

Introduction: Teaching—the Call to Authentic Engagement

The child learns to speak, though it has no learned teachers,
because it lives with those who know how to speak.

—Chuang Tzu 26

“What we have here, son, is a **failure** to communicate.”

—*Cool Hand Luke*

The “Ah-ha” Moment

First year of teaching. Enormous suburban high school. Metro Nashville Public Schools. Two sections of chemistry. Two sections of world history. And, Heaven please help me, one section of AP European History—because no one else in the department would do it in response to the petition from the student body.

It is 7th Period on a dreary Friday in February. Things are not going well....

Nathan Williams tossed his book onto the seminar table and sneered.

“Locke was completely full of it!” He declared.

The others in the class squirmed. It was not our first heated discussion, but this was still Nashville, Tennessee in the late ‘80s and directing a tone like Nathan’s at an authority figure violated just about every one of the teacher-student mores there were at that school.

Internally, I sighed. My behavior management classes at Peabody said that I was supposed to pounce on moments like this one, and my mentoring colleagues had lectured me on more than one occasion about the danger of letting the students perceive you as a peer.

But by this point in the year, I had already learned that how I chose to respond would either silence the dialogue or open it up, and we were at a critical juncture in our discussion of Locke’s *Second Treatise*. We had been examining the evolution of the idea of civic freedom and its role in democracy’s development, and without getting them to understand Locke’s radical understanding of freedom, I wasn’t going to get them to see how it lay the grounds for Jefferson’s language in the Declaration of Independence.

I turned to Nathan.

“Want to elaborate a little more articulately?” I replied calmly. “I’m afraid ‘full of it’ isn’t very helpful.”

“His claim in section four that people are in a natural state of perfect freedom. It’s completely bogus.” He answered. “None of us are completely free, or we wouldn’t even be here. *They* make us come to school.”

Tanya stirred at that.

“Nathan, kids skip school all the time! And they do it....” She paused and looked down at her own copy of the *Treatise*, stabbing a finger on the page. “They do it ‘without asking leave...of any other man’.” She stated.

“Good.” I complimented. “Always remember to keep coming back to the text. The DBQ on the AP exam is going to require you to support your argument with direct material from whatever historical document they provide.

I turned back to Nathan.

“Sorry to interrupt you, Nathan. Go ahead and continue with what you were saying.”

He leaned forward toward Tanya and pointed at her book.

“I think you need to read the rest of what you were quoting.” He challenged. “The part about not ‘depending upon the will of any other man?’ Sure, some of us may skip school. But we get punished for it when we do, and then they **make** us come back here. People can make other people do things.”

He looked around the class for confirmation.

“Want to tell me how *that’s* freedom?” He asked.

Richard, who had been silent throughout, suddenly spoke up.

“What you’re saying,” He replied, “is that adults can control your decision to be in school. That you don’t have the power to choose not to be here. Sorry, I’m with Locke; you can leave any time you want.”

Nathan sighed in exasperation.

“No, that’s not what I’m saying at all.” He insisted, gesturing yet again at everyone at the table. “Look, none of us are going to say that we aren’t free to make some decisions. I’m just arguing that Locke’s wrong that we can make *any* choice we want.” He picked up his copy of the book. “ ‘Within the bounds of the law of nature.’ Someone in prison, for example, isn’t free to make any choice they want; they’re stuck there against their will. In fact, that’s the whole point of prison: to make people behave so they won’t lose freedoms that are important to them!”

I shook my head in disagreement.

“Anyone in prison is absolutely and completely free to do whatever they want all the time.” I declared in provocation.

THAT woke them up.

“Look, Mr. Brock,” my other Nathan responded. “While I actually think Locke’s basically right and that, as he says later in chapter two, we essentially all have to agree to limit our use of our freedom in order for everybody to be able to function in society, I’ve got to go with Nathan on this one. Somebody in prison doesn’t have any freedom. They’ve lost it until someone else decides to let them out.”

There was a general murmur of assent, along with a mixture of head bobbing and expressions of confusion.

I studied both Nathans and then turned to the one who had started all this and made sure I had his full attention, knowing that the others would get it if he did.

“Anyone in any prison anywhere in the world is absolutely and completely free at all times. He can choose to walk out of his cell; he can choose to walk out the prison’s door; he can choose to walk across the prison yard to the fence; he can choose to climb over the fence....”

“But the guards will stop him! They’ll shoot him!!” protested Nathan.

“Yes, according to Locke, the prison guard is absolutely and completely free to shoot a prisoner trying to escape.” I replied. But then I paused and leaned forward, tapping my finger on the table for emphasis. “*But does the consequence of getting shot get rid of the freedom to choose to escape?*”

Nathan briskly shook his head.

“No, of course not. But....”

His eyes actually widened, and his mouth actually made an “oh” shape, and I could see from a quick glance that similar expressions of understanding were popping up on the rest of the class’s faces.

“Right,” I told them. “The existence of total freedom never implies an absence of accountability.”

“That means, though, that...”

Nathan’s voice trailed off as the full implications of the new insight hit him, and what had just been a slightly smaller world got a little larger for him.

Damn! I thought. How’d I just do that, and how the hell do I make what just happened happen again?

The Looming Crisis

Education in this country is in trouble. Public, private, K-12, universities...our entire schooling system is failing our children, adolescents, and young adults in some fundamental and critical ways, and I am not alone in thinking so. Entire books have been written over the past decade about this issue.¹

But as someone heavily trained in both the sciences and the humanities, I am all too aware of the genuine consequences if we leave this problem unaddressed—as far too many of us in education are currently doing. The recent resurgence of diseases such as the measles and whooping cough is only among the more obvious examples of the potential perils facing a world that fails to secure learning for its children, and along with environmental degradation, climate change, and unchecked population growth, the list of major issues threatening us today continues to grow almost exponentially.

Humanity, in fact, is facing a “bottleneck” in the coming century—a moment when the confluence of resource demands and their unavailability will strain the abilities of institutions and individuals to survive—and the final outcome of this predicament is in no way certain.² Already, the emerging economies of India and China have started to siphon away the limited supply of material and intellectual capital that are available to us here in this country, and the damage to our nation’s capacity for further growth and development has been significant. In addition, “machine intelligence is racing ahead, wiping out millions of routine jobs as it reshapes the competencies needed to thrive,”³ and we are facing the reality of a world where some individuals may be unemployable, not simply under or unemployed. Future generations will have to learn to live as thoughtful individuals who are attentive stewards of their lives in order to weather the coming storm, and if our society wishes to prevail, we must somehow find a way to combat the mounting intellectual illiteracy that currently threatens us and to teach our children the wisdom they will need for tomorrow.

How we will do that, though, is at present quite problematic. Again, the overwhelming data today shows that we are failing completely in our efforts to provide children with the education they will need to succeed in a world that has become truly global, and the past few decades of new standards and other educational reforms have apparently done nothing to change this situation.⁴ Indeed, it is hard not to have a “been there; done that” cynicism when it comes to the seemingly endless attempts to improve education since *A Nation at Risk* first warned us that we had a looming crisis on our hands—back in 1983!⁵

The simple fact is that none of the reform efforts since I started teaching have succeeded in fixing our schools, and until we recognize that this failure is an inherent feature of a certain way of understanding the educational process itself, we will “keep feeding children into an education machine that churns out young adults lacking meaningful skills and purpose, primed to throw hand grenades into the ballot box, or worse.”⁶ What I want to challenge us to see is that the real crisis we face in education today isn’t that our children aren’t learning what we teach

them: it is that they are learning *exactly* what we are teaching them. So much of education remains broken (and the consequent future we face so grim) not because we haven't been working hard to repair and change what goes on in our classrooms but because the ways in which we have tried to accomplish this task literally *can't*. I want to suggest that the reforms of the past decades have all employed a vision of teaching and learning that makes their inability to improve these things inevitable and that until we change this vision, what is now "merely" a looming crisis will indeed become an incarnate disaster. Therefore, if we want to avoid a future that is as frightening as we think it is, we must alter our understanding of education, and to do that, I think it is critical to see why the current dominant educational paradigm is fated to fail in the first place.

The Failure of the Cartesian Paradigm

In his pivotal book, *The Courage to Teach*, educator Parker Palmer wisely points out that "the way we diagnose our students' condition will determine the kind of remedy we offer."⁷ Therefore, if we want to understand why education in this country is so often dysfunctional, we must first understand the "lens" through which the numerous reform efforts have examined the problems in today's schools in the first place. Only by so doing can we grasp why they have offered their particular remedies to education's problems, and—accordingly—only if we understand the properties of this "lens" will we see its fundamental flaws when it comes to offering successful solutions.

To do that, though, we must start with a brief detour into the history of modern thought and recognize that most contemporary educational theory has historically rested on the same analytical system that has dominated the rest of Western thought for nearly 400 years: the Cartesian paradigm. Developed by René Descartes in the 17th Century, this outlook basically states that the objects in any system can be mapped out onto a coordinate network⁸ and that anyone can then use this mathematical model to manipulate and test predictions about the relationship(s) between the many parts of the system. It effectively turns our understanding of the entire universe into that of a giant "machine," and since any real machine can be made to come apart into its pieces to see how it works, the revolutionary power of the Cartesian paradigm for so many centuries has been its ability to do the same with the universe.

For example, instead of suffering at the perceived whims of supernatural forces to explain illness, people after Descartes could learn how the "machine" we call a body gets sick and fix its "parts." They could take apart the "machine" we call story-telling, look at the "parts" of an event, and produce a more accurate historical understanding. Or they could learn how the "machine" we call manufacturing works and create an assembly line of (literal) parts.

The key is "they could." Any situation that could be reduced to the machine-like sum of its parts fell before the power of this paradigm, and it has consequently dominated our understanding of the world for as long as it has precisely because it has given us a level of dominion over the natural world which humans had only fantasized about during the first 6,000 years of history and beyond. The world we live in today is very much the product of the scholars, scientists, and engineers who followed in Descartes' footsteps.

Including education. You see, from the Cartesian outlook, students are "machines." But if they are "machines," then thinking and learning merely involves the "parts" of this "machine" working together in a certain pattern. Education, therefore, simply becomes the systematic manipulation of a student's "parts" until he or she works like the kind of "machine" we desire.

“Truth”—the way we want the “machine” to work—just becomes a set of propositions that teaching delivers to students (“standards” anyone?), and we will know they have learned the “truth” when they can repeat these propositions back to us correctly (i.e. when they work their “machine” the way we want them to). In other words, according to the Cartesian paradigm, we can script the teaching process in such a way that it will manipulate children in a specific, ordered manner to produce someone who will then behave in a required fashion. In the field of education, we call this “teacher-proofing the curriculum.”

All the recent school reform efforts suddenly make absolute sense. Simply tinker with the children’s “parts” in one “mechanic’s” work area, shift them to another “mechanic” to tinker with a different set of “parts” in a specified fashion, and continue until we have our kids “tuned” exactly the way we want them to be. The assembly-line-like character in most schools in which children move from one class covering one isolated subject to another class covering another usually disparate subject now takes on a whole new meaning, doesn’t it? Tire rotation, radiator flush, and lube job, anyone?

Emergent Properties and Their Implications for Education

The only problem with this approach to education is that it assumes the mind functions as a machine—that we can somehow disassemble the brain into its parts, map them out, and manipulate them accordingly. But modern biologists and neurologists are now confident that everything about how the mind works is an emergent property of the brain,⁹ and what they have found has profound implications for this discussion because emergent properties of any kind (weather, quantum states, water-flow in pipes, etc.) are fundamentally non-deterministic in their character—which means we can never fully understand how they work using a deterministic system such as a Cartesian one.

The simple truth is that “every brain is wired differently,”¹⁰ especially in the difference between learning rates and retrieval rates which the research in this field has revealed.¹¹ While every brain can input new information and retrieve this information (since doing so simply involves neurons sending signals), what emerges out of this signaling between neurons can vary dramatically from one person’s brain to another. Thus, even though every human brain uses the same neural “parts” (which is why drugs such as alcohol work on both you and me), the rates at which each brain inputs new information and retrieves it later is an emergent property that varies in each of us. Some can do both rapidly; some can only do both slowly. Others can do one fast and the other slow. The key is that none of us have learning and retrieval rates that are ever exactly the same—in spite of having brains made out of the same kinds of “parts”—because what emerges out of each brain’s system of neurons is unique.¹²

Thus, a mechanistic understanding of teaching is incomplete because the human brain is not a machine and therefore cannot be analyzed as one. Viewing the mind as a deterministic system can never produce the “ah-ha” moment that *is* genuine learning. At best, such teaching produces training in a set of skills, and the dilemma for our society “is that the skills that are easiest to teach and easiest to test [this way], are also the skills that are easiest to digitize, automate, and outsource.”¹³ Hence, the Cartesian diagnosis of education’s current problems being employed by the various school reform efforts can only lead to a remedy that will never work: it cannot explain what learning really is and thus cannot fix where learning is not happening. As Albert Einstein observed, “we cannot solve our problems with the same thinking we used when we created them.”

The “Ah-ha” Moment Revisited

Fourteen years later. Small urban all-girls school in Baltimore.

Two sections of biology. One section of senior electives (genetics & anatomy), and one section of AP Biology—for which, thank the Heavens, I am fully qualified.

It is 2nd Period on a lovely early May day. Things are going per usual....

A chorus of “Mr. Brock!” erupted across the classroom, and not for the first time, I wondered silently how so many groups could manage to have questions at exactly the same time. I flashed my hand signal at each group to let them know what order I would come around and then walked over to where Chris, MariaLisa, and Dasha were working.

“Yes?”

Since each had a different question about their project, they took turns.

“Mr. Brock, I’m still confused about the positive control,” said Dasha. “Why do we need ‘before samples’ of soil from our plots?”

I signaled to the other two that they should pay attention to this as well and stepped over to the board. I sketched a quick graph.

“Let’s say this first bar on the graph is your negative control and this second one is your independent variable. What would this graph say about your hypothesis?” I asked.

The three of them studied my sketch for a moment.

“It would confirm it,” replied Chris.

I then drew two additional bars on the graph to represent possible data from samples taken from before they applied their variable. I made the height of the bars nearly identical to the first two.

“Now what does this graph say? What does knowing the population of bacteria *before* you apply the fertilizer tell you?”

All three looked puzzled, and then Chris’ eyes widened.

“There were already more bacteria in the fertilizer plots to begin with!” She declared.

“Meaning?” I asked.

“That the fertilizer didn’t do anything to the bacteria.” She answered.

I nodded approval. “And that, Dasha, is why we need a positive control; to see if our experiment even worked in the first place.” I gave them a “next question look.”

Chris just had a clarification about one of their experimental steps, but when I turned to MariaLisa, I could tell she was feeling anxious about whatever was troubling her.

“What’s up?” I asked her.

“Mr. Brock, I still don’t understand your feedback on our background portion of our report. You keep asking how the fertilizer might disrupt the nitrogen cycle, but I don’t get it.”

“Okay,” I replied. “Why don’t you get out a copy of your list of ingredients in the fertilizer you are using and let’s find the diagram of the nitrogen cycle in your textbook.”

I knew this would take her a moment; so I signaled that I would be right back and checked in with a couple of the other groups in the queue before returning.

“Ready?” She nodded. “So what is the key ingredient in the fertilizer that is related to the nitrogen cycle?” I asked.

“Ammonium.” She replied.

“All right. I now want you to find on your diagram where the ammonium is located.”

She studied the picture for a moment and then placed her finger between two of the different bacteria groups involved in the cycle.

I reached down and pointed at one of the groups.

“What does this arrow tell you ammonium is to this group of bacteria?” I asked.

“It’s their waste product.” She said.

“And what about this other group?” I queried, using my finger to highlight the arrow leading from the chemical to the next group of bacteria.

“It would be their food.” She responded.

“So when you pour excess fertilizer into the ground, what do you think happens to each of these groups of bacteria?” I asked her.

She puzzled over it for a moment.

“You’re making the first group live in their own waste and you’re over-feeding the second group?” She responded hesitantly.

I nodded. “So what do you think happens to the first group and what do you think happens to the second group?”

“I would think the first group would suffer, maybe even die, while the second group would use all that extra food to make more bacteria.”

Again, I nodded. “The first group has its population crash and the second group has its population exploded, which means when you take the fertilizer away....?”

“Well, the one group would be dead.” She replied. “But then the second group would no longer have its food from the first group....”

You could see her puzzling it out; so I gave that little extra push.

“So what happens without additional fertilizer the next time....?”

I let my thought hang there, and MariaLisa jerked her head up, with a look of pure amazement.

“Oh my god, Mr. Brock, we’re turning them into ‘junkies’!”

I smiled. The “ah-ha!” moment never grows old for a teacher. Only now I knew how to do it deliberately.

An Ecological Paradigm: A Call to Authentic Engagement

So how do we create the conditions for the “ah-ha” moment?

If learning is an emergent property of a non-deterministic system, then perhaps we need to start by asking ourselves what makes these kinds of systems what they are. We have already seen that they are non-reductionist: that they cannot be broken down into their component parts and retain the properties of the whole system. However, the opposite is equally true: isolating even one component from such systems is effectively meaningless because it is the unique relationships between all of them that give rise to the system in the first place. Furthermore, because individual components are essentially meaningless in isolation from one another, there is an ethical element to these kinds of systems, a structure to their relationships that *must* be maintained to keep the system going. Thus, what characterizes non-deterministic, non-linear systems is a community of relationships functioning together as a distinct unit, where any change in a single connection or ingredient threatens to alter or destroy the identity of the system.¹⁴

However, what I’ve just described is an ecosystem, and I propose that when we recognize this essentially ecological character of the systems that produce learning, we quickly realize the way to avoid the pitfalls of the Cartesian paradigm and find a way to reform our schools

successfully is to stop envisioning schooling as a “machine” to fix and to start envisioning it as an “environment” to restore. To see how this might work, we must first recall that in ecosystems, the health and vitality of a given environment depends on how successfully its inhabitants fill their respective roles—their niches. Trees in a forest, for example, perform their physical and chemical tasks in response to the other living things they encounter, and it is out of their authentic interaction in this web of relationships—their *engagement*—that the various properties of the forest emerge. But if one of these trees or other organisms in the web disappear or if something inauthentic arrives (such as the application of a pesticide or the invasion of a non-native species), then the emergent properties of that forest will change and, hence, so will its health and identity as an ecosystem.

Of course, the implications for education are clear. Like real ones, school “ecosystems” also depend on the authentic engagement of their “inhabitants.” How teachers, students, and everyone else in a school choose to participate—to be *engaged*—in the relationships which make up that educational community determine all its emergent properties just as the interactions of organisms in the natural world generate all the characteristics of a forest or wetland. The quality of the learning, the safety of the classroom, the success of the graduates, the well-being of the larger neighborhood—*everything* emerges from the degree to which all involved are authentically engaged, and where the children and adults are all genuinely “inhabiting” each of their respective “niches,” schools are healthy, productive places where “ah-ha” happens regularly.

Yet one individual has a greater degree of impact on this health and productivity than any other “inhabitant” of an educational community, and that is the teacher. Like a keystone species, he or she occupies the niche that informs *all* the relationships involved in the learning environment, and thus, the authenticity of his or her engagement plays the single most pivotal role in deciding the success and fitness of the instructional “ecosystem.” A teacher’s “identity and integrity”¹⁵ are the very heart of education, and where his or her full engagement with students is lacking or—worse—inauthentic, then the consequent environment is not one where much genuine teaching or learning are going to happen. Hence, while schools need all their “inhabitants” to be authentically engaged to function at their most effective, they need their teachers’ authentic engagement to function effectively at all.

Again, the implications for education are obvious. If we want a system that finally works, we must increase how authentically engaged our teachers are in their classrooms by diagnosing and fixing how well they are inhabiting their “ecological” roles in the first place. But to do that, we must enter “the tangles of teaching”¹⁶ using a paradigm that sees education in environmental rather than mechanistic terms, and that is the purpose of this project.

Specifically, I will focus on what it means to be an authentically engaged teacher (since that is the aspect of an ecological paradigm with which I am most familiar), and what I want to suggest is that authentic engagement in teaching involves three critical things: 1) embracing the role of co-learner in all educational situations; 2) generating appropriately intimate rapport with students; and 3) employing a full understanding of the tension between the brain’s plasticity and its hard-wiring. Using learnings from my own 30 years as an educator, I will be exploring each of these qualities in more detail in Part I of this project, looking at what a teacher with these properties can accomplish in Part II, and examining the challenges of being such a teacher in our society in Part III. I hope in so doing to provide a vision of education that can help replace the inadequate one we currently have, and I hope thereby to contribute to repairing some of the damage it has done. We have an obligation as educators to be the best teachers we can be, and in

what follows, I hope that my words might enable those of us in this profession to meet that challenge better. I believe our children deserve it.

Notes

1. For more about the state of K-12 education in the U.S., see Charles Fadel, *et al*, *Four-Dimensional Education* (Boston: The Center for Curriculum Redesign, 2015) & Ted Dintersmith, *What School Could Be* (Princeton: Princeton University Press, 2018). For more about the state of undergraduate education in the U.S., see Richard Arum and Josipa Roksa, *Academically Adrift: Limited Learning on College Campuses* (Chicago: University of Chicago Press, 2011).
2. Edward O. Wilson, *The Future of Life* (New York: Alfred A. Knopf, 2002).
3. Dintersmith, *What School Could Be*, p. xiii.
4. See, e.g., *Crisis at the Core: Preparing All Students for College and Work* (Iowa City, IA: ACT, Inc., 20005) or *Performance of U.S. 15-Year-Old Students in Science, Reading, and Mathematics Literacy in an International Context: First Look at PISA 2015* (U.S. Department of Education: Institute of Education Sciences, 2015).
5. An archived copy of the report can be found at <https://www2.ed.gov/pubs/NatAtRisk/risk.html>
6. Dintersmith, *What School Could Be*, p. xviii.
7. Parker J. Palmer, *The Courage to Teach: Exploring the Inner Landscape of a Teacher's Life* (San Francisco: Jossey-Bass, 1998), p. 41.
8. Rene Descartes, John Cottingham (Translator), Robert Stoothoff (Translator), Dugald Murdoch (Translator), *The Philosophical Writings of Descartes, Vol. 1* (Cambridge: Cambridge University Press, 1985).
9. John Feinberg, *Altered Egos: How the Brain Creates the Self* (Oxford: Oxford University Press, 2001) & V.S. Ramachandran and Sandra Blakeslee, *Phantoms in the Brain: Probing the Mysteries of the Human Mind* (New York: William Morrow, 1998)
10. John Medina, *Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School* (Seattle: Pear Press, 2014), p. 92.
11. David A. Sousa, *How the Brain Learns, 2nd ed.* (Thousand Oaks, CA: Corwin Press, Inc.), pp. 108-109.
12. The research and literature on this are extensive, but for anyone wanting to get a general overview, an accessible book for the non-biologist is Daniel Levitin's *The Organized Mind* (New York: Dutton, 2014).
13. Andreas Schleicher, quoted in Fadel, *et al*, *Four-Dimensional Education*, p. 1.
14. For more on complex systems, see Stuart Kauffman, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity* (New York: Oxford University Press, 1995).
15. Palmer, *The Courage to Teach*, p. 10
16. Palmer, *The Courage to Teach*, p. 2.