well. According to traditional economic theory, rational decision makers do not factor sunk costs into decisions, but real people do. It would appear wasteful to not apply those sunk costs to current and future endeavors, but it is water under the bridge, so to speak.

I’d invested two decades and my heart and soul in the paradigm of education, and I am now wrestling with not how to let that investment go but rather how to reshape it so as not to fully lose those sunk costs. The conclusions described in this essay came through a painful paradigm shift that was in certain very real ways akin to a religious conversion experience. In just a few short years, I went from being an evangelist for the idea of public schooling (if not for typical practice) to a harsh critic of, really, the very idea. I went from being part of a flock of millions with temples in every city and town to being very lonely in my paradigm.

This transformation was well underway before I willingly left the tenure track at an elite liberal arts institution and an at least moderately promising career in academic research and teaching. How did someone with 20 years as a professional educator and a true passion for teaching and for public schools end up largely giving up on the enterprise of schooling? The nail in the coffin was a return to high school teaching after more than a dozen years in academe, but I was very close to this tipping point before I joined the faculty at Urban Charter High School.

Abandoning the belief system that shaped not only my professional work but also my larger identity and the community with whom I identified is still ongoing and still painful. I will likely never completely divorce myself from the community as many of my friends and family will probably live there until they die. But I doubt I will ever feel the sense of belonging that was such a comfort after I found my footing at Small City High School. Science teaching and teacher education was my calling. I thought of teaching more than anything else—even sex. And mostly those were happy and exciting thoughts, even if they were focused on how to unsettle the system.

**Drawing Parallels to Teaching Evolution and Climate Change**

If a belief, such as belief in the biblical creation story or belief that climate change is a liberal hoax, is tightly held, evidence alone is insufficient to change a believer’s mind. So it is with schools serving as a vehicle for the delivery of evidence-based understanding of the world. In engaging with climate change deniers in recent years, I use different strategies in different settings. Generally, I do not expect to change the mind of the person I’m engaging but hope to provide useful insights to
any audience to the discussion. Facebook allows me to carry out such discussions with spectators regularly.

In those discussions, I frequently draw from a blog post I wrote for the Museum’s climate change blog in which I make the case as simply as I can.[^4] It draws attention to some grade school vocabulary (the difference between weather and climate) and states two facts: increasing carbon dioxide in the atmosphere is known to increase heat absorption within the atmosphere and we are increasing the amount of carbon dioxide substantially. These facts are indisputable, and without being able to dispute them, climate change deniers have no real argument. Similarly strong evidence can be drawn for the basics of evolution or for the broad failure of schools to build understanding of the social and natural world.

As with anthropogenic climate change and evolution, the evidence for the failure of the school and the current paradigm of science education research as tools for building scientific literacy is clear. What are the key facts to support that proposition? Three facts seem to stand up to evidentiary challenges:

1. Nearly all American adults have attended school at least through the age of 16, typically completing science through high school biology.
2. Scientific literacy is not widespread.
3. There is no evidence of improved scientific literacy of high school graduates over at least the last few decades.

That the above has held true for a generation should lead us to the conclusion that the very nature of the approach is unlikely to yield the desired results.

In the teaching methods courses I had taught before teaching at Urban, I had advocated for a backwards design approach to instruction (G. Wiggins and McTighe 1998; G. P. Wiggins and McTighe 2005), but now I recognize the need to step further back. If educational institutions were designed from scratch and by people who were either unaware of the school paradigm or who had managed to divorce themselves from it but who understood what research says about how people learn, these institutions would likely look nothing like schools.

The big ideas advocated for in that same book were also generally not big enough, though the basic argument for structuring learning around such ideas is sound.

Concluding Remarks and Future Direction

You never change something by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.

~ R. Buckminster Fuller

I suspect I will remain enamored with learning and how to foster it for the rest of my days and that this infatuation will continue to be at the center of my professional work, but, like Wallace (this volume), “...I no longer have the desire to promote and research classroom interventions that may result in better science learning.” Or at least, I no longer delude myself that these efforts will have the desired effect on any kind of broad scale. I am no longer primarily focused upon either improving teacher education or improving schools. While my work still includes substantial work in educator PD (no longer just for classroom teachers) and the creation of resources useful in classroom settings, my hope is that the work supports learning in an array of settings. This last aspect connects, obviously, to my work at the Paleontological Research Institution, its Museum of the Earth, and its Cayuga Nature Center—my current employer. In addition to serving what I currently do, I hope it lays the groundwork for entities that might replace schooling.

I am hopeful that what I do now is useful in supporting teachers in making instruction (and therefore schools) better, that these resources and approaches are useful in new schools, and that they are useful for learners outside of schools. This includes my work serving as a member of the Earth and Space Science Design Team for the National Research Council’s *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* and as a member of New York State’s team reviewing *The Next Generation Science Standards (NGSS)* now under development. Serving to define the content students should learn might seem inappropriate for someone who doesn’t believe in schools, but it isn’t. I still believe in education and that we ought to think carefully about what people ought to (and can realistically) understand. I was asked to contribute to the development of NGSS because of my work drawing attention to the mismatch between what we expect people to understand related to Earth system science and the way we structure curriculum and instruction.5 This work has largely been in the context of creating and using Virtual Fieldwork Experiences (VFEs) to build understandings of how a place came to be the way that it is; and that approach is part of a broader place-based approach to learning applicable in both formal and informal settings. Most of my work is funded by National Science Foundation grants: the VFE work under NSF DR-0733303 and in climate and energy education under NSF GEO 1035078. This second grant uses the Marcellus Shale as something akin to a gateway drug for energy literacy and connects formal and informal educators within our target communities.

For the practical purposes of earning income, the fact that I enjoy the company of educators and the fact that I am not fully a rational thinker with respect to sunk costs, I have not completely divorced myself from the system of schooling. I do, however, aspire to that separation, and I look forward to the time where I can make a declaration similar to the one made by Harry Blackmun regarding the death penalty’s inherent flaws. See Fig. 5.3.

---

5 See [http://virtualfieldwork.org/Big_Ideas.html](http://virtualfieldwork.org/Big_Ideas.html)
Readers of this might be looking for explicit guidance, especially if any of the preceding resonates. But it should be clear to take that with a grain of salt, as I’ve clearly spent a lot of time not knowing what the hell I’m doing. With that caveat, I will offer some advice. After years of wondering if there’s a right way to do the wrong thing, I’ve concluded that the answer is decidedly “no,” but if you are going to do the wrong thing, some approaches are better than others, and attempting to do the wrong thing—and attempting to do things you won’t actually be able to do—is a powerful way to learn. “Just surmountable difficulties” are probably the most pleasant and invigorating ways to learn, but it’s important to take on insurmountable difficulties with some regularity. For one thing, it helps you empathize with learners who struggle to understand what we might teach. Reading researcher David Pearson suggests that all teachers should occasionally read or attempt to read “Waterloo texts,” that is, books so far outside their areas of comfort that they have no real chance of comprehending them (Afferback et al. 2008). Urban High School, in the context of my life at that time, was my Waterloo teaching experience. It certainly made me more empathetic for the teachers I work with as to why reform-oriented teaching isn’t commonplace. And it taught me much more than just that. Of course, I’m hesitant to advocate directly for people to go out and teach ineffectively, but a central point of this chapter is that the system of schooling is generally ineffective anyway. I suppose what I’m advocating here is go out and be bad, but less bad than the average person in that position would be! And, to do so with the recognition that it will make you better at whatever comes next, so that ultimately the good outweighs the bad.

The book that includes this chapter, Practicing What We Teach, is preaching to the choir. The choir, however, is not composed completely of believers, and I want...
to reach the nonbelievers and bring them out of the closet. This chapter serves as my own formal “coming out.” I can no longer be closeted as a nonbeliever. I have long served as something akin to a bishop in temples of schooling. I no longer believe in the fundamental tenets of the religion, or the culture, of schooling. I hope that my coming out will connect me to others who have reached similar conclusions and that it will ultimately lead me to connecting to a new (or new to me) community that shares my love for nurturing learning but recognizes that the most conspicuous entities in our society thought to be working toward that end do not resemble the structures needed for doing the task well and that they are unlikely to be transformed into something that will.

I am also advocating for your understandings to be more than academic but to actually change your behavior. If schools don’t yield desired outcomes, work to make something better than schools. I hope to work with others to build a learning-centered entity that will one day replace schools. Drop me a note if you are interested in joining me.

References


development effective: Results from a national sample of teachers. *American Educational


Boston: Beacon.


NSTA Board of Directors. (2006, May). *NSTA position statement professional development in

Cambridge: Harvard University Press.

Tyack, D., & Tobin, W. (1994). The “grammar” of schooling: Why has it been so hard to change?


Association for Supervision and Curriculum Development.