Light a Candle

Lessons from a Life in the Classroom

By

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Table of Contents

Forward

Introduction: Teaching–the Call to Authentic Engagement

Part I: *Tabula Rasa*

Chapter 1: The Co-Learning Moment–Authentic Engagement's Potential

Chapter 2: Appropriate Rapport–Authentic Engagement's Risky Business

Chapter 3: Mastering Reality–The Challenge for Authentic Engagement

Part II: *Cogito, Ergo Sum*

Chapter 4: Not in Kansas Anymore–Authentic Engagement in Action

Chapter 5: Change Happens–Authentic Engagement's Ultimate Purpose

Chapter 6: The Long and Winding Road–Making Authentic Engagement Happen

Part III: "Hier blieb ich..."

Chapter 7: No Greater Love–the Vital Need for Authentic Engagement

Chapter 8: Self-Evident Truths–Authentic Engagement's Dangerous Challenge

Chapter 9: A Voice in the Wilderness–the Difficult Task for Authentic Engagement

Conclusion: Learning—The Impact of Authentic Engagement

Afterword: On Being Human Well

Acknowledgements

Notes & References

Forward

It is better to light a candle against the darkness than to curse it.
–Proverbs

Part memoir, part philosophical reflection, part how-to, *Light a Candle: Lessons from a Life in the Classroom* is the culmination of 15 years work that started during my first sabbatical from the classroom in 2005, and it is my contribution to the current dialogue taking place about how best to reform and improve the education occurring in our schools today. In the Introduction, I make my case for why our current system in this country is broken and outline what key changes I believe will need to happen to make our schools functional again, introducing a concept I am calling "authentic engagement." Next, in Part I, I expand on my proposed changes, exploring in depth the three critical properties that I think make someone a highly effective teacher, followed by Part II, where I examine what highly effective teaching and learning would look like in the classroom if the reforms I am suggesting were, in fact, implemented. Part III is where I present what I consider the three most significant forces in our society working against our schools becoming truly functional, and in the Conclusion, I will be looking at what might motivate us to resist these forces to work on behalf of our children to fix education in this country.

While much of what the current situation confronts us with these days can feel rather dark, my intent with this project is to be aspirational rather than admonitory, and toward that end, I feel the need to take a moment here at the beginning to explain my decision to include brief moments from my own teaching career as illustrations for the ideas and arguments I present. I think it is important for the reader to understand that my goal with these vignettes is not instructional; I do not intend to suggest that these are what someone *should* do to be a good teacher. Every one of us who enter this profession has our own unique voice and must follow our own unique path.

No, I share my own experiences to inspire all of us who teach—including myself—to aspire to become our very best selves as educators. These moments I am using to illustrate a larger idea were often me being my best teacher-self on my best teacher-day, and not the rest of the time when I was bumbling along, struggling as everyone does to live up to my own ideals. Therefore, I ask my readers—should you find yourself comparing and judging yourself—please remember that my own stories are simply aspirational illustrations at best (that I too still strive for as well) and nothing more.

It is my sincere hope to generate feedback and discussion from readers about how we can be addressing the issues I am raising about teaching and learning in today's classrooms, and toward that end, I invite the reader to visit the Light a Candle Blog, where you can leave comments at each of the books main sections. Or I can be contacted directly at stemteacheremeritus.rpcs@gmail.com to share a thought or suggestion.

I hope you find the journey that starts in the Introduction a rewarding one, and I look forward to hearing other's ideas and thoughts.

David L. Brock
Santa Fe, 2006; Baltimore, 2020

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 network[8] 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 heath 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.

Part I: *Tabula Rasa*

"If I became a great teacher, who would ever know?"
"You, your students, and God. Not a bad audience."
–A Man for All Seasons

Who is the authentically engaged teacher? How do such educators understand their work? What do they look like? Why do they act the way they do? These are the sorts of questions we will address in the first part of this book as we examine the teacher's "niche" in the classroom. We will look first at how a teacher's authentic engagement informs his or her sense of identity as a co-learner (Chapter 1). Then we will look at how this engagement informs the structure of the relationships he or she has with students (Chapter 2) and, finally, we will look at how an authentically engaged teacher understands education's purpose (Chapter 3).

Chapter 1: The Co-Learning Moment–Authentic Engagement's Potential

Words exist because of meaning;
once you've gotten the meaning,
you can forget the words.
Where can I find a man who has forgotten words
so I can have a word with him?
–Chuang Tzu

Making the Connections

"…The standard model for the development of cancer is, therefore, a fundamentally genetic one." I concluded. "However, as you ladies know, I'm always trying to provide you with the latest; so I want to show you something I found just the other day in a *Scientific American* article."

I turned to pull the screen down and dim the lights, and there was the usual shuffling in their seats as the projector warmed up.

"Now I want everyone to pay attention to this picture in the bottom right hand corner." I pointed. "These are karyotypes of human chromosomes where they have been able to tag each of the individual chromosomes with a different florescent dye so that it is easy to identify chromosome number 1 from chromosome number 2, etc."

"This," I said, circling the top portion of the diagram. "Is the karyotype of a normal, healthy human cell. You can see that each of the 23 pairs is properly aligned, and you can see how the chromosome 1 pair is yellow in color, chromosome 2, green, 3 light blue…you get the idea."

I scanned the room for nods of understanding and continued.

"*This*, though," I said, circling the bottom half. "Is the karyotype of a cell from a tumor, and as you can tell from the colors, the chromosomes are all broken apart and rearranged. Here we have three chromosome number 7s." I pointed. "Here there is only one number 11, with the bits and pieces of the other number 11 now part of numbers 3, 8, and 21…the chromosomes of this cell are totally abnormal."

Again, I scanned the room for nods and then deliberately paused for dramatic effect.

"And when you do the karyotypes for the other cells in this tumor…every single one is *different*."

There was an audible collective gasp.

"But that means…" blurted Maddie. I nodded for her to continue. "That means that no two cancers are alike—even if they are cancers of the same organ!"

There were a lot of concerned expressions as people processed that information.

"Which means?" I queried.

Devon raised her hand, and again, I nodded.

"That you cannot treat them the same." She answered

"Precisely." I responded. "If this research is accurate, this—we'll call it the 'chromosomal hypothesis'—if this chromosomal hypothesis is correct, then the standard model—the idea that cancer is the result of a specific sequence of mutations and that if we could

just figure out what they are, we could potentially change those genes back—the standard model doesn't work."

"But Mr. Brock," replied Sandy. "That would mean cancer is theoretically uncureable. We could only treat it, not fix it."

"Exactly." I said. "If—we'll call it the 'genetic hypothesis'—if the genetic hypothesis of the standard model is in fact how the majority of cancer operates, we could theoretically one day cure cancer. But if this new chromosomal hypothesis is how most cancer occurs, then we need to be focusing our research on better treatment options, more targeted chemotherapies."

There was now a low buzz of murmur from the entire class.

"And this is not just some academic scientific matter. Not only are lives potentially at stake but billions of dollars of your money."

That brought puzzled frowns on everyone but Devon.

"Why don't you explain it." I said to her.

Everyone turned expectantly, and Devon spoke.

"I learned this from the lab where I worked this summer. Most medical research is funded by the federal government."

"The NIH alone," I said. "Has a budget of over forty billion. And those are your tax dollars people."

Again, I paused for some dramatic effect.

"Right now," I continued. "Nearly all of the money devoted to cancer research is going toward research that employs the standard model. But if the genetic hypothesis is not really correct—if it turns out that this new, recent finding is indeed the way the world actually works—then the money we are currently spending on trying to find a cure for cancer is basically what?"

"Wasted," several of the girls responded.

"And you all will eventually be the ones…" I started to say.

"Paying the bill." Devon finished.

"To Know as We are Known"[1]

It may sound like a ridiculous truism to say that a teacher's greatest challenge in the classroom is teaching, but the reality is that moments of real learning such as Devon's and her classmates' are too often the result of fortuitous happenstance rather than deliberate intention. In the overwhelming deluge of tasks educators must cope with daily–attendance, grading, IEPs, student discipline, faculty meetings, and so forth–it is easy to neglect the teaching act itself and to take refuge in specific instructional techniques, assuming that simply exposing students to the material through an explicit set of maneuvers will itself somehow cause them to absorb it. That is, after all, the essence of a Cartesian understanding of education, and most theoreticians from Plato to Sizer have focused on this so-called "science" of teaching. Courses on pedagogy and behavioral management make up most of the classes in almost every teacher training program, and the cookbook curricula of the textbook industry and on-line learning are simply outgrowths of this fixation on instructional technique. Behavioral psychologists have even suggested that teaching is merely an exercise in habituation that a properly designed machine could perform.[2]

But I want to argue that there is a distinction between teaching and training and that an ecological paradigm's understanding of education can provide us with a better definition of what it means to teach.[3] Ecosystems are at their very foundation about relationships, and in fact, all of modern science has come to recognize that everything from quarks to cells to ecosystems to

galaxies are constantly tugging and pulling at one another in one vast networked web of interacting connections: "community *is* the essential form of reality."[4] But if reality is this enormous community of relationships–including us–then our knowledge of it can only come through our active participation in that community and the relationships we form with its parts. Put simply, "we know reality only by being in community with it ourselves,"[5] and therefore to truly know something—science, math, history, language…anything!—we must enter into a relationship with it; we must treat it as an "Other" that can actually impact and alter who we are.

The essence of the teaching act, then, is a process of creating ways of relating to a subject that fundamentally alters a person's experience of reality. It is establishing those conditions that will enable students to join in and to form real relationships with the subject matter they are studying and thereby change who they are (which, intriguingly, is precisely what the neuroscience shows happens[6]). Yet only as teachers engage in their *own* relationship with a subject *with* their students can teachers use their own modeling of how to encounter the subject as "Other" to aid their students in entering into a similar relationship (i.e. learn). Thus, without the teacher as a co-learner, joining students and subject matter in a community of concurrent dialogue "about things that matter, conducted with passion and discipline,"[7] reality's truths will not disclose themselves and true understanding will not occur. In other words, if the teacher is not showing how a subject alters his or her reality, then the students are not likely to have it alter theirs.

The Not-so Prodigal Son

I was standing at the reception counter in the main office of my old high school when the subject of my query walked up to stand beside me.

"Mr. Krauskopf?" I asked.

"Yes." He replied, turning to look at me.

"Mr. Krauskopf, I don't know if you will remember me. But my name is David Brock, and fifteen years ago, I was in your 10th grade English class."

"David Brock!" He exclaimed, taking a small leap back as if in shock. "Now there's a blast from the past!"

I had to suppress a smile. He had clearly not lost his flair for being slightly over-dramatic.

"What brings you back here?" He asked.

"Actually, I came to see you." I told him. "If you have a minute. I'm a teacher myself now and so I was hoping I might catch you during a planning period. That's what I was asking about." I pointed with my head to indicate the receptionist.

"You're in luck." He replied. "You caught me right before lunch duty. I have about 30 minutes." He indicated the pile he had placed on the counter and said, "I need to take care of this paper work first, but then we can go have a seat in the teacher's lounge."

I nodded in both agreement and understanding and waited while he finished up with what looked like lesson plan logs.

"So you're a teacher now." He remarked as we walked.

"Yes. And that's actually why I am here." I replied. "To say 'thank you' after all these years."

He looked bemused.

"You see," I continued. "I've just been named the Outstanding Biology Teacher of Missouri, and as I realized how much of that I owe to all my own former teachers, I knew it was time to come back and say 'thank you'."

I paused to hold the lounge door open.

"Besides, I now know firsthand how much having one of *my* students coming back to say thanks means." I said.

"Have you been able to see Bob Flavin?" He asked as we sat down.

I nodded. My old math teacher had been thrilled to see me at his classroom door.

"He was just finishing a class when I arrived." I replied. "We had a nice long visit."

We both sat down then and simply started "talking shop." I told him how much his own teaching continued to influence me and how I acted in the classroom. I shared my passion for teaching science and how thrilling it was to watch a kid get excited about biology. We shared some laughs about the differences in view from "the other side of the desk," and it felt like the thirty minutes was up scarcely before it began.

"Let me walk you to your car." He said, and we exchanged some observations about how Dayton had changed over the years as we left the building.

But when we got to my car and I started to unlock it, he placed his hand on my shoulder and spoke.

"David, thank you. Congratulations again on your award and know that I am proud for you. It sounds like you have become quite the biology teacher." He smiled. "But as you move forward in your career, David, always remember: care at least a little more about the kids than you do about the subject."

He then gave my shoulder an affection squeeze, bid me safe-travels, and headed back into the building. Watching him go, I stood rooted to the spot, unable to get into the car as I processed those words. I shook my head in wonder: even after all these years, he was still teaching me how to be a better me.

A Community of Metaphor Makers

Many notable educators speak regularly about the importance of "[working] hard to make the subject matter itself be the intriguing focus that gets the students interested"[8]. Yet one of the ironies in education is that almost none of them have any experience in K-12 teaching or were, at best, "a school teacher for only one year."[9] As a consequence, I think a critical piece of the act of teaching gets overlooked in much of the writing about education, which is that in the K-12 world, our "subject"—the "Other" with which we are in a learning relationship—is ultimately the *child*, not some specific discipline. Our "eternal conversation"[10] is about the total self of the individual student–about what it ultimately means to be authentically human–and what that means for the classroom is that the traditional disciplines or subjects become tools students use to produce the explanations about reality, the "metaphors," which they will live in relationship with to help them become who they are. Math, science, literature, history, languages–they all become "lenses" through which students can examine reality in order to learn the most important "subject" of all: themselves.

At the K-12 level, then, teaching really becomes the act of engaging students in the deliberate creation of the "self" through constructing relationships between students and the meanings they make with a given discipline's tools. Instead of generating a "community of truth"[11] around some subject, teaching is about involving and guiding children in their own

development through different ways of understanding the universe in which they live. Hence, the definition of teaching we need as educators to generate genuine learning in our schools is: *to teach is to immerse students in the communal practice of composing our metaphors for reality.*

Yet even this alternative to how most teachers understand their task will only work if we recognize that the key to immersing children in any of the methods humans have for constructing meaning is the creation of a certain kind of relationship in the classroom. A student's capacity to grasp and to use any subject's explanatory "myths" depends entirely on the quality of their encounter with a teacher's own metaphor making process, and that's where embracing the role of co-learner enters the picture. Teachers must make their own struggle to comprehend the world through mathematics or literature or chemistry, etc. just as real to students, as much a "person" or "Other" to them, as the students' own struggles are. Likewise, these student struggles must become "Others" whom the teacher interacts with because only when children witness their teacher joining with them in constructing a "self"–using the very metaphor-making process the teacher is challenging them to master!–will children take both the risk and the moral responsibility to learn how to do the same.[12] Putting it a little less philosophically, if we want what happens in our classes to be vitally real and transforming for our students, we have to show them that it is vitally real and transforming for us.

Thus, in order for both teaching and learning to happen successfully, what we must do as educators is participate fully in relating our own use of a subject to create a "self" to the similar efforts of our students. We must be authentically engaged in becoming our *own* genuine "selfs" in our classrooms to turn the "teachable moment" into the "learning moment." We must immerse our students *with* us in the communal practice of composing reality's metaphors, and we will need to be so engaged *all the time* if we want to transform our schools into places where learning happens regularly and intentionally.

I just wish that were as easy to do in practice as it is to write down on paper.

The Class from Hell

It was Friday afternoon, the last period of the day, of an already *long* week.

"Bye Mr. Brock!" said one of my students as she exited the door. "Have a good weekend!"

"You, too, Denise." I answered.

A chorus of other "goodbyes" filled the air, and I responded in kind. But as the last of my previous class filtered out of the room, I found my teeth already grinding and my stomach clenching.

God help me, I thought; Hour 7 on a Friday and it has to be THEM.

The passing bell rang, and my 3rd Period class began to trickle in from the hallway, pushing and shoving each other.

"Hey, Mr. Brock!" Seth greeted as he entered the room. "What are we doing in class today?"

Before I could respond, the rest of the class started clamoring.

"Let's watch a movie!!" Carl and Regina both shouted.

"No, let's play a game," said Mary Beth.

"I think you should give us a free, Mr. Brock," declared Rachel.

"Yeah, it's the last period on Friday, Mr. Brock. You can't expect us to work," agreed Megan.

"Movie, movie, movie." Carl and Regina began to chant.

"No, free period, free period, free period," said Rachel and Megan.

"Enough!" I said too loudly as the rest of 3rd Period came into the room. "You all already know what we're doing today; we're reviewing for Monday's test. So please take a seat and be quiet!"

"Aww, Mr. Brock..." came the chorus of groans.

I glared at them, and they settled down and plopped into their seats.

"Get out your textbook," I told them. "And something to write with and then go to your lab station with your partners. We're going to try something new for review today."

There were more groans, and three hands shot up into the air.

"Yes, Megan?" I asked impatiently.

"Can I go get my book from my locker?" She replied.

"Me, too," said the owners of the two other hands.

I sighed and frowned.

"The three of you *know* that you're supposed to come to class prepared."

"But it's last Hour on Friday, Mr. Brock!" whined Megan.

"Just..." I clenched my fingers and fought for patience. "Just get them and get back here quickly."

The three scurried off while the others got out their materials and went to their lab stations, and not for the first time that year, I thought to myself: I can do this; I can do this; I can make it through 3rd Period one more day.

I glanced at the class to quickly take attendance and realized that at least Mark was not here today. Thank you, Jesus! I thought.

"Okay," I announced. "We are going to review for the test a little differently this time. You all remember doing 'map drills' in geography in seventh grade? Well, we're going to do something similar today, only with your textbooks. You'll work together in your lab teams to find the answers to the test questions, and you'll be racing against the other teams to earn extra credit points for each correct answer you find. Each team will have an envelope of questions up here on the front counter, and one at a time...."

"Hey, Mr. Brock!"

Mark sauntered into the room and, as usual, was bereft of any school supplies of any kind.

"You're late." I scowled, stating the obvious.

"It's cool, Mr. Brock. I was just busy with my lady making plans for the weekend." He replied.

"You packin' Mark?" Seth jested from across the room.

"You better believe it, brother." He replied with an enormous grin, patting his backside where he kept his wallet.

"**Mark**...." I growled.

"It's cool, Mr. Brock." He said, raising his hands. "I know how you feel about me hauling out the protection in front of everybody." He looked around unabashedly. "So what are we doing today?"

I shot a quick glance of reproof at Seth, who at least had the intelligence to look mildly contrite, and then pointed my arm at Mark's lab team.

"Reviewing for the test. Join your group, please."

He sauntered across the room to where Mary Beth and Regina were sitting, and I sighed inside. My first encounter with Mark on the very first day of school had involved him dumping the condoms out of his wallet in front of the class to "prove" his tales about his sexual exploits. The necessary response on my part had pretty much set the tone of our relationship ever since. He was utterly and completely disengaged from school, and his attitude and behavior nurtured those feelings in everyone else in that class. 3rd Period was hard enough to engage without Mark present; with him there, it felt like a nightmare.

"All right," I said. "Let's finish going over the rules of the game. Each team must send a member to the front of the room to collect a slip of paper with the review question on it. When I say 'go,' you need to race back to your group where each one of you must copy the correct answer on your review sheet once you've found it in the textbook. You must bring all three sheets with the answers on them back up to me, and the team that makes it first with the correct answer earns an extra-credit point on the test."

I looked around to see if there was any confusion. Then Mark raised his hand.

"Mr. Brock? I don't have a textbook; can I borrow yours?"

I tried to avoid giving him a look of despair.

"No, Mark." I replied, feeling like Sisyphus. "You know the rules about coming to class prepared."

"Here, Mark, use mine" interjected Mary Beth. "I'll write while you look things up."

I decided to overlook this tiny bit of enabling and asked, "Any other questions?" There were none; so I told them to begin.

It was a simple game, and for a few rounds of questions, it went quite well. The students were busy; even Mark was actively engaged. I watched my "success" and sat there rationalizing that at least this way they were finally reading the book in some fashion–since I could never get them to do any homework–and that I would know they had at least *seen* the answers to the test questions at some point in their lives.

But deep down, I felt absolutely and utterly ashamed at what we were doing. Every single one of my other classes was wonderful. I was learning how to design innovative curriculum; my students were engaged and excited about the material; I was growing as a teacher. Yet, for months, I had tried every teaching technique and every classroom management style that had ever been invented in the desperate attempt to get 3rd Period to learn something–*anything*–about biology. I had tried inquiry lessons and had found I couldn't trust them not to abuse the supplies; I had tried traditional lecture and had found out when the paper airplane fight broke out why a class of ADHD students don't do well with lectures. I had tried the "don't smile until Christmas" approach of passing out detentions for the smallest transgression and had found myself spending every afternoon after school in a room filled with the very class I had spent an unsuccessful hour with already that day. I had tried, tried, tried, tried...until I had been reduced today to using the most pathetic excuse for pedagogy I could think of–settling for what amounted to a trivial pursuit game.

That sense of shame made me almost want to break down and cry right there in front of them. But as Mark and Megan raced toward me with their team's papers, I suddenly saw more immediate trouble. Mark deliberately bumped into one of the desks in the aisle he was running down, pushing it just enough into Megan's path to break her stride, and she reached my desk a fraction behind Mark.

"No fair! You cheated!" She shouted. "Mr. Brock!!"

"Hey, it's not my fault you can't dodge a desk." Mark replied, panting. Then he very deliberately looked Megan up and down and added, "Maybe if you didn't stuff your face all the time you could do it."

Oh shit! I thought and was already launching myself across the desk between the two of them as she pulled back her arm and curled her fingers to claw him.

"MEGAN, NO!!" I yelled, stepping in between them.

"Get him, Megan!" shouted Rachel.

"Yeah, give the little midget what he deserves!" declared Maria.

"Watch it M.B. or I'll show you just how 'little' I am," warned Mark.

He turned his attention back to the struggle and said, "It's cool Mr. Brock. Let her go; I can take her."

The rest of the class then chimed in pretty much along gender lines, and for a second, I thought I was going to have a riot on my hands.

"***ENOUGH!!!***" I bellowed.

For once, instant silence. I don't know what the expression on my face was, but from the ones on theirs, I could tell they understood what awaited any of them who so much as sneezed at that moment.

I turned to my two immediate delinquents.

"Mark, be quiet and sit down now." I said sternly. "You are in enough trouble as it is. You, too, Megan." I pointed in opposite directions.

They both did as they were told, and I glared at them both.

"Congratulations, Mark." I told him. "You've just earned detention this afternoon, and unless you'd like to serve it with Sister Mary Ellen rather than me, you have less than thirty seconds to apologize to Megan."

He went slightly pale and stammered out an immediate apology. Sister Mary Ellen was the assistant principal in charge of discipline and the one person in the world Mark truly feared. The classic stereotype of the fierce, ruler-smacking nun, she frankly even frightened me a little, and she was the only lever I truly had over any of them; so I tried to use the threat of her sparingly.

"The review game is over." I said. "And there will be no more opportunity for extra credit points today. I will put the remaining questions up on the board for you to copy down and do as homework to prepare for the test."

There were looks of anger shot at both Mark and Megan as the class went back to their assigned seats. But while they all muttered about it, no more tempers flared. I risked turning my back on them long enough to do as I'd said, and for once, they all copied everything down in silence. When the bell finally rang, they all filed out much more subdued than normal, and I allowed myself to exhale.

"I'm going to the bathroom real quick before detention, Mr. Brock," said Mark, heading out the door.

I shook my head. Doesn't even bother to ask permission, I thought. I also knew from experience that he was lying and wouldn't be back–which ironically would earn him the very trip to Sister Mary Ellen's office I had been trying to avoid for him. But skipping detention was a violation of a major school rule, and I couldn't ignore it.

Oh well, I thought, walking over to close the door, that's one hundred and twenty-three days that I've failed him and the rest of these kids; only 65 more to go.

I put my head down on my desk to cry.

The Power to Transform

"3rd Period" taught me many things that second year of teaching–not least of which was an abiding sense of humility about my own abilities as a teacher! But the most invaluable lesson of all was the discovery of just how powerfully complex it really is to stay authentically engaged in the classroom and ultimately why it is worth the struggle to do so. In my daily battle to find ways to produce any meaningful learning with those kids, I kept forgetting that they were not the only ones involved in the long, slow, continuing process that is the journey toward selfhood. Just as I was trying to challenge them to do, I also needed to remember to recognize my own self-emergence as a teacher—that I, too, was a "work in progress"—and to participate in that emergence with more deliberate self-awareness. Part of embracing the role of co-learner is one's own fumblings in the endeavor to become an effective teacher, and "mistakes are essential to progress, yours or the children's."[13] That was what "3rd Period" had to teach me: that only when we are deliberately *fully* human in the classroom–failings and all–can we participate in our students lives in ways that actually change them. In other words, teachers who are authentically engaged are teachers who live out their humanity with their pupils instead of trying to deny it.

But what does that look like in actual practice?

To offer a preliminary answer to that question, I must share an important coda to my year with "3rd Period." I have always had my students fill out an evaluation of my performance as their teacher at the end of every school year, and while I cannot lie and say I was not tempted, there was no exception made for "3rd Period." I can even still visualize the raw glee with which they attacked it, and the ribald nature of most of their remarks were pretty much exactly what I expected when I read them later that August. All except one. Unlike the others in the class, he had sat quietly and written steadily that last day, and when I saw that he had put his name on the paper, I quickly put it on the bottom of the pile, leaving what I dreaded reading most for last. But when I finally read Mark's evaluation, this is what he said:

Dear Mr. Brock,

I know we haven't always gotten along too good this year, but I want you to know that you are the best teacher I have ever had and the only teacher I ever respected. You told us first day that you would always respect us and you expected us to do the same, and you always did. Even all the times I misbehaved, you never looked down on me or put me down like a lot of teachers do when I'm bad. You always respected me even when I didn't deserve it. I hope I get to have you as a teacher again when I'm a senior because you'll see Mr. Brock next time I'm going to EARN it and be the kind of person who deserves your respect.

Sincerely,
Mark

It has been nearly three decades since I read that evaluation, and the shock feels as real now as it did then: in the class from hell, I had somehow reached out and positively impacted the devil. It was a moment of supreme enlightenment for me because I suddenly understood the wisdom of Donald Graves that "you don't go in part way; you go in all the way....Immersion. Do it with your students. Invite them in to do something that you're already doing yourself."[14]

Real teaching, I discovered, isn't just about getting students to see how their learning challenges them to transform their lives; it is about also getting them to see how your own work in the classroom is transforming *your* life. To use my ecological metaphor, just as all the organisms in a healthy ecosystem mutually impact one another in ripples of interaction, so too only as our own work in the classroom qualitatively changes us can or does it change our students. Mark had changed in his understanding of himself because I had joined with him in the classroom in trying to change my understanding of myself, and *that's* why it is so critical to be authentically engaged as co-learners in schools: only by engaging our students with our full humanity do we have the power to transform–to cause learning—about anything!

Hence, "we [must] teach with our hearts as well as our heads because we do not know what part of our lesson will have a lasting impact on any one student's life"[15] or on our own. I moved on from the parochial school where I taught Mark, and I never saw him again. Nor did I ever again see Nathan or any of the other children I taught my first couple of years in the classroom. But while I do not know if my early stumblings as their teacher had the meaningful impact on them I might hope, I do know that what they had to teach me has lasted a lifetime: that it is the risk-taking on the teacher's part–totally being myself—that is the invitation to learning in its own right.[16]

Chapter 2: Appropriate Rapport—Authentic Engagement's Risky Business

Those who'll play with cats must expect to be scratched.
–Don Quixote

Teaching is a life-long moral quest. You never have it exactly right.
–Nel Noddings

Open Mouth, Insert Foot

My third school in as many years and once again, I found myself confronting a room full of people wondering "who the heck is this guy?"

To make matters worse, I was a last-minute replacement for a highly beloved and effective teacher who had left in the middle of the summer for a more alluring position at one of the area private schools. So I was getting a lot of angry scowls and suspicious glares in addition to the usual expressions of curiosity. These were "her" AP biology students who had signed up simply because "she" taught it, and there was a distinct air of sedition in the room: "where's Mrs. Sparrow and who the hell does this guy think he is standing there instead?"

It didn't help that I had these people for the next two hours–and would every day! Nor did it help that I had never taught the course before in my life and had no experience of any kind in urban schools. The whole situation was as foreign to my experience as snow is to the Sahara, and I suspected that I now knew how the wildebeest feels when it sees hyenas on the horizon.

The irony was that this made the second year in a row that I had had to fill the shoes of someone who had been an "institution" at her institution; so you would think by now I'd be used to walking into the proverbial lions' den. But since I had just quit the Archdiocesan school under exactly the same circumstances that my current predecessor had left here, I was feeling a little guilty and wondering whether this particular "den" wasn't my karmic payback. But with my student loan situation, I could not turn down the additional $11,000 in salary of a public school.

Looking out at all the resentment in the room, all I could think was "Scheiße!"

"Good afternoon everyone." I finally said. "My name is Mr. Brock, and while I know I'm not who you expected to see, I will be your AP biology teacher this year."

There was a general rustling and some murmuring as they stirred at the finality of my announcement. But everyone stayed seated, and I thought, "well, no rioting yet."

I picked up the attendance sheet and made a decision.

"Because I am new to all of you and you are new to all of me," I began, "I would like to ask you to please stand up when I call your name, rather than simply raising you hand. It will allow me to remember who you are sooner."

Several of them deliberately slumped lower in their seats in preparation for rebellion.

"In return," I continued. "You are free to ask me any question about myself–*any* question–and I will promise to answer it, no matter what you would like to know about me."

There was again a general rustling, and a more experienced teacher would have sensed that I'd just made things worse, not better with that announcement. But I had successfully used this question-answer process to start building positive working relationships with every other class during my first two years of teaching, and it simply didn't occur to me that the culture of Southern civility or the religious character of a parochial school might have inhibited what my previous students had felt comfortable asking. In this environment, though, I had just effectively

given a room full of angry teens carte blanche to vent their resentment any way they wanted, and I was about to pay for my hubris.

"Oh, please also know," I said, finishing my instructions. "That I assure you that I did not wake up this morning asking myself how I could mispronounce your name; so if I do, I apologize in advance. Please simply tell me how to say it correctly–or if you prefer I call you something else, tell me that, and I will gladly do so from here on out."

I paused and then started to take roll.

"Aaron?"

"Here." A gangly boy with brown hair said, raising his hand.

I frowned a little at him and gave the universal gesture for "stand up."

He remained rooted for a defiant moment and then shrugged his shoulders.

"Fine." He muttered as he stood up.

"Thank you, Aaron." I said. I studied him intently for a few seconds and silently mouthed his name to myself. Then I nodded at him. "So, what would you like to ask?"

He gave me a look that said "okay, sure, I'll play your silly game" and said "where did you go to school?"

"I went to Washington University here in St. Louis." I answered.

He sat down, disinterested, and I looked at the next name.

"Andrea?"

"It's An-dray-uh," replied a young African-American woman sullenly. "But I go by 'Andi'."

"Thank you, Andi." I made a note on my sheet. "What's your question?"

"I don't know...." She responded with mild exasperation. "Um...do you have a pet?"

"Yes." I replied. "I have two dogs, Pepper and Bailey."

She sat down in a disinterested huff as well, and it went on like that for quite a few more students before I came to the name of a particularly angry looking young woman at the back of the room. I would discover later that she had been especially close to Mrs. Sparrow and felt extremely betrayed by her decision to leave. But at the moment, I was the only adult target available, and I was about to pull the pin on a grenade.

"Michelle?" I asked, looking around for her.

"Here." She answered, standing dramatically, hands on hips. "And my question is this: how old were you when you lost your virginity?"

There were a few brief snickers, but they disappeared rapidly in the ensuing absolute silence. Thirty pairs of eyes studied me closely, and I knew the tenor of this class for the entire rest of the year depended on what I chose to do in the next thirty seconds.

Michelle sneered. "Well? You did say *any* question." She challenged.

Yes, I thought; yes, I did, and I plunged into the abyss.

The Razor's Edge

In spite of the fact that our society looks upon teachers as its "professional adults," the people who "model for our children the values and norms that we ordinary adults rarely enact consistently in our own lives,"[1] everyone who has ever taught has participated in the kind of toxic encounter I had with Michelle all those years ago. Even now, whenever I recall it–or any of the humiliating others like it–I find myself wanting to apologize to every student I ever taught for my pathetic inadequacy as a human being, let alone as an educator. To this day, I still don't

know which was worse: that I sanctioned totally inexcusable behavior by responding, that I answered such an inappropriate question at all, or that I lied while doing so–something I suspect the students knew even then.

Yet as lamentable as my encounter with Michelle was, I share it because it is a marvelous example of the challenge that can come from living out our full humanity with our students. The authentically engaged teacher must walk a very narrow ridge to generate appropriately intimate rapport with his or her students, and whenever he or she stumbles off to one side or the other–even a little–his or her effectiveness as an educator falters. On the side of familiarity, it can be as innocuous a few steps as acting "cool" so the students will like you, or it can be as extreme a tumble as devouring children through sexual predation. On the side of aloofness, it can again be an inoffensive couple of paces such as failing to put a gold star on a child's paper to say "good job!" or it can be the severe crash of a teacher I once knew who did nothing but sit at his desk reading his newspaper in every class while his students silently completed vocabulary worksheets. Either way, even a little loss of the "ecological" balance in the relationship between teacher and student sabotages the learning environment and invites the kind of "toxic waste" I created in my AP class that first day and which I spent the rest of the year (ultimately successfully) cleaning up.

What good teaching demands, then, is that we walk a razor thin line between constructing the connections with our students we need to engage them in meaningful dialogue and erecting the necessary barriers to force them to take responsibility for their share of that dialogue. We must seek an almost yin/yang balance–what the Buddhists would term "the middle way"–between appropriate intimacy and authoritarian indifference if we really want to engage students effectively in our classrooms. Furthermore, only if we employ this notion of the "authoritative centrist" who can and does "emphasize both caring *and* responsibility"[2] can we maintain the equilibrium we seek and achieve the necessary balance of "nurture, structure, and latitude"[3] that are the heart of good teaching and learning. Only then can we correctly handle the inherent challenges that come with being fully human with our students.

For example, if we now look back on what happened between me and Michelle, we can see that in my efforts to nurture the trust in me those students needed to cope with their woundedness, I provided too much latitude in my openness to potential rapport between us. When Michelle then took advantage of that, I failed to provide the necessary structure to disengage and re-establish appropriate boundaries and to make her responsible for a poor choice. What needed to happen was that as I opened up the opportunity for my students to begin to know me, I needed in my language and tone to set the parameters for what sorts of questions were acceptable, and when they pushed back to test the limits of that freedom, I needed to gently but firmly demand that my students meet my expectations about the character of the conversation. In the case of Michelle, that could have been as simple as asking her whether *she* thought that the information she sought was something a teacher should share with a student–particularly a male teacher with a female student. But regardless of how I did it, I should have redefined the acceptable latitude in that situation by reasserting the necessary structure needed to nurture successfully the new positive relationships I was trying to establish in the first place.

Of course, what I have just described is probably one of the single most incredibly challenging and difficult courses of action to accomplish that humans attempt. In fact, what took sixteen years in the classroom for me to analyze properly and over an hour for me to write about accurately is a balancing act every teacher must do in fractions of seconds almost every moment for several hours a day for 180+ days a year. Only emergency room physicians, I have heard it

said, make more judgment calls in a work day than the average teacher does. Thus, to do it well, with conscious deliberation and self-awareness, borders on the insurmountable. It is why I believe even mediocre teachers who make a career of it deserve beatification and the good ones deserve permanent installation in the pantheon.

Short of armed combat, policing, and fire-fighting, I do not think there is anything as demanding, exhausting, and potentially risky as good teaching. In our imperfect humanity, we will regularly fall off to one side or the other the razors edge we must walk in this profession. But what distinguishes good teaching is the commitment to risk cutting one's self time and again for the sake of genuine learning in the classroom. As Sara Lawrence-Lightfoot reminds us, "the terrain [in teaching] is difficult because the signposts are not always clear and because productive encounters require the balancing and embracing of stark conditions."[4]

What characterizes the authentically engaged teacher is how successfully he or she navigates these conditions.

"You're a Racist, Mr. Brock"

Another year, another AP biology class, and still things weren't going quite like I wanted.

"Mr. Brock! You're going too fast again!" Latisha complained.

There was a general murmur of assent and a lot of head bobbing. I looked out at them from where I stood at the chalkboard and shook my head.

"Look, people, we've talked about this before." I replied wearily. "We have a ton of material to cover and only a year to do it in. Besides if you're going to survive science courses in college someday, you've got to get used to the pace of college level lecturing."

They didn't quite groan, but there was a collective exhale of disgust.

"Couldn't you slow down just a little?" begged Evan.

Again, I shook my head.

"I'm already practically a snail compared to what you're going to face next year." I told him.

He and the others simply frowned at me in disbelief, and not for the first time, I wondered if I was ever going to get any better at this job.

"Okay, let's get back to the mitochondria." I said, continuing my lecture on cellular respiration. "As I was saying, the NADH products from the Krebs Cycle and earlier stages such as glycolysis enter into the ETC...."

I had turned to sketch my next diagram on the board, and you'd have thought a party had broken out behind my back.

"Did he tell us what 'ETC' stands for?"

"Yeah, it's short for 'electron transport chain'."

"Can I look at your drawing, Audrey?"

"What are you doing this weekend?"

"My dad's got tickets to a Blue's game."

"NADH? What the heck is NADH? Mr. Brock, you haven't...."

If murmuring can be characterized as cacophonous, this fit the description. I stopped talking entirely and simply stood there, watching them. One by one, the voices began to go silent as they noticed me staring.

"I've told you before; I'm not going to try and compete with you." I said stonily, letting the silence hang in the air for a few additional seconds before continuing. "You all don't have to

be in this class. It's an elective. If you can't control yourself enough to cope with a few minutes of lecture, there's the door." I nodded my head.

By this point, all of them were trying to look anywhere other than at me.

"Ready?" I asked after deliberately counting out a full thirty seconds to myself.

There was a general mumble of agreement, and I started up my lecture again.

"Okay, the bond between the hydrogen and NAD plus breaks, releasing the electron from it to one of the cytochromes in the carrier chain...."

This time the murmur was only a mild buzz, and I sighed inside in frustration because I knew that if I tried the silent treatment *every* time they muttered or made sounds, I'd never actually get anything covered. So I did the mental equivalent of clinch my teeth and went on.

"As the electron is passed from cytochrome to cytochrome, its loses some of its potential energy each time...."

"I think we should go see Malcolm X this weekend." I heard Latisha say too loudly, and something in me snapped. I turned around and walked over to where she was sitting and glared.

"Latisha," I announced in my darkest tone. "If you interrupt class again, you will be asked to leave."

She shrunk back into her seat.

"Am I clear?" I demanded.

"Yes, Mr. Brock." She whispered.

The room was a silent as you can imagine by then, and as I walked back up to the chalkboard, I hoped that maybe I had actually bought myself some genuine attention for a while. But within minutes, the murmuring in the background returned, and this time, it was Jane Anderson who made the mistake of being loud enough to single out.

"Jane, will you please be quiet and stop talking!" I growled at her.

I felt defeated. Could I do nothing to get these kids to shut up at the appropriate times?

A hand shot into the air. Alleluia, I thought, my good one; my bright one; the student who will ask a meaningful question about this material and hopefully get everyone's interest back on track.

"Yes, Audrey?" I asked.

"Why did you tell Latisha that she would have to leave if she was caught talking again but all you just did was simply tell Jane to be quiet?"

Oh SHIT!!

I closed my eyes and stood there in my own stunned and naked silence. It didn't matter that what I had done had been an unintentional response to my feelings of defeat, that I had singled out Latisha while I was still hopeful I might modify their behavior and had simply given up moments later with Jane. It didn't matter that my teacher mind had been preoccupied with how to transition from lecturing to encouraging questions. I had just screwed my publicly professed personal values–accidentally or otherwise didn't matter–and Audrey had had the integrity to call me on it.

I took a deep breath and slowly opened my eyes to face them all.

"I did so, Audrey," I answered, "because I was not paying the attention I should have been to what I was doing. Thank you for pointing out that error."

"Latisha." I said, turning toward her. "I apologize for singling you out earlier. Everyone today has been talking when they shouldn't be, and any rebuke I made should have been shared equally with all of your classmates."

"Jane." I pivoted. "If you–or anyone else in this class–chooses to speak out when you shouldn't, you will not be welcome to remain."

"Is *everyone* clear on that?" I asked determinedly.

They all nodded, and I turned once more to Audrey.

"Again, thank you." I said.

She responded with a terse, single nod, and for the rest of class that day, she and the others acted like nothing had happened.

Later, though, when class was over, the one student I expected might stay behind walked up to my desk, smiling, shaking his head, and studying me with bemusement.

"I told you that first day, Mr. Brock," said Lamar Johnson, chuckling, " 'you're a racist'."

"Yes, Lamar." I replied, my own expression downcast. "And I still stand by what I replied to you then–'Of course, I'm a racist. You cannot be raised in a racist society like ours and *not* be one!' "

"*'But the goal in life,'* you said," he continued, quoting, "*'is to be a* ***conscious*** *racist and to fight it with every fiber of your being. To always pay attention to everything you do and say and to how you see people and to deliberately stop yourself whenever you're about to judge or treat them for the wrong reasons.'* "

His young face stared down at me sympathetically.

"Guess you missed one, today, huh?" He declared.

I barely nodded my head, still feeling ashamed.

"Yes," I replied. "Yes, I did. Thankfully, Audrey was here to call me on it."

Lamar nodded in agreement and then scooped up his books.

"Don't beat up on yourself, too hard, Mr. Brock." He said, heading for the door. "Nobody's perfect, and we all know you care enough to at least try. Which is a lot more than can be said for some of the teachers in this school."

He started to push the door open and then turned around for a parting remark.

"Just remember, Mr. Brock, that Audrey only said anything at all because she trusts you might really listen."

My student gave me a long knowing look and departed, and I sat at my desk, thinking, for a very, very long time.

The Moral Quest

Among the most significant challenges authentically engaged teachers ever face when generating appropriately intimate rapport is not the failure to learn to balance the ways we share our full humanity; it is the complacency that we already know how to do it *well enough*. In the everyday struggles of the classroom, it can be extremely tempting to compromise just how much latitude we allow our behavioral pendulum to swing when balancing between connectedness and aloofness, and each time the amplitude increases–even a little–it becomes more and more easy to turn what should be a razor's delicate edge into a concrete walkway. Even the best-intentioned teachers can fall prey to this trap, and when they do, the consequences can be both ugly and disillusioning–as happened with me and Latisha.

They can also be educational. The research on implicit association and hidden bias is extensive,[5] and I am hardly the first teacher to struggle with prejudice (nor, most certainly, will I be the last). But as I sat there that afternoon long ago, I realized there was a larger learning to extract from my own instance of complacency. Like others before me, I suddenly saw that I

must "try not to have the arrogance to think I [can ever fully] understand what other people know, what they understand, [and] what meanings they're making"[6] with their lives because when I do so, I stop respecting the innate "Otherness" that is so critical to the teaching and learning process. I realized that afternoon that the real danger of getting complacent about how well I or anyone else balances our presence in the classroom isn't just about forgetting or failing to fight potential prejudice, racism, bigotry, low expectations, or any of the other host of social evils and hidden biases a teacher can bring to the classroom. It's about neglecting to embrace the full, unique richness that is an "Other" person–about not recognizing that the complexity of our students' identities equals our own and must be engaged accordingly.

Nel Noddings is right, then, to remind us that "teaching is a life-long moral quest."[7] The ideal balance between disengaged intimacy and intimate disengagement is precisely that, an ideal, and while it lies at the heart of all human interactions–even a handshake juxtaposes the trust of touch with the respect of firmness–the aspiration to attain this balance is particularly significant for education. As teachers, we must intentionally and reflectively strive every day to walk as narrow a path as possible between connectedness with our students and separation from them because only when we do so are we reaching beyond our own incompleteness in the very way that equips children to reach beyond theirs[8]–the defining essence of learning. Hence, we must never believe that we have *fully* learned how to maintain our "ecological" balance in the classroom environment because if we *did* believe we have learned how to maintain it "well enough," we would stop the very striving process toward constructing "selfs" that *is* education. It is the fact that we really will "never have it exactly right" that makes teaching and learning possible in the first place, and *that* is why we must always "keep trying to get better at it."[9] Anything less just isn't education!

But if that's true–and teaching in its essence is a struggle for an unobtainable ideal–then why choose an actual career in it? There are many occupations that have quite obtainable goals, that still involve the moral quest to become as good a person a you can, and that are as equally stimulating as teaching is. If being authentically engaged in the classroom is as difficult a task as I've been describing, why would anyone in their right mind actually join this profession? To have experiences such as those I had with Mark, Michelle, and Audrey? To spend thirty years being underpaid, blamed for society's ills, and swamped in paperwork? My inner skeptic appears here to smile maliciously and argues that perhaps there is a reason why nearly a third of those who enter teaching leave after only three years in the classroom, why five years on the job makes you a "veteran," and why over 50% of us never make it past the tenth year.[10] Who, he challenges, would want to *care* that much for a living?

"Deadbeats and Losers"

"All right, people! Pass 'em in!" I hollered.

There was a general sound of shuffling as the kids passed their essays toward the front of the room, and I walked to the head of each row of desks and began to collect the assignment.

"Mr. Brock?" One of the students called.

"Yes, Jamilla?" I replied.

"I didn't get completely finished." She complained. "I only got one paragraph written from my outline."

"Just turn in what you have." I told her, extending my hand. "These are only rough drafts after all."

That seemed to satisfy her, and she handed me her paper with a nod.

"Okay, folks, grab a seat."

I glanced at the clock as I turned and scanned the room, preparing to make some last-minute announcements.

"Chris." I scowled. "Laurie's lap is not your seat."

He grinned, totally unselfconscious, and slid over into his own chair.

I looked up to take in the class as a whole to see if anyone else was doing what they shouldn't….

BRRNGG!!

The bell cut me off, and en masse, all my students jumped up to leave.

Damn! I said to myself, I've *got* to work on controlling that better.

I shouted at receding backs about finishing their reading and studying for the quiz, but I knew it was pointless. Oh well, I thought, I'm still learning, too.

I ambled over to my desk as they left and plopped down into my seat, letting out a huge sigh of exhaustion. My planning period at last!

"David?" I heard.

"Hey, Ellen!" I grinned, motioning for her to come on inside. "What's up?"

"Have you got a second to talk?" She asked.

"For you, always." I responded.

As my best friend at school, Ellen and I often shared the joys and agonies of being first-year teachers. But today, I hadn't expected to see her because of something she'd said at lunch about her grading backlog.

"What's the matter?" I asked, noticing her frown.

"Oh, I'm upset with Mrs. Stillmann again." She answered. "I swear all that woman can ever do is criticize."

Uh, oh, I thought.

"What happened?" I asked.

"Some of us were talking a minute ago, and I was trying to ask Mrs. Hilliard for advice on something one of my students had come to talk with me about, when Mrs. Stillmann came up to us in the hallway and went off on her usual tirade about how I shouldn't feel sorry for any of these kids and that they're all deadbeats and losers and that they get what they deserve."

I frowned. Sounded like Clarice to me!

"I just get so angry around her, David," Ellen snarled.

"Yeah," I replied knowingly. "What's sad is that she's not alone."

A look of dismay came over Ellen's face, and she bobbed her head vigorously.

"I know." She said, intensely. "Sometimes it seems like all the teachers here do is nothing but put the students down all the time. The kids are either 'lazy' or 'stupid' or 'apathetic' or.... It goes on and on. It's as if no one has anything good to say about any of them."

She looked downcast.

"You have to admit," I responded, trying to play "Devil's Advocate." "It has to be hard to have taught for as long as most of these people have. After all, people like Mrs. Stillmann have watched thirty and sometimes forty years of teenagers come through their classrooms. A lot has happened to our society in that time. Kids today are not like kids in 1962."

"But that's all the more reason to see them with compassion instead of with bitterness." Ellen contested. "Take what I was sharing with Mrs. Hilliard. One of my students, Kristie, came

to talk to me because her boyfriend has told her that he wants to sleep with her and that if she won't he'll dump her."

"Ouch." I replied.

"Precisely." She agreed. "Kristie is scared and upset because she's afraid that if she says no, she won't be lovable anymore and that if she says yes, she'll lose her own self-respect because premarital sex goes against her religious beliefs. She is worrying about what kind of person she is going to become, and Mrs. Stillmann's response is 'what can you expect with all the sluts we have in this school.' "

"She actually said that?!" I replied, unable to hide my astonishment.

"Yes!" insisted Ellen.

There was an awkward silence as I absorbed the news.

"David, do you ever wonder whether what we're teaching is important or not?" She asked abruptly.

I thought about it and answered truthfully.

"Yes." I said.

She looked at me intensely.

"Whether all the facts and dates and theories we have our students learn make any real difference in their lives?" She added.

"Yes," I answered. "I look at the lessons I plan in history and chemistry each day and question all the time whether any of it really matters or not."

"But shouldn't it?" She demanded. "I watch what we do here in this place, and I see the needs of these children, and I can't help but ask myself if the two truly having anything to do with one another."

She looked into the distance.

"The other day, I was working with Mrs. Hilliard after school." She continued. "And we were planning our unit on the post-Civil War era. She was getting all excited and running around the room collecting references about the immigrant movements of the 1880s and the Nativists. And of course, I was jotting down all the information she said I should be including in my lessons. But as I did so, I found myself growing increasingly frustrated. The longer we worked together, the more it took for me not to break down and start a fight with her."

"Why?" I asked, puzzled.

"Because right before we were supposed to meet that day, a student came up to me to talk about a problem she has with her mother." Ellen replied. "Her mom emotionally abuses her - calls her a whore, tells her she's worthless - and this girl desperately wants help. But when I asked, Mrs. Hilliard said that since it wasn't physical or sexual abuse, there was nothing we could legally do about it, and she simply started our meeting!"

Ellen clenched her hands and shook her head.

"How could she do that?" She implored. "Someone needed help, David, and she was more interested in getting the lesson plans together! These kids are walking around with wounded souls, and all any of the teachers seem to care about is whether they know when the Panama Canal was built or who was the twentieth president of the United States."

She scowled and glared at the same time.

"Something is not right about that." She asserted.

"Look, Ellen," I sighed. "I wake up every morning with the exact same difficulties you do. I look at the 'officially approved' lesson plan; I walk into the classroom where the naked

woundedness of my students' lives confronts me; and I go home cursing because I cannot heal them with the knowledge of how to balance a chemical equation."

"So why do it, then?" She demanded.

"Because if you *weren't* here the other day," I told her. "Where would that student of yours have gone? What meaning would she have found then?"

Where Deep Gladness Meets Deep Need

"Why teach?" is not an insignificant question. Indeed, it is probably the single most important question any educator must answer for themselves, and it probably has as many answers as there are individuals in the profession. But what makes this question so significant to the current discussion is that it exposes the single greatest challenge an authentically engaged teacher must confront: despair. If being a highly effective teacher requires generating appropriately intimate rapport, then good teaching demands everything a person can offer, and unless you find a motive for doing it that comes from the deepest, innermost reaches of your soul–"where your deep gladness and the world's deep hunger meet"[11]–then you will not only fail to inhabit your niche in the classroom; you will become like an invasive species–a destroyer of worlds. For despair leads to complacency, complacency leads to imbalance, and imbalance leads to collapse (if I may be forgiven for paraphrasing Yoda), and when we have fallen off from despair into either excessive intimacy or outright disengagement, we can do only one thing: harm.

What "deep gladness," though, could possibly be powerful enough to meet the demands and difficulties of teaching? Again, it is perhaps the single hardest question anyone in education must address, and its answers can range from a burning desire to sustain a truly democratic society and achieve social justice to the need to "[face] the lingering pain of [our] own old wounds, many of them inflicted at school."[12] As for myself:

*I teach because I ultimately want a better world than one we have. I teach because I want our children to become human beings who are **worthy**, not just worthwhile. I teach because if I can equip others to grasp the difference between "knowing something" and "making meaning out if it," then I have hope that we may **all** someday rise above our compromises and recreate ourselves in the noble image the Divine intended. I teach because fundamentally I love. I love my students, and the only gift I have to offer to them is my fragile efforts to draw out from within their minds the faculty and wisdom to conceive the very meanings and visions that will surpass my own.*[13]

That is my "deep gladness," and it has kept me striving toward authentic engagement in the classroom and confronting the challenges of being a co-learner and creating the necessary rapport with my students for the past 30 years. Each day, I have fought off the despair because I know that if I do not, the world *won't* become a better place, and each day, I know there are hundreds of thousands of teachers everywhere in the world fighting off their despair with whatever "deep gladness" they have found for the world's endless "hunger." It is never an easy fight for any of us who live in the classroom; nothing about teaching ever is. But as the character of Jimmy Dugan says in the film, *A League of Their Own*: "It's supposed to be hard. If it wasn't hard, everyone would do it. The *hard* is what makes it great."[14]

Chapter 3: Mastering Reality–The Challenge for Authentic Engagement

The Eye altering alters all.
–William Blake

The mind is its own place and in itself
Can make a heaven of hell, a hell of heaven.
–Milton

What's Wrong with this Picture?

I cut the lights and pointed at the screen with a nerf ball.

"So today, ladies, we're going to start class by watching a short film." I said.

I turned to gently toss the ball at Casey.

"Now in this video, you are going to see two groups of people. People in white shirts tossing a basketball back and forth, and people in black shirts tossing a basketball back and forth."

I motioned to Casey to toss the ball back.

"Your task," I continued. "Is to count how many times the people in the white shirts pass their basketball."

I rapidly threw the ball behind my back at a startled Keating, who didn't quite catch it.

"And the challenge," I told them. "Is that the people are moving all around and throwing the ball over other people, bouncing it off the floor, with nobody ever standing still. And what counts as one pass is this." I motioned to Keating to toss it back. "That's one." I said and bounced the ball to Katherine. "That's two. Is everyone clear on what you are trying to do as you watch this film?"

I paused to confirm that heads were nodding in understanding and then started to walk over to my computer to press play.

"Oh," I said. "And for those of you who have done this before, please keep quiet while we're watching so you don't spoil it for those who haven't." I pressed play and the video did its thing. Then, as I had for years now, I slowly and deliberately walked around the room, pointing at each individual girl and asking "How many?"

"Fourteen…Fifteen…Seventeen…" came the responses, and when I got to the last girl and she said "Twelve," I raised my hand. "How many saw the gorilla?" I asked.

The room erupted.

"Gorilla???!!...Yeah, I wondered what that was all about…What do you mean??...Gorilla? WHAT gorilla??...You mean you didn't see it?!..."

I went to the front of the classroom and raised my hand for silence.

"Let's watch it again, and this time, don't try to count how many times the ball is passed." I told them.

We did, and this time, those individuals who had not seen the gorilla walking through during the middle of the film beating its chest were even more incredulous.

"Oh my god, how could I have missed that?" declared Caroline.

"Shall we try another one?" I asked. "A little harder one?"

The loud chorus of yesses told me I had them hooked.

"So this next one," I said. "I'm going to show you a picture for several seconds, and you have to determine what's wrong with it." I pressed the play button, and everyone else stared intently.

"So, what's wrong with it?" I asked.

Most of the hands in the room went up. I motioned at Jamie.

"There's a tree in the middle of the river." She declared confidently.

"Nope." I replied.

The show of hands faltered.

"The water's not moving the right direction?" Mehek offered tentatively.

I shook my head. "Want to try again?"

There was an even more vigorous chorus of yesses, and I showed the picture again, to the same results.

"Ready to see what's wrong?" I asked them.

They all gave a mixture of nods and various vocalizations to the affirmative, and I pressed the "reveal change" button on the video.

Again, the room erupted.

"What??...The rock disappears??!...How is that possible?..."

"Watch the bottom right corner of the picture this time?" I told them, hitting the play button again to show the bolder slowly fade away.

There were lots of "how could I have missed that?" as I walked back up to the front to continue the lesson.

"Ladies," I said. "Welcome to the brain!"

Food, Sex, & Safety

If I could wave a magic wand, I would make it a foundational requirement that before any educator at any level was *ever* allowed to teach, they must have taken a neuroscience class. Not the educational psychology class that is the standard licensing requirement in most of this country. A course in neuroscience. Because if a teacher does not comprehend and fully appreciate the workings of the organ that lies at the very heart of this profession's primary endeavor, it is simply not possible to be authentically engaged in the classroom. Put bluntly, no one can adequately fulfill the keystone niche of teaching without employing a full understanding of the tension between the brain's plasticity and its hardwiring.

That is because the human brain is itself a completely 50:50 blend of genes and environment, hardwiring and plasticity.[1] In fact, this division is physically built into the very structure of the brain, with the left-hemisphere nearly uncompromising in its conservation of its neural pathways while the right-hemisphere readily adapts its pathways to meet demanding change. It is why, for example, victims of strokes in the left-hemisphere, where language is located, can sometimes relearn to communicate (the right-hemisphere adapts to take over the job) but victims of stokes in the right-hemisphere can refuse to believe that appendages once controlled by this hemisphere are parts of their bodies anymore (the left-hemisphere cannot change to take over the job of seeing them).[2] In fact, because a right-hemisphere stroke victim preserves much of the functions such as language which we associate with being human, right-hemisphere strokes are significantly underdiagnosed.[3]

Learning, of course, is one of the brain's most plastic processes as new neural synaptic connections are formed, others pruned, and even some additional neurons actually generated in response to changes in the environment, and it is why, as noted earlier, every person's brain is

wired with his, her, or their own unique neural pathways. Learning is so plastic in its character and our brains "so sensitive to external inputs that their physical wiring depends upon the [very] culture in which they find themselves."[4] However, the methods the brain actually uses to make learning happen are governed by some of the brain's most genetically controlled hardwiring, placing significant boundaries on what can and cannot happen during the learning process, and it is these boundaries that explain why some educational techniques are highly effective while others are not (a topic we will return to later in this chapter).

First, though, we need to have a better understanding of the origin of these constraints if we are to fully appreciate their impact on teaching and learning, and to do that, we have to start by recognizing that the organ we all possess in our heads evolved just like every other part of our bodies and that the environmental forces of natural selection through which this happened were ***very*** different from the world we live in today. The human brain evolved during a period of tremendous ecological upheaval and instability as the climate dried and tropical jungle gave way to open savannah in Eastern Africa,[5] and as a consequence, it became very good at rapidly solving new, immediate problems related to survival—i.e. food, sex, & safety—and it did so in near constant physical motion (the average early human traveled 12 miles or more a day).[6]

In addition, the part of the brain responsible for all of this was basically just layered by evolution onto the two previously inherited brains: the brain stem which we have in common with any animal with vertebrate and the limbic system we share with every other reptile, bird, and mammal. To top it all off, as any pre-K or middle school teacher can tell you first hand, the three don't always communicate well together, and in fact, much of what the brain does is well below the level of self-consciousness (e.g. the signal for moving your hand to scroll through these pages leaves your brain to tell your hand to move *before* the signal making you consciously aware of your decision to do so is sent!).[7]

That is why, from the perspective of teaching and learning, "if you wanted to create an education environment that was *directly opposed* to what the brain was good at doing, you probably would design something like the classroom,"[8] and the bottom line is that much of teaching and learning that take place in our schools is often ineffective at achieving any real mastery because it simply ignores how our brains actually work.

To become more authentically engaged teachers, then, we need to have a richer understanding of the human brain and its inner workings. But this project is not a course on neuroscience; hence, I am going to limit my discussion to only the three key things the brain does that most directly impact learning: perception, attention, and memory.

Caro's Biology Freakout

"Mr. Brock? Can I PLEASE film this for Mackenzie since she can't be here to see it today?" Lauren begged.

I looked in Caroline's direction. "It's up to you whether we film this demonstration or not." I said.

"Please, Caro!" The rest of the class entreated.

She looked at me. "You swear I won't feel anything?" She asked, motioning toward the hammer on the table.

I gave her that look a teacher gives when it really is a dumb question. "Caroline, first of all, I would never lie to you. And second of all, your parents would sue me back to the stone age if I ever caused any of you any harm. I like my job." I teased.

She smiled at that and gave Lauren a nod of approval.

"Yes!" said Lauren, clinching her hands in victory.

I motioned to Caroline to take a seat on the stool in front of the box on the edge of the table and had her slide her right forearm inside the opening in it. I then carefully placed the dismembered Halloween arm prop so that it was outside the box and properly aligned with her arm inside it. I looked at her directly.

"Since you were the only one in the room to pass the nose-test for altering body image, we're now going to see if we can convince your brain that when I am touching this fake arm that I am, in fact, touching you." I told her. "And we will test whether we were successful or not by having Lindsey here give the artificial arm a nice strong smack with the hammer."

Lindsey picked up the hammer and gently bounced it off the rubber.

I shook my head. "No, when I tell you to, I want you to SMACK it" I said.

I turned back to Caroline to finish giving instructions.

"So, what is going to happen," I said. "Is that we are going to stroke the surface of the back of your hand in the box at the exact same time that we are stroking the identical surface on the artificial hand. While we do that, you are going to focus your attention strongly on the fake arm. After about 45 seconds, we will test to see if we have made your brain think the fake arm is now you."

I looked around at the rest of the class gathered around the front table. "Just so everyone knows, there is a strong chance this will not work. Only about 30% of the people who we can make the nose feel like its longer can move on to the next level."

"Ready?" I asked, glancing at Lindsey and Caroline. The former waggled the hammer in her hands with a slightly malicious grin on her face, and the latter simply nodded. "Let's begin."

I started swiping both surfaces with my index fingers while watching the clock, and after about a minute, I spoke.

"Anything?" I asked.

Caroline nodded vigorously, and I motioned with my head to Lindsey.

"Let's test it." I said, and the hammer came down with a blow so strong it made the rubber arm actually bounce.

"AAAAHHHH!!!!"

Caroline screamed and leapt from the stool so hard she knocked it over. The box went flying in the air. "Oh my god, oh my god, oh my god, that is SO creepy!" She repeated, over and over. The rest of the girls reacted.

"What's it like?" Several of them asked all at once.

"Yeah, did you really think it was you?" Jenn added, eagerly.

Caroline starred at the artificial arm with an expression that was a mixture of dismay and uncertainty. She nodded. "When the Lindsey hit the arm with the hammer, I swear to God I thought she was hitting me."

"Could you actually feel it?" said Didi.

Caroline shook her head. "No, there was no pain. But…" She shook herself like a wet dog. "SO creepy," she muttered.

"You genuinely were convinced that the hand touching that arm was touching you?" I confirmed.

Still staring at it, she bobbed her head rapidly, and I turned to the rest of the class.

"So you now see what I'm talking about when I say that what is real for your brain is what your brain determines is real. It's why, for example, eating disorders are treated as

psychiatric disorders: the person suffering from one literally perceives themselves differently than the rest of us do." I said.

There were expressions of wonder mixed with a little anxiety as they pondered my words and what they had just witnessed.

"It's why," I told them. "In a very real way, all of you in this room are figments of my imagination; I'm simply making you up as we go along."

Plato's Cave

What sets the human brain apart from the rest of the animal kingdom is that we can employ symbolic reasoning to make and execute plans. Where the brains of other mammals, for instance, would see a predator such as a leopard coming toward them and respond unilaterally (usually by running away), our brains are capable of seeing the leopard and imagining how we might kill it and use its hide for a coat. Or we might notice the pattern of its spots and think about how we might reproduce it in a drawing. Basically, our brains have the capacity to take the data from our stimuli and manipulate it in ways that no other animal, including our primate relatives can do. To put it simply, what makes the human brain unique is that we can fantasize about the future.[9]

In fact, our brains essentially live in the future, using predictive information acquired from experience to bias both incoming stimuli and outgoing responses.[10] But what this means (and the neuroscience research affirms) is that our perception of things—both the world "out there" and the world "in here"—is not the result of taking in input and integrating it into a single "picture" of reality; we don't receive the stimuli and assemble them together the way a computer assembles and organizes pixels to represent an image. Instead, perception is an active process in which our brains first generate and construct a "picture" of reality that is then tested against the sensory input for accuracy. Perception is, in effect, (and what the research now even calls) "a controlled hallucination."[11] Our experience of reality, therefore, is a construct of our brains; we make it up as we go along, testing its veracity against our sensory input.

This last point is a critical one. The research is not suggesting that there is no reality. A moving car, for example, occupies space and time, and if you try to occupy the same space and time, it will hit you and damage or kill you. We are here today as a species (with our brains working the way they do) precisely because—regardless of any individual differences in the perception of it—our ancestors knew to run when they saw the leopard!

But the brain's perception of reality is individual, and since no two brains are wired the same, "two people can see the same input and come away with vastly different perceptions."[12] Simply recall the blue/black vs. white/gold dress controversy from a few years ago to see this truth in action: humans have no single accurate way to perceive things. Thus, "those flowers you decide to pay attention to actually do look much redder to you and smell much sweeter than the ones you chose to ignore,"[13] and beauty really *is* in the eye of the beholder.

The implications for education are profound: it means that in a classroom of 28 students and the teacher, there are, in fact, 29 *different* classrooms being experienced! It is why it is so critical to present *all* instruction using a variety of methods because each individual brain is testing his, her, or their construct of that instruction in different ways. It is why it is so critical to revisit and review content repeatedly (and why teachers quickly learn instinctively to say everything at least thrice) because an individual child may *not* have generated a perception of the "gorilla" the first time. It is also why the first two properties of an authentically engaged teacher

that we have examined are so important: only through appropriately intimate rapport with our students can we discover how they actually are perceiving what is taking place in the classroom, and only as a co-learner can they encounter their teacher's perception of a subject. The "buck-stops-here" truth that neuroscience confronts us with is that an educator simply cannot authentically engage in their niche in the classroom without always keeping in mind that their perception of what is happening may not be the students' perception and trying to address any differences as deliberately and thoughtfully as possible.

There really are "all kinds of minds" in that room.[14]

It'll Cook Your Eyeball!

We had just finished reconstructing the Big Picture concept map, adding our next question mark that would involve the next couple of periods, and I set the piece of chalk down and picked up a pile of handouts.

"Ladies, as you know, this is biology." I said. "Which means we are going to ***do*** something to figure out the answer to our next question. Right now, though," I motioned toward the back of the room. "I would like you to take the sharpies that are at your tables, write your names clearly on the sides of your goggles, and come join me at the lab bench."

There was a general shuffling as the girls did what I asked, and we all moved to the lab bench back where I had my demonstration materials waiting.

"Shift around, people," I said. "We need everybody to be able to see." I motioned with my arms. "Some of you can come over here to my right. I showered this morning; I promise."

That brought a few snickers.

"Also," I continued. "Those of us who are a little more height challenged, let's move those folks to the front. Thank you, ladies."

I scanned my gaze across the entire group.

"Today," I told them. "Is going to be our first time working with chemicals. So we need to go over some basic safety rules. I think it is important that you understand *why* we wear goggles when working with chemicals."

I picked up a familiar object. "What is this?" I asked.

"An egg" came the chorus of responses.

"Very good," I replied. "It's an egg." I cracked it open carefully and spilled the raw egg into a specimen bowl.

And what do we have here?" I asked, pointing at a small beaker.

Several replied "Water;" while others responded, "I don't know." I pointed at one of the latter.

"Exactly, Foula," I responded. "We don't know what this is other than that it is a clear liquid."

I picked up a plastic pipette and begin transferring some of the liquid into the specimen bowl with the egg.

"What's starting to happen?" I asked. There were several observations that the "white" of the egg was starting to turn solid white in color.

"And what general process are you all familiar with that cause the clear part of the egg to turn white?" I mused. Hands went up this time, and I pointed to call on one.

"Cooking." Susan replied.

"Hmm." I mused once more. "What's this chemical doing to the egg?"

There was a collective gasp. "Cooking it!" They all said.

"And if this clear liquid that looks like water got into your eye….?" I mused one last time.

"It would cook your eyeball!" Meghan called out in horror.

I nodded and looked around at all of them again. "Can we uncook an egg?" I asked.

There was a general look of fear as the full weight of what I was implying sank in, and I then leaned over to place my face directly above the cooking egg.

"While I myself am somewhat folliclely challenged," I said. "I don't have to worry about this anymore. But what might happen if some of you did what I'm doing right now—say in order to make an observation?"

I looked up to see several of them already pulling their hair back and securing it.

"Exactly." I said. "This is why we always wear our goggles and we always tie our hair back whenever we are working in the lab."

I put my own goggles on at that stage and waited for the entire class to catch up with those who already had their hair and goggles secured.

"Finally," I said. "What do we need to do if we spill or have an accident?"

There was a show of hands.

"Annie?"

"Clean it up?" She responded hesitantly. I shook my head and pointed at the next person.

"Immediately tell you?" Reagan answered.

"Right." I responded. "Look, accidents happen, and I am not going to explode at you when they do. Or think to myself, '*OMG, how could she be so stupid?*' "

They chuckled at that.

"I've got to know right away." I told them. "Because certain chemicals require extra steps to clean up safely. It's why it is SO important when working with chemicals to pay attention to *everything* we are doing."

I checked expressions for understanding and then started to pass out the handout.

"Okay, then," I told them. "Grab your lab notebooks, Ladies, and head out to your lab benches. Let's get started!"

Focusing and Filtering

The brain's attention process is highly selective, and it biases our perceptions heavily toward the problems and stimuli that are involved in our survival (i.e. food, sex, & safety).[15] That is why it has always been challenging to get a small child interested in "2x2=4" or any of the rest of the multiplication table, and it is why that challenge is even greater today when your smartphone has already "memorized" it for you and can produce far more interesting input. The brain essentially does not like to "hallucinate" about boring stuff, and because it evolved in an environment where most survival problems were taken care of quite quickly (you outran the leopard or you didn't), the brain only pays attention to anything a maximum of 10 minutes before requiring something emotionally strong and relevant (i.e. the next piece of fruit, potential mate, or leopard) to reset the attention "clock."[16] In addition, during a prolonged problem (such as a class period during a school day), the brain pays its strongest attention only to the *first* of the series of potential 10 minute resets[17]—which one of the many reasons why "do not waste the precious opening part of the class doing routine activities, like checking homework."[18]

The challenge we have as teachers, then, is how to deal with the constraints of this hardwiring and to keep, hold, and reset our students' attention to focus on the problems we want

them confronting—problems which, let's own it, are *never* survival problems. Somehow, we have to create the conditions to keep the brain's attention engaged in learning situations it might otherwise dismiss as boring. We must find a way "to create opportunities where students truly care about learning—where the potential joy of learning shouts so loudly that it drowns out the background noise."[19]

Ironically, it turns out the best method for doing this is to generate stress. Yes, you read that correctly. The best way to capture the brain's fullest attention and generate the deepest learning is to create stress in the classroom. Basically, we want to make student brains think they are confronting a survival situation, one they should care about deeply.

But it has to be a special kind of "survival situation," one that the brain feels confident it can "outrun," and to understand why, we have to know more about the structure in the brain where attention resides: the hippocampus. This part of the brain, buried deep inside the limbic system, is where immediate awareness and memory intersect, and it is the gate-keeper to the learning process because its neurons are heavily peppered with the protein receptor for the stress hormone, cortisol, making the hippocampus extremely responsive to stressful situations.

Yet why would stress be so heavily associated with attention and learning? Because, as neuroscientist, John Medina, points out:

> *Our survival on the savannah depended upon remembering what was life-threatening and what was not. Ancestors who could commit those experiences to memory the fastest (and recall them accurately with equal speed) were more apt to survive than those who couldn't.*[20]

Those life-threatening moments, though, would also have been relatively brief (you survived the leopard and remembered how or you didn't), and our brains evolved accordingly. Therefore, the kind of stress we create in the classroom needs to be the right amount and kind: bursts of stress stimulates the hippocampus, focusing attention and generating learning; while excess stress can actually kill neurons and prevent the growth of new ones.[21] It is why PTSD is so hard to treat; the excess cortisol literally rewires the brain, and it is also why for "children who grow up in stressful environments…it's hard to learn the alphabet."[22]

We will explore how a teacher can successfully produce the proper amount and kind of stress in the classroom next in Chapter 4. But for now, what our knowledge of the brain's capacity for attention clearly shows us is that to be authentically engaged in our teaching, we need to be exposing our students to difficult situations in the classroom that challenge them without overwhelming them and we need to help our students embrace these difficulties by modelling how we employ stress for our own growth as co-learners.[23]

We also need to address the "dark side" of the brain's capacity for attention which is the challenge of interference. Sensitivity to distraction is a fundamental vulnerability of the human brain[24] because the ability to filter out irrelevant stimuli from our attention did not keep up in the natural selection process as we evolved our capacity to "fantasize about the future" in the prefrontal cortex. In fact, "the fundamental limitations in our cognitive control abilities do not differ greatly from those observed in other primates, with whom we shared common ancestors tens of millions of years ago."[25]

What is more, the neural networks that generate this filtering half of attention are independent from those that cause the focusing half of the process. Hence, the more distracting the input there is in an environment, the more the demand for energy increases in the brain and the less efficient it funtions.[26] Our brains literally have to work harder in such situations to pay attention, leaving less energy available for other functions.

Again, we can see clearly the implications for authentic engagement in our teaching. To maintain student attention, we must create classroom environments that have the right balance between attention grabbing and attention overwhelming—which can involve anything from the temperature of the room to the quantity of content to the presence of technology—and we need to think long and hard about the workloads we create for students. The brain alone consumes 20% of the body's daily energy supply, and much of that is expended on paying attention. Too much work—in or out of the classroom—can exhaust a brain to the point of dysfunction. It is why "just one night of poor sleep can lead to less efficient filtering out of important information from junk"[27] the entirety of the next day. Lastly, we must remember not to "expect (or worse, demand) adult-level, [attention] abilities from children and young adults."[28] Instead, we need to work to create deliberate self-reflective opportunities to challenge a child's attention abilities to expand in order to enable their brain's neural networks for attention to mature.

Making It Stick

"Oh, Mr. Brock!" came the sing-song sound of Anna from around the corner.

I suppressed a smile as the three of them came into view and stood expectantly by my desk. Ah, my little 3rd period "Coffee Klatch" as I had come to think of them.

"Yes, ladies?" I replied.

"Are you available next period?" Caroline asked, as all three of them eagerly held out their study hall passes. "For help preparing for the test?"

I took their passes and began to sign them. "Yes," I told them. "I can be available for academic help next period. I'll meet you in the usual spot." I said, gesturing with my head through the window at the other half of the science prep room.

They ran off to give their passes to their proctor, and I stood, thinking, "*my how things change. Beginning of the year, I can barely get any of them to come get extra help. Now they practically live in this room.*"

I went to refill my mug with water, and by the time I returned, the three of them were ensconced in their usual places, laptops, notebooks, and papers strewn across the table in front of them.

"I don't have any specific questions just yet, Mr. Brock," declared Anna. "But I'll be sure to let you know when I do."

"Me too," said Caroline. "I don't have any questions just yet. I just want to be able to work through the study guide with you available."

"Well, I have a question!" Madison stated anxiously. "I don't know what to write down in my Quizlet for number three."

I walked around to where I could glance at the review sheet PDF on her screen and said "That's because there is nothing *to* write for number three. Number three is a skill. The question is telling you that you have to be able to construct a cladogram and know what the required features are." I pointed with my finger at her screen. "It's why you have practice cladogram problems in number fifteen. The same thing is true of number thirteen." I told her. "That's a skill. You have to be able to take a collection of things and classify them into appropriate groups."

"About cladograms, Mr. Brock," Anna interjected. "I don't know about those. The practice problems you gave us were kind of rough! I don't know that I could do one of those on a test."

There was a general murmur of assent from the other two.

"Okay," I replied. "When we have something tough, how do we address that?"

"We practice." All three of them sighed.

"Exactly." I said. "So let's practice."

"But Mr. Brock, I've already done the ones you gave us." Anna protested.

"Did you get them right?" I asked.

"Yes, but I need more." She replied.

"Yes, we need more!" Madison and Caroline both pleaded.

"All right," I answered, turning to the whiteboard to write the words *box, tree, cardboard, pulp, paper*. "There you go; make a cladogram."

They turned toward one another.

"So the one at the bottom always has the property that everything else has, and the one at the top is the most different," said Anna.

"And things usually get more complex as you move up the diagram," added Caroline.

"But what do all of those things have in common?" Madison asked, plaintively.

They started to discuss the answer to that question, and I put out my hand.

"Stop." I told them. "What have we learned about studying? Always try it on your own first all the way through? THEN share and talk things out with someone else? It's why I keep telling all of you NOT to have one person in the class make a Quizlet and share it with everyone. *Each* of you should be making her own Quizlet and *then* take each other's."

I could tell they were thinking "*But that's so much work, Mr. Brock!*" But they dutifully stopped communicating and each sketched out the answer in her own notebook. I walked around the table so that I could observe their work, and when I could tell all three of them were finished, I instructed them to talk it out.

"Don't just immediately compare answers," I told them. "Talk through how you reasoned out your answer."

"Well, I noticed that a lot of the items are made of paper and paper is made of trees." Anna said.

"And you have to crush up the tree to make paper," added Caroline.

"And boxes are folded paper." Madison contributed.

Steadily, they worked through their reasoning as I sketched their ideas on the whiteboard.

"So, is that what you think the correct answer is?" I queried, pointing at the board.

They all nodded.

"Congratulations," I said. "That's because that *is* the correct answer."

"YES!" exclaimed Anna. Then she perked up in her chair. "Can we do more?" She asked.

"Yes, *please* Mr. Brock!" said the other two.

I replied that we certainly could, and for the next half hour, we worked on improving everyone's cladogram skills. We started to move on to some of their other questions when suddenly Maia walk in to ask if she could join us.

"Whoa!" She said, looking at the board. "Can I take a picture of that with my phone?"

I started to respond when Madison exclaimed "No, Mr. Brock! You need to erase it! Otherwise, she won't really learn!"

This time, I could not suppress the smile.

Why Practice Makes Perfect

To state the obvious, memory is where the process of learning actually happens. It is the intersection of perception and attention that enables the transition from working or short-term memory (STM) to long-term memory (LTM), and it is—again to state the obvious—clearly the whole point of the educational process. It is why you are reading any of this in the first place. But, just as with perception and attention, the neuroscience again has much to inform us about how the brain's hardwiring generates the process of memory, and thus, to engage children authentically in the classroom, we again need to be using knowledge of this process to be informing our teaching. Let's start with the basics.

First, when new input arrives in the brain, the brain takes this information and "acts like a blender left running with the lid off."[29] Every element of the experience is dissected into discrete pieces, each of which gets its own set of neural pathways to process it into a perception of it. For example, we know from studying victims of strokes, that even the consonants and vowels of each of these words you are reading are processed by different parts of the brain and that if the neural pathway for one becomes damaged, the rest of this sentence w_ _ ld r_ _d l_k_ th_s.[30] Also, when I say 'every element,' I mean *every* element. The entire environment being experienced with the new input—including emotions and other internal states—is being discretely processed by its own neural network to generate a single perception of that information. As I tell my own students when teaching this material, every thought has a feeling; every feeling has a thought. The knowledge that "2+2=4" has an emotional content to it.[31]

Once the brain has used its neural networks to encode an awareness of any new information, it will then store this information on those same neurons and pathways recruited for the perception of it, which is why "every time you learn something new, you change the brain [and] the residue of your experience is stored"[32] on the very same neural pathways employed to have the experience in the first place. The key word here, though, is "residue." The first time you encounter new information, it is like walking across a lawn only once; the grass will flatten for a brief time in the places where you have stepped but is highly likely to bounce back shortly thereafter. To store that information permanently, the brain must re-experience it time and again, just as you must walk over the same patch of grass repeatedly before it becomes a dirt path.

One of the key ways the brain engages in this repetition process is through sleep. Research has shown that following a learning event, the neural pathways recruited during that event fire repeatedly during certain portions of the sleep cycle and that if you wake someone up during one of those times, the individual has poorer recall of the learning event the next day than someone who was allowed to finish their sleep uninterrupted. In fact:

> *Take an A student used to scoring in the top 10 percent of virtually everything she does. If she gets just under seven hours of sleep on weekdays, and about 40 minutes more on weekends, her scores will begin to match the scores of the bottom 9 percent of individuals who are getting enough sleep [so poorly is she now learning any new material].*[33]

Therefore, the unconscious re-exposure to new information is just as critical as the conscious re-experiencing of it is, and it is only through a mixture of both that the brain generates a permanent memory of it; that it carves out a "dirt path."

Until the brain does this, though, a memory is not stable, and since the barrage of constantly new input sometimes needs the same neural pathways as previous input, the transition from STM to LTM can sometimes take years.[34] Furthermore, as old neural pathways get used to recall a memory, the act of recall itself employs additional neural pathways, which means there

is now a "new" memory of the "old" memory. This memory instability is why each of us regularly get memories of similar events jumbled up together and why at family gatherings, people will sometimes descend into arguments about "what actually happened that one time at thanksgiving." It is also why, as every educator knows from firsthand experience, you do not truly learn something until you have to teach it to someone else.

Deliberate "Controlled Hallucinations"

Now that we have a better understanding of how the brain produces memory, let's examine the implications for learning and then teaching. First, the act of learning requires significant effort on the learner's part. The neural pathway encoding a memory must fire those neurons regularly and repeatedly to transition STM to LTM, and they must do so by actively interacting with the material because unless the brain creates a *new* perception of the material each time, the necessary genes will not be activated to induce the additional synaptic connections that turn "bent grass" into the "dirt path" of a completed neural network.

Second, "regularly and repeatedly" does not mean continuously. As we saw with attention, the brain uses up a tremendous amount of energy. Actively engaging with the material for short periods of time, followed by a break, followed by another short period of engagement, and so forth allows the neurons doing the encoding to rest, clean out their metabolic wastes, and reset to fire their signals again.[35] That is why cramming doesn't work for actual mastery of new material (and why so much is forgotten over summers): racing back and forth across the "lawn" for a while isn't going to wear out a "dirt path," but it will wear out you.

Third and finally, a learner must truly understand a body of new material for the brain to remember it. A faulty "hallucination" is going to produce at best a "dirt path" where it is not wanted (and unlearning something wrong is as difficult as my analogy of needing to "reseed" and then trace a new "path" suggests). But more likely, if the perception does not match reality (which is the brain definition for "understanding"), the brain is not going to keep that neural pathway at all and will employ it for future input it that does make sense. It is why "trying to solve a problem *before being taught the solution* leads to better learning, even when errors are made in the attempt"[36] because the brain wrestling to produce the initial perception of an answer sets up a pre-existing neural pathway that can then incorporate the additional knowledge of the solution later. To use my analogy of the "lawn," by bending down the "grass" with the initial attempt at problem-solving, the brain knows already where to dig up its "turf" to make the "dirt path" of the solution.

As for the other side of the educational coin, teaching, the implications from how memory works for our classroom practice are significant. For starters, teachers need to present material in a manner so compelling and appropriately stressful that the students spontaneously engage in deep and elaborate encoding.[37] Thus, we have got to stop the common practice of "death by PowerPoint." Not only is it bad for attention, it does not present material in an active manner that will make the hippocampus "sit up and take notice." Next, we need to provide plenty of opportunities to practice what we are teaching at appropriate intervals. For example, in my 9th grade classes where we learn experimental design, we perform the design process starting at the beginning of the year, and then do the next one about every two weeks throughout the

year. That way, my students are re-engaging the concepts of variables, controls, etc. over and over as they steadily master this investigational process, and when I get many of them back three years later in my AP Biology class, I have never had to reteach this material. Lastly, teachers also need to be actively reviewing as we go along. I provide access to any test review materials at the *beginning* of the unit, not the end, and whenever we revisit the concept map we steadily build and enlarge throughout the year (what my students have nicknamed, "The Big Picture"), we start from scratch at its very beginning each time and fully reconstruct what we have learned so far before adding the next element to it—which is why there are alumni who can still talk about it intelligibly at reunions 15 years later.

Final Thoughts

As I said near the start of this chapter, we have only scratched the surface of how neuroscience can and should be informing what is taking place in schools, and I encourage the reader to take a deeper dive into the books heavily referenced so far (as well as the research referenced in those books). My goal at this point is simply to demonstrate how and why employing a full understanding of the tension between the brain's plasticity and its hardwiring is essential for authentic engagement in the classroom.

However, now that we do have a better working grasp of what the brain is doing during the learning process, we can also begin to see how this knowledge fits in with the other two properties I have set forth as being essential for good teaching. For example, as we generate appropriately intimate rapport with our students, we also generate the trust necessary for the deliberate conditions of stress which we must create to actually work to produce the learning we want; a child who genuinely knows and feels their teachers' caring will risk the stress of learning something new (and potentially uncomfortable) and not feel overwhelmed while doing so.

Moreover, as we embrace our role as co-learner, students get to witness first-hand our own struggles with the material. When children see for themselves how much effort and attention we as teachers must engage in to learn our craft better—the effort to find a new analogy for a difficult concept; the risk-taking of a new lesson and the adjustments we make when it doesn't quite work out as intended—they, too, will more willingly embrace their own need for a "growth mindset" over a "fixed mindset"[38] and make the real effort to learn what we are asking them.

Together, then, the three properties of the authentically engaged teacher intertwine to generate successful education. By working to practice them in our own classrooms and in this profession, we can transform our schools into places where true mastery learning takes place and where, as I once overheard a student put it, "I actually **want** to go to class."

Part II: *Cogito, Ergo Sum*

There is doing, but no doer.
There is walking, but no walker.
There is only the deed to be done;
there is only the path to walk on.

–The Visuddhi-Magga

What does it mean to say that someone teaches well? Could we identify good teaching if we saw it? What about real learning? These are the sorts of questions we will address in this second part of the book where we look at what a truly authentically engaged teacher who is actively practicing the three features presented in Part I can accomplish in his, her, or their school. First, we will examine what successful teaching looks like (Chapter 4). Then we will study the properties of genuine learning (Chapter 5), and finally, we will explore what it might take to get these two things actually happening in our educational institutions.

Chapter 4: Not in Kansas Anymore–Authentic Engagement in Action

The first step in making a choice is to **have** a choice.
If we want our children to take responsibility,
then we have to **give** them responsibilities.
–Alfie Kohn

Change your thoughts and you change your world.
–Norman Vincent Peale

Those Pesky Variables

As we gathered around the rear lab bench, I held up a familiar object.

"What do I have here?" I asked.

"A potato" replied the entire class.

"Right, it's a potato." I replied. "And what do we have here?" I asked.

A few girls closest to the bench leaned in so they could read, and Michelle replied, "Hydrogen peroxide."

I nodded approval. "And what do we usually use hydrogen peroxide for?"

Again, a chorus of responses about cleaning and disinfecting.

"Which means that if you are bacteria on your skin or any other kind of cell, it is pretty toxic stuff." I continued. "But according to the introduction, cells make H_2O_2 as a by-product when they engage in cellular respiration. So somehow, they have to be able to break it down in order to survive."

I gestured at the screen. "How do cells to that?" I asked.

Several of the girls turned to read the introduction to the activity being projected while a few hands went up immediately. I slow counted to five inside my head to allow my screen readers to get a few hands in the air before calling on Phoebe.

"They turn it into water and oxygen." She said.

"Very good." I replied. "Cells turn the hydrogen peroxide into water and oxygen, chemicals a cell actually needs."

I poured some H_2O_2 into a small specimen bowl and then took a knife and cut a cross-section from the potato. "Now I want you to watch something." I told them and placed the slice of potato into the bowl. It immediately began to fizz as the girls all leaned in to observe it.

"What's happening here? What's the potato doing?" I said.

"It's dissolving," replied several of the girls.

"No," I responded. "That's the key; it's NOT dissolving. The potato is *doing* what?"

There were a lot of puzzled looks and furrowed brows as they tried to work out what was happening. Then suddenly, Ella's hand shot up, and I pointed at her.

"It's a chemical reaction!" She said excitedly.

"Excellent," I replied. "It's a chemical reaction."

I paused to let this sink in before switching gears a little. "But unlike the chemical reaction we performed the other day, where *we* combined the baking soda and vinegar to make the reaction happen, what has to be happening here?" I said.

More expressions of thinking taking place, and when hands went up again, I called on Brittany.

"The potato has to be doing it on its own." She stated.

"Right." I responded. "But what's the only thing a potato is made of?" I asked.

"Cells" came the collective response.

"And cells are made of?" I continued.

"The biological molecules." They replied, nearly in unison.

"And ONLY the biological molecules." I said firmly. "Which means what is causing the chemical reaction we are observing?"

A general look of enlightenment began to spread across the group, and Susan uttered sotto voce, "One of the types of biological molecules."

"And THAT," I nodded. "Is our next task. To determine which of the types of biological molecules controls a cell's chemical reactions. So head back to your tables, and you have the rest of the class period to work on designing your experiments."

They shuffled to their tables with their groups, and I started my usual pattern of pacing around the room.

"Mr. Brock!"

"Yes, Katie," I answered, walking over to their table.

"How are we going to come up with a hypothesis for this experiment that isn't just a random guess?" She asked.

"Do you have your biological molecules chart?" I responded.

"Yes." She answered.

"Why don't you look at it?" I told her. "With what you now know about chemical reactions, I suspect you can narrow it down to a logical choice."

She started shuffling through her folder of papers, and I turned to see the next hand in the air.

"Yes, Maiya?" I queried, strolling over, noticing that she already had her biological molecule chart out.

"Would it make sense?" she asked, pointing at a spot on her chart. "That since carbohydrates are responsible for energy in a cell that they might be the molecule that starts chemical reactions?"

"The use of energy *is* a key component of chemical reactions." I replied. "Do you think that makes carbohydrates a logical choice for your hypothesis?"

"I do." She answered, looking concerned. "But…"

I held my hand up. "Remember, it's not about whether your hypothesis is right or wrong; it's about whether it is logical or not. Ninety percent of the time in science, the hypothesis is wrong, but we still learn from that."

That seemed to reassure her, and by then, the next hand was already in the air. It went on like this for several minutes, quick little Socratic dialogues, moving from table to table. But then Ella raised her hand, and I knew from overhearing where they were at in the design process that they were about to enter the uncharted territory this experiment deliberately presented to them.

"Yes?" I said, heading over to stand next to their table.

"Mr. Brock, we can't figure out what the dependent variable is for this lab." She stated.

"Well, what is it you are trying to show?" I asked her.

"Which of the four types of biological molecules causes a chemical reaction." She replied. "But what are we going to measure to show if there's a reaction or not?"

I pursed my lips; it was always a challenge this early in the year getting them to figure it out for themselves. "What did we learn in our last lab that makes something a chemical reaction?" I asked her.

"That there has to be a new substance created and that it has to use energy somehow." She responded, her tone not quite hiding her frustration that I was not simply telling her what she wanted to know.

"So look over at the potato," I told her. "What do you think is going to be your evidence for a new substance?"

Ella studied the potato still reacting in the specimen bowl and then her eyes widened. "The bubbles!" she exclaimed, making the link between the foaming and the production of oxygen.

"Okay." I agreed. "And how did we know that energy was used in the reaction between the baking soda and the vinegar?"

"It got colder." Ann Bradley said, joining the conversation. Then she added quickly, "That means there must be **two** dependent variables!"

"And they are…?" I said, turning my attention back to Ella.

"The presence or absence of bubbles and the temperature of the hydrogen peroxide." She answered confidently.

"Uh hu, not 'just' temperature," I added. "But what?"

She looked puzzled for a moment and then an expression of pure enlightenment came over her face that I knew I would remember for the rest of my life.

"The **change** in temperature!" She stated proudly. "You have to measure the temperature of the peroxide before *and* after you add the biological molecule to it!"

"Excellent!" I told her, then walked on to the next waiting hand.

To Learn by Doing

Up to this point, I have quite deliberately remained silent about describing what I think good teaching looks like because I do not think that the educational process can simply be reduced to technique.[1] As the reader may recall, that is one of the fundamental errors that arises from the Cartesian approach to education, and any detailed description of good teaching earlier might have misled the reader into believing that an educator only has to act or behave in a certain specific way and then he or she will automatically be authentically engaged in the classroom. I wished to avoid encouraging that error.

However, I do think an "ecological" paradigm for education has to involve some understanding of a "how," and I believe teachers who practice the three properties of authentic engagement outlined in Part I will do something fundamentally differently in their classrooms. But to see and understand how and why the act of teaching would be different in a good teacher's classroom, we need to examine some epistemological issues we have not yet explored. Basically, we need to talk a bit about the mind.

The human mind, of course, is considered by many to be the most fundamental of our brain's emergent properties, and while I am at heart a hard-core neuroscientist, I do recognize the value of employing psychological concepts and metaphors for understanding how the mind works when it comes to understanding the "how" of good teaching—just as long as we keep things grounded in the way the brain actually works. To quickly recap, then, when the brain interacts with its environment, this input and its processing causes the cellular components of the

brain to reconfigure, altering both the number and types of connections between neurons and the frequency with which they communicate with one another. This alteration then affects the flow of electrical and chemical signals between the various structures and parts of the brain, and the mental properties–the "mind" we experience–emerges from this flow accordingly.[2]

What this means for the purposes of this discussion is that as the brain interacts with its environment, the mind develops cognitive tools–what I am going to call *interpretive mechanisms*–for making sense out of the brain's perceptions (e.g. a newborn starts to translate hairy moving objects that lick and bark at it into "dogs"). Then, with each interaction, the mind that emerges develops increasingly more complex interpretive mechanisms (e.g. when water is poured from a short into a tall glass in front of a child, it looks like there is now more water to someone under the age of seven; while an older child realizes that the amount is still the same).[3] Eventually, as these steadily more complex interpretive mechanisms increase in number and the brain continues to reconfigure its neural pathways in response to experience, the mind that emerges begins to use its interpretive mechanisms (e.g. that certain symbols are words) to construct what I am going to call *operative mechanisms* (e.g. language) that are capable of assembling paradigms of meaning about the world (e.g. literature).

We, of course, have a term for this process: stating the obvious, we call it "learning." But the fact that the mind learns in this particular fashion means that effective teaching becomes about the "continuous reconstruction of experience" into ever more faithful translations of reality,[4] and the implications for education are clear and obvious (and provide sound biological grounds for the classic notion of the liberal arts): expose children to as much and as many types of experiences and ways of looking at the world as possible, and the brain will build the necessary neural pathways to produce the interpretive and operative mechanisms the mind needs to cope with and make meaning out of those experiences

Yet, how best to accomplish this exposure? Are there ways of teaching that are better at this process than others? That produce the changes that are most beneficial and effective, the best learning? I've already clearly suggested that the answer is "yes," and in the case of interpretive mechanisms, the kind of teaching best able to promote learning these mental tools is self-evident. It *must* be experiential because–to use the example from Piaget's work–for children to learn to recognize that the amount of water in a tall and short glass are the same, they must repeatedly have poured water back and forth, measured how much is in each glass, etc. until their brains have built the necessary synapses to figure it out. Students must spell words, count oranges, hear sounds–they must **do**–before their minds will ever translate certain stimuli to mean language, others to mean numbers, and still others to mean music. The mind's interpretive mechanisms are exactly that: how we make sense out of our perceptions of the world; hence the only way to learn them is by actually practicing the act of making sense out of something until we can.

But operative mechanisms seem different. Unlike interpretive mechanisms–which are, after all, simply skills for making single judgments (a child either recognizes that the letters b-l-o-c-k mean an object of a certain shape or they do not)–operative mechanisms can be used in a variety of ways to produce a variety of meanings. For instance, if a student uses the basic operative mechanism of writing with a set of words, he or she might write "A dog is cold and brown;" they might write "And a cold dog is brown;" or he or she might even write "Cold is a dog and brown." In each of these sentences, this student would have correctly used the same operative mechanism on the exact same words to produce completely different meanings–from communicating a generic observation to making a poetic claim–and this same variability holds true for every operative mechanism from simple arithmetic to architectural composition.

Therefore, with operative mechanisms, we have to wonder whether it even makes sense to speak of a "best" approach to teaching them in the same way that we could with interpretive ones.

However, a moment's thought makes clear that the best way to teach operative mechanisms is *exactly* the same as the best way to teach interpretive mechanisms–just **do** it. In both cases, the emerging mind can only change because of how the brain interacts with its environment. Hence, if the only real way children learn how to construct judgments about perceptions (interpretive mechanisms) is to keep translating experience into coherent notions until their brains operate in the world effectively, then unquestionably the only real way children likewise learn how to use knowledge to make meaning (operative mechanisms) is to have them repeat this process until their brains operate effectively in this manner as well. As educator Alfie Kohn nicely illustrates this truth, "kids learn to make good decisions by *making* decisions, not by following directions."[5] Hence, students must employ operative mechanisms in order to learn them, and therefore, the best teaching is that which engages children in actively using them.

What we must do, then, as educators is immerse students in actively employing their minds to construct the knowledge and skills we want them to have, either from scratch if their young enough or out of the raw material of their own direct experiences and memories as they get older. We must train children to discover concepts and acquire knowledge for themselves rather than passively receive it, and we must engage them in thinking critically rather than merely knowing critical things. We must create the conditions wherein students actively participate in unfamiliar (i.e. stressful) experiences and reflect with deliberation on the value and meaning of them in order to turn these experiences into new (to the child) knowledge about the world.[6] Hence, we must make kids strive to write their own "textbooks" in place of reading someone else's and to *live* their learning rather than observe it like some spectator.

Yet that can only happen if the real "stars" of what Stuart Palonsky has called "900 shows a year"[7] are no longer the teachers. As educators, we must stop playing the cliché of "the sage on the stage" and start, instead, asking with each lesson planned and every action taken, "Who is *really* working here? Who is *really* changing because of what's happening in this clasroom?" and then adjust matters to ensure that the answer is always "the children." We need to start making what the student does the dominant focus of our professional self-reflection, and our teaching needs to be about the children applying ideas in ways they never have before to situations without preestablished explanations.

When we do so, education can stop resembling a trivial paint-by-numbers project, and it can start looking more like...well, like my experience with Ella: demonstrating a cognitive tool in a new situation and then turning her loose to master for herself a broader outlook on the world. Thus, what our understanding of the properties of the mind that emerge from the brain's functions ultimately tells us about our task as educators is that to teach well is to create ways to immerse our children in what we want them to learn and then to make ourselves dwindle steadily away until we are nothing but educational phantoms. As Lao Tzu once said, "a good walker leaves no trail."[8]

To accomplish all this dwindling, though, will take a lot of love, guidance, and support along the way. After all, there does need to be a *little* P.T. Barnum in every teacher.

“Mr. Brock, My Brain Already Hurts”

The class fidgeted in their seats and tried hard to suppress their smiles. Repeatedly, they glanced back and forth between me and the film crew, and as I finished some mandatory paperwork at my desk, I had to suppress a grin of my own at their anticipation.

After all, it isn’t every day that Disney comes to document your class.

Noticing the clock, I scribbled the last of my attendance taking, laid down my pen, and looked up and over at the cameraman. He saw me and signaled that he was ready, and I nodded in reply and walked around to where I was facing my students.

“Okay, ladies,” I said to them. “As I told you in yesterday’s class, the folks from Disney are here today, filming, and just so we can all get it out of everyone’s system, go ahead and wave ‘hi’ now.”

There was some giggling as the twelve of them acknowledged the cameraman and the producer. Then they turned their attention back to me, and I switched to teaching mode.

“All right, then.” I declared. “Before you get started, I just want to double check: you’ve all already chosen and divided up the environmental conditions you want to study for this group problem, correct?”

They all replied “Yes,” and I continued. “Then you know where everything is, and you’ve got the period to get your experiments set up.” I told them and gestured at the camera.. “Oh, and if I can ignore this thing two feet from my face all morning, then you can too, please.”

The girls all chuckled at that and broke into their research groups without further direction. They began to collect their materials from the lab drawers, and I strolled around the room, film crew in tow, studying each group’s assembled materials to see if they needed any intellectual nudges.

Emily came up to me. “Mr. Brock, do you have any sand?” She asked.

I stopped and gestured with my head in the direction of the science workroom.

“In the supply closet.” I told her. “Just knock on the door and ask Ms. Gleason to let you get it.”

“What about some other kind of soil than potting soil?” Beth asked, coming up to join her partner.

I shook my head. “Sorry.” I replied.

“But our condition is different kinds of soil,” said Emily worriedly. “We designed our whole experiment around that.”

“Okay, good; the effect of soil on plant development is a logical choice.” I affirmed. “So how could you adapt what you’ve come up with to cope with the fact that we only have potting soil and sand available?”

They both looked thoughtful for a moment and then Beth spoke up.

“Percentages?” She inquired, and I smiled.

“Good!” I said, watching Emily’s face to make sure she understood, too. “Anything else you need right now?” I asked.

They glanced at each other, shrugged “no,” and headed off to get the sand.

I renewed my walk around the room, listening in to the girls’ conversations about their work, debating when to step in with a suggestion and when to let them work it out for themselves. They seemed to be doing fine; so I paused for a moment and scanned the entire room, noticing that the producer was interviewing Rebecca.

"How is this class different from previous science classes you've taken?" I overheard him say. "What would you say makes how Mr. Brock teaches it unique?"

"Well for one thing," she started to reply. "He wants us to see nature's patterns for ourselves and to...."

I deliberately tuned her out. I wanted today's filming to be an honest reflection of my teaching, and I wanted Rebecca to feel that she was free to say exactly what she thought.

Beth and Emily returned, then, and as I watched them walk by me to their lab station, I gazed past and noticed that Wiena's group had only fifteen pots out. Uh oh, I thought and headed over to where they were working.

They were busy preparing soil and scooping it into their pots the way I had shown them to do and were just starting to add seeds when Elise noticed me standing there.

"You have a problem." I told them straight out. "You don't have enough plants for your experiment."

"But we're planting enough for five different conditions of the independent variable and three replications!" Wiena protested.

"Yes, and that would work with one of the earlier group problems." I replied. "You could control for everything in those experiments."

I pointed at the pile of seeds they had next to their pots.

"Plants, though, are finicky little things." I continued. "Seeds don't always germinate, and even when they do, there's no guarantee they'll develop and grow fully. So you have to allow for that by planting at least five seeds for each condition, hoping you'll get the three adult plants you need for replication."

"But if there's that much variation in plants," Elise demanded, puzzled, "then how can any data we collect allow us to make any kind of meaningful conclusion." She indicated two of the groups of pots. "Say the plants in the pH 7 pots are taller than the ones in the pH 4 pots; how can we know the one's in 7 simply weren't healthier to begin with?"

"Good question." I responded, pleased with her for catching that. I grabbed a piece of chalk since we were next to the board and started to draw when I noticed that the film crew had taken notice of our discussion and were coming over to us.

Ignore, ignore, ignore, I told myself.

"Look," I said, rapidly sketching a graph on the board. "Your independent variable is pH, right?" She nodded. "So what's your dependent variable? What are you measuring?"

"The height of the plant." She answered.

"Okay; so you measure the height of each plant each day over the course of your experiment and you graph the results." I drew two swift lines at different angles. "The taller plants might have a line located higher on the graph, but..." I stopped and nodded in the direction of the drawing on the board.

"But if the slope of the shorter plants is greater, they're growing faster." She responded, nodding her in understanding. "They like their condition better."

"Exactly!" I told her, setting the chalk down.

With a satisfied "I get it," Elise pivoted around back to her group, and as she did so, the producer caught my eye and smiled, giving me a brief "thumbs up."

"Great footage." He said.

I shrugged and glanced around the room to make sure the girls were self-sustaining for a moment. Then, I walked over to where both men were standing while the cameraman changed out batteries and tape.

"Must be very different teaching nothing but girls." The producer said.

"Well, my mother used to joke that she raised two children and one feminist, and it wasn't her daughter." I waited while he politely chuckled and then continued. "No, seriously, the all-female nature of this place hasn't been that much of an adjustment for me. The biggest shock to my system coming here was discovering how fundamentally similar certain things were given how dramatically different they appear on the surface."

He looked at me quizzically, and I paused, choosing my words carefully because his were not the only ears in the room. I finally settled on a half-truth I felt comfortable having the girls overhear.

"I was surprised by how hard I still had to work to challenge students to think for themselves." I answered.

A couple of the girls tried to hide their smiles, but Ellen looked up from where she was sliding paper towels into their plastic freezer bags to test for germination rates and spoke out without any hesitation at all.

"Mr. Brock, my brain already hurts enough every time I walk into this class." She teased. "It certainly doesn't need to hurt any more because you actually want us to think."

I shook my head in mock dismay and sighed dramatically.

"I keep telling you, Ellen." I playfully jabbed back. "I teach because I want people around me in my old age who are actually interesting to talk to."

"But what if we don't want to be 'interesting,' Mr. Brock?" She replied mischievously. "Ever think of that?"

I just glared mildly in response, and the whole class laughed.

I turned to the producer and cameraman. "You can see the respect I get." I declared in my best drama-queen style.

"Yes, clearly they hate you." The producer replied, grinning. He turned to the cameraman. "You ready to go again?"

"We're filming as you speak." He answered, pointing at the red light.

We three turned almost in unison, and I started to resume my meanderings around the classroom to see how things were progressing when the producer caught my attention again.

"So why do you teach the way that you do?" He asked, gesturing at the class.

"Because, when it's done right," I responded bluntly, "this job gives me hope."

Fixing an Untenable Situation

To summarize our discussion to this point, what good teaching looks like, from one account, is a lot like students conjecturing and designing testable solutions to a sequence of logically related problems, performing their own experiments to find the answers rather than following directions in some lab manual. It can also look like students immersed in a class where they may not speak English in order to make their minds scramble to understand what the teacher is communicating (the Dartmouth Method works for a reason). It can look like students discovering how to use a mathematical formula by graphing data from experimental observations they made themselves to determine its function. It can look like students presented with the elements of a novel and told to write their own instead of only discussing the one they've been assigned. In short, it looks like students hypothesizing, painting, advising, observing, evaluating, composing, thinking, knowing...in other words, **doing themselves** whatever it takes to make new meaning with their minds.

So why—in so very many classrooms in this country—aren't they? From John Dewey to Roland Barth to Charles Fadel, the field of education has understood for over a century now that good teaching means children "doing." ***Nothing*** I have talked about in this chapter is new! Yet for all 30 years of my career, I have observed most of my colleagues use the typical "passive, direct-instruction model" that "teaches [students] that education means listening to a teacher or reading a textbook."[9]

Nor has it mattered *where* I was teaching when I made these observations! I will never forget my disillusionment when I switched to the private sector. Like many who had attended only public schools all my years growing up, I had never had any exposure to independent ones before moving to Baltimore. Thus, I had always assumed that what people bought at these institutions was a superior education; these people had the autonomy and access to resources to turn their schools into educational heavens. Yet, what I frequently saw was the same numbing instructional purgatory I had observed in every other school where I had taught or attended. Why on earth, I thought, would school communities that have the power to avoid the exact same mistakes regularly forced on their public counterparts not actively and deliberately do so? Moreover, why if you asked parents about these "mistakes," the majority would tell you that the emperor's clothes look just "smashing?"[10]

Where's the disconnect? Why this apparent universality of teaching mediocrity? What *is* going on here? It is an issue that is not just a professional one for me; it is a deeply personal one as well, and I have thought about it a lot. What I have come to decide is that educators themselves commonly misunderstand what this "doing" actually needs to look like to produce authentic teaching and genuine learning, and consequently, they fall into a dangerous and seductive trap: interpretive and operative mechanisms can be reduced them from cognitive tools for understanding and learning to simplistic catechisms for memorizing and regurgitating. All a teacher has to do to make it happen is to: 1) take a given methodology for making meaning (e.g. historiography or experimentation); 2) present students with a description of how *someone else* actually employed this methodology (e.g. read a history of the American Civil War or a chapter on the structure of DNA); 3) have students somehow practice using this description *in the exact same way* the original thinker did (e.g. make a time line of key events or follow instructions to build a model of DNA); 4) evaluate how well the students can parrot back the description of *the other person's thinking* through some kind of passive assessment (e.g. write a paper describing what happened at Gettysburg or answer questions about how the parts of DNA fit together); and 5) simply move on when finished to the next item the curriculum standards require and repeat the same process all over again.

If it sounds familiar, it should. I've just described 90% of all classrooms in this country and the experience of 100% of us who went to schools where any of our teachers catered to the notion that learning equals mastering a set of responses to predetermined situations rather than discovering new ways to think. Dry texts have a long history in education of imposing dogmatic assertions that cookbook activities confirm, and endless worksheets have followed droning lectures since practically the invention of paper and pencil–all because it is very easy to collapse teaching the mind's cognitive mechanisms into a catechism, even more straightforward to instruct someone in this way, and easiest of all to follow "those eight miserable words: 'We have to be able to measure it' "[11] and give a multiple-choice test for it. Worst of all, when we teach the wrong "best" way, we have the illusion that we have actually educated people: children after a catechism can, after all, recite or recount something they couldn't before; so it looks like learning has modified their minds for the better.

The only trouble is: knowing the correct responses to a catechism (of any kind) does not automatically mean that someone either believes or understands. As teachers, what would actually happen:

> *if you moved your final exam to the start of the next school year? What would your students still know? Why is the very notion of doing this preposterous? Given that it sounds preposterous, what does this tell you about the school culture we have created? What value does it place on actual learning?*[12]

Even when we think back on our own learning, how many of us can actually recall most of the coursework we took at any juncture of our education? We studied to pass the exam, and we moved on to the next class. As we will revisit more in the next chapter, that's *not* learning.

The problem with the catechism approach to "doing" is that it is like trying to "teach" an individual how to cook by first showing them a video of a chef preparing something such as a dessert, then having them follow the recipe to make that dessert, and finally determining their cooking skills by how well they can recite the dessert's recipe from memory. If you later give that same person a bunch of raw ingredients and tell them to prepare a meal in the expectation that they now know how to do so...well, feel free to consume the results; I know I wouldn't enjoy risking it.

The simple truth is that using catechisms to teach doesn't work–in spite of how identical this kind of "doing" looks to the correct way of "doing"–because this method ignores the critical piece of brain research we discussed earlier: that during the brain's development, the mind that emerges begins to use its interpretive mechanisms *to construct* the operative mechanisms that assemble paradigms of meaning. I add the emphasis this time because what's critical to understanding why catechism does not generate genuine learning is to recognize that the only way for a mind to learn any manner of assembling meaning about the world is *actually to build the operative mechanism **for itself** out of its **own** interpretive mechanisms to do so.* In other words, the only way to learn how to cook is to engage in actual cooking.

Mimicking someone else's employment of an operative mechanism such as historiography or experimentation or calculation or composition or… can never truly teach another how to actually **do** historiography, etc. because that individual's brain is not truly engaged in the process of historiography, etc. Instead, what the brain is only doing when mimicking another's thought processes is constructing the operative mechanism for mimicry! Hence, we cannot use the catechism method to teach our children how to generate any kind of real understanding–other than how to repeat what they're told–because the human brain simply does not operate in a fashion that can enable the mind to do so.

However, that hasn't stopped us from trying, and in the process, we have created a self-fulfilling prophecy that has regrettably trapped us into perpetuating ineffective education. In our various school systems full of catechisms for everything from language arts to science, those who learn to mimic well are the ones we call "good students:" they can parrot back whatever's asked of them in any given area and do it rapidly and well. But that means that since what we test for in schools is this capacity to mimic, then those individual students who do it well throughout their schooling years are described as successfully educated, and institutions where there are lots of such kids are described as "good schools."[13] The cycle then repeats itself because the "good students" are going to want their children to be "good students," too, and since the parents' own "good student" status was the product of certain catechisms, they are going to ensure that these same catechisms do the same for their kids–who will then become the next "good students" who will want *their* children to be likewise.... Hence, since the catechism

approach to education is self-reinforcing, it has remained the dominant teaching paradigm in our schools for a very long time.

As we have already seen, though, this situation is no longer tenable. Everyone from corporate executives to university presidents has come to recognize that our schools are not preparing our children to cope with the realities of the 21st Century.[14] Therefore, for a whole host of reasons–from the moral one of social justice to the pragmatic one of economic survival–we must change the prevailing habits of those who currently work in our classrooms. We must eradicate the entrenched practice of using catechisms to teach our kids, and we must establish, instead, the methods known to produce actual effective learning. We must stop developing the capacity to mimic someone else's thought and engage kids in the kinds of "doing" that will generate their own. We must, as Ira Shor has challenged, take "students who arrive socialized into passive education and top-down authority" and compel them "to see [learning] as their active responsibility to make meaning, to examine things, and to use knowledge to change their conditions."[15] In short, we must fix the broken status quo.

Yet can those immersed in a defective system truly repair it? I believe so, but only in so far as everyone involved recognizes that the key to any educational change lies in the nature of the actions of the teacher. True knowledge, as we saw in Chapter 1, can only result from the knower forming an intimate relationship with the known: learners must engage a particular subject as an active "person" in their lives in order to gain any understanding of it. But that means whatever is being learned must become a perception as potent as any direct sensory input because as we now know, it is this "dialogue" between learner and subject matter that literally changes the brain and the consequent mind that emerges.

This same "dialogue," though, does not take place in a vacuum; the teacher plays a critical role. The type of relationship teachers have with their students continuously influences and alters the character of the student-subject relationship, and because the teacher-student interaction can directly modify the student-subject "dialogue," it has the potential to impel children to "re-form"–to create again–their relationship with a subject so that novel understanding can emerge that wasn't there before (i.e. the children will have learned).

Yet only if the teacher is guiding the student-subject "dialogue" so that *that* "dialogue" is doing most of the "talking" can genuine learning truly happen. Thus, what distinguishes the catechist from the real teacher–what "defines" authentic engagement–is *the perpetual introspection about the dialogue students are having with what they are learning to ensure that this interaction places the students in charge of and holds them accountable for building knowledge out of their own encounter with a subject*. It takes deliberative self-awareness to produce the kind of child-centered lessons we will need to change our schools and to keep the instructional focus on what the students are doing, but when teachers use this kind of self-reflection every day in every class with every student, they successfully perform their jobs in a way no other approach to teaching allows, and the consequent learning that happens doesn't just change children superficially; it transforms them deeply.

Hence, the fundamental "fix" we need to make in education is to "present [students] with a problem-solving class in a dialogic format"[16] and then be as authentically engaged with them in that process as we can possibly be. If we as teachers will do so, students will leave our classes empowered to become the critical thinkers and thoughtful individuals our society so desperately needs, and they will walk away as attentive and reflective stewards of their gifts, their lives, and the world–which after all is sort of the whole point of education in the first place: to draw out in another their capacity to become fully human.

Chapter 5: Change Happens–Authentic Engagement's Ultimate Purpose

Treat people as if they were what they ought to be
and you help them become what they are capable of being.
–Goethe

You should really think of the student as innocent of understanding
until proven guilty by a preponderance of evidence
–Grant Wiggins

"Trig Has a Purpose!"

"Hey, Mr. Brock?!"

The sound of drills filled the workshop, and I looked up from where I was squatted, marking a two-by-twelve for a staircase. Katie waved where she and Alyssa were working, and I stood up and walked over to them.

"Yes?" I asked.

"We're trying to secure this leg, and none of the two-by-fours that are left are long enough to run the length of the platform," said Alyssa.

I looked at the pile of wood they had next to them on the floor, estimated the size of the longest pieces, and made a decision.

"So cross-brace it instead." I replied, glancing at the height of the platform's legs. "You both know how to do that."

They shook their heads in unison.

"We tried that already," replied Katie. "But Michael said this platform can't have any bracing on the outside because of the facade we have to attach to it, and we can't get the pieces of wood to lie flat enough when we hold them up on the inside to mark them to cut them."

Alyssa nodded in agreement and reached down to pick up a short two-by-four.

"See?" She emphasized. "It's impossible." She held the length of lumber awkwardly against the leg and top of the platform.

"Okay, so we'll have to figure out how to make it fit." I told them. "Which one of you has a calculator?"

Katie said that she did and headed off to get it out of her book bag. Meanwhile, I pulled out my pencil and started making sketches on the plywood covering the platform.

"Should you be drawing on the set, Mr. Brock?" Alyssa asked, slightly concerned.

I turned and gave her the "you know better" look.

"Oh, right." She said, coloring a little. "We have to paint everything before we're finished."

"Mmm, hmm." I murmured and went back to drawing out my triangle. I finished putting in the angle symbols and then leaned back to study where the leg met the platform.

"Is this one of the ones they have to dance on?" I asked her.

Alyssa shrugged, but Katie answered "Yes" as she returned with her calculator.

Standing by the platform, they both studied me with puzzled expectation. We had worked together long enough that I knew what they wanted to ask; so I gave them an expectant look of my own.

"You tell me." I told them.

"The braces need to be longer if they have to dance on it," said Katie, not quite making it a question, "because that will make it sturdier."

I nodded for her to continue.

"But we only have so much wood left." She added.

"And if we want to have the budget to build the elevator into the stage floor and all the other stuff you've all dreamed up for this set..." I said deliberately.

"We have to know precisely how long to make the braces and where to attach them." Alyssa finished, the understanding dawning fully. She looked at my drawing and asked, "So how do we do that?"

I pulled the tape measure off my belt, made two quick marks on the side of the leg and the middle of the platform, and determined the lengths from the corner to each mark. I then started writing numbers next to the lines on my triangle drawing and held out my hand toward Katie.

"Calculator, please." I asked. Alyssa looked over my shoulder as I made additional marks on the wood and entered numbers into the small computer, and then she gave a little gasp.

"Oh my god," she exclaimed. "You're actually using the Pythagorean theorem!"

I paused, nonplussed, and just stared at her for a second.

"Yeeaahh..." I said slowly. "How else did you think we were going to figure out how long to make the braces?"

Alyssa ignored my sarcasm and shook her head, getting excited.

"No, no, Mr. Brock." She said. "You don't understand. I never knew math was actually good for anything before right now. They make us memorize all those stupid equations, and suddenly, maybe there's a use for them after all."

A look of understanding came over my own face, and I recalled my own first time that the abstract became real.

"Well, if you think that's something, just wait." I grinned, handing the calculator back to Katie. "Do you know how to make that thing do the inverse of a function?"

"Sure." She nodded.

"Well, I don't yet." I told her truthfully. "So I'll need your help. Cosine theta is 30 inches over 45 inches; what's the angle, theta?"

She rapidly started to plug the numbers into her calculator, and I had to ask her to slow down. She looked at me, confused.

"How else am I going to learn how to do it?" I asked her.

She grinned and walked me through the calculations slowly as I looked over her shoulder for a change rather than the other way around, Alyssa just muttering over and over again in disbelief: "Trig has a purpose...."

"Forty-eight degrees, Mr. Brock." Katie said finally.

"Okay," I replied, turning back to the platform. "So now we know one angle to set the chop saw; now we need to figure out the other." I started to reach for my pencil on the plywood, but in her enthusiasm, Alyssa grabbed it and was already busy adding and subtracting angle values.

"Forty two!" She all but shouted.

"But which direction on the saw?" I questioned, making sure both of them were thinking through the full 3-D nature of the problem.

"Opposite, Mr. Brock." Katie chided lightly, reminding me that they had been doing this for a couple of years.

"All right." I said, laughing at myself. "You both know what to do now." I nodded in the direction of the rest of the set crew still putting the legs on their platforms. "When Allison, Suzanne, and Tory get ready to brace, teach them how to do it and pull anyone you need off from painting flats to help you if you need it. I've *got* to finish marking and cutting the stairs; otherwise it won't matter what you all do because no one will have a way to get onto the platforms in the first place."

I started to walk back to my own work when Alyssa said, "I could help you if you need it, Mr. Brock."

I turned and shook my head.

"Only one 'impossible' per day." I told her. "We'll tackle stairs another time."

Room for Other Minds

Historian Marshall Hodgson once wrote to the effect that all learners have an obligation to experience what they study as *Other* before they can ever claim any real knowledge of it. A Westerner studying Islam, he knew that he had to construct his metaphors of understanding in "terms available in his own mental resources"[1] just like everyone does. But he recognized that neither he nor anyone else could claim that these metaphors accurately reflected the true nature of Islam–or any other subject–unless this mental construction process itself were done in such a way as not "to substitute [our] own... conventions for the original, but to broaden [our] own perspective so that it can *make a place for the other*." Hodgson saw that not "until [we have] driven [our] understanding to the point where [we have such] an immediate, human grasp of...a given position [that we] could feel ourselves *doing the same*" can any of us presume with any certainty to truly know whatever it is we are trying to learn. Thus, he knew that we must allow for the true *différence* of another to take hold in our minds if we ever want the discovery process to succeed, and he challenged his fellow scholars and other thinkers accordingly.

I share Hodgson's argument here because I think it provides us with a critical insight about the educational process. We have already discussed at length that *how* teachers and students engage in meaning making is the key to educational success and that this "how" must involve immersion of one's self in active engagement in a specific subject. But what Hodgson now allows us to see is that the study of anything can only lead to genuine knowledge of it when the learning process has caused the learner to become a new and different person, one who now incorporates what they have learned into a revised paradigm for making meaning about the world.

That is actually one of the dangers of a catechistic approach to teaching: that it equates memorization and recitation with learning and understanding. However, we need only look at a classic catechistic exercise such as reciting poetry to see why this equation is an invalid one. We all know that anyone can memorize and recite a passage of verse. In fact, doing so during the school years is practically a rite of passage. However, precisely because recitation is such an abiding ritual, each of us are also fully aware from our own personal experience that knowing the words to a poem and understanding what it means are two entirely different things, involving entirely different ways of interaction between the learner and the piece of verse. Everyone who has ever sat through an English class knows firsthand that unless you can identify with what you are reading at some personal level, it will remain just so many words on a page, and indeed reciting poetry is the exercise in educational torture we all remember it to be precisely because this activity is *not* how to enter into a sonnet's world and experience its universe as if it were our

own. A mere recitation remains as empty of meaning as a blank sheet of paper, and as long as a poem stays nothing more than an organized collection of words–just so many data bits for the brain to absorb and recall–then it will remain an unfathomed enigma and nothing more.

The only real way to understand a piece of verse is to learn the meaning behind its words, and to do that:

> *you have to open yourself to a poem...wait patiently upon it, and* ***make an empty space for it in your mind*** *[until] the work declares itself to you, steals deeply into the interstices of your being [and] line by line, note by note, phrase by phrase...becomes part of you forever*.[2]

No one ever fully grasps a poem's true meaning, its identity, until they have lived with it so intimately that the person can exhibit this meaning in his or her understanding of their own identity, their own sense of self. Hence, the critical difference between the mere recall of a poem and actual learning about it is that in the latter, a person's newly created awareness of self now incorporates that poem as an integral part of that changed self.

Moreover, what holds true for poems holds true for everything else as well. Any successful student or a teacher of a foreign language will tell you that what defines fluency is the difference between the plu-perfect form of a verb being something someone has simply memorized for a test or to read a text–no matter how well–and something he, she, or they has made such an innate sense of his, her, or their own identity that he, she, or they can actually dream using it. As a matter of fact, those fluent in another tongue will even speak of their "Spanish self" or "Chinese self"–so totally does their understanding of the particular language affect their sense of who they are–and that is why total immersion in another language remains the only real way to master it.

Studying another language, of course, is not the only subject in which successful learning demands a new "self," and I could just as easily have provided similar illustrations from every other academic field. But then–to state the obvious–that's the whole point. The difference between the mere recall of information and genuine understanding of it is how it changes us. In order to genuinely learn, we must permit what we study to touch us and to alter us at our most basic level, otherwise how can we truly say we understand it? If what we learn doesn't transform our actual attitudes and actions, it's not learning, simply assimilation, and if newfound awareness doesn't remold our understanding of ourselves and the world—does not truly change our paradigms of meaning in some fundamental way—it isn't genuine knowledge, just data. Hence, like with a poem, how could anyone, for instance, fully comprehend the American Civil War until they've responded to the remnants of its racism in their own soul? Or how could they faithfully understand the forces of climate change and still leave lights on in empty rooms? Real learning fundamentally changes who we are and how we live in the world.

"What will You Do with Your Power?"

They were working on preparing their cases for their endangered animals when Julia raised her hand.

"Mr. Brock?" She asked. "What were the three criteria again?"

"You mean from the ecological triage article?" I responded.

"Yes." She nodded.

"A unique job or niche in its ecosystem. Preserves genetic diversity. And is a species rich ecosystem." I told her, ticking each item off with my fingers. "Since we are only looking at specific endangered species, only the first two apply in this case."

She grimaced and replied, "Then I think we have a problem."

I walked over to where she and Reilley were sitting and asked, "What's that?"

"Genetic diversity," said Reilley. "There's only one of our tortoise left, and it's a boy."

"Yeah, can we change our animal?" Julia asked.

I shook my head. "No. You all picked the animals you wanted to save, and your task is to make your best case for us to choose yours over everyone else's."

"But how can we save something that can no longer reproduce?" asked Julia, plaintively.

"Look," I replied. "All of the Galapagos tortoises are subspecies, right?"

"Yes, that's what we've found." Reilley stated.

"So I know that scientists have brought back the populations on some of the islands by cross-breeding." I told her. "In fact, that could be part of your case for preserving the unique genes of your tortoise."

Reilley shook her head.

"They've already tried putting him in a pen with two females from a related species. He's refusing to mate with any of them." She said.

"You could always make the case for artificial insemination." I replied, refusing to let them off the hook. "Zoos have been making ligers for years now in order to keep their lion and tiger populations from becoming too inbred."

"NO!" came an outburst from Cassidy across the room. "Really, there's such a thing as ligers?"

I turned to nod and witnessed a sudden flurry of activity on everybody's laptops.

"They're so cute!" declared Kitty, followed by a chorus of "Aww!" from several others.

I snapped my fingers twice. "Okay, people! We need to focus. Remember, we're trying to make this a homework free zone right now, and you are giving these presentations next class no matter what." I turned back to Julia and Reilley. "Including why we should preserve your tortoise and not someone else's animal."

They both gave a sigh of acquiescence and started typing on their laptops again.

"Mr. Brock?"

I walked over to where Lexi and Rebecca were working.

"Yes?" I queried.

"I think we may have a similar problem." Lexi stated. "Ours won't breed in captivity because whenever anyone tries to capture one, they die from shock. They are very temperature sensitive and live only in the northern Gulf of California."

"Remind me your animal." I told her.

"The vaquita." She replied.

"Yeah…" I said slowly. "I won't lie; you all have a tough sell. Because even if we do save it, climate change is probably going to heat up their environment faster than they can evolve to adapt to it. And they can't leave where they live because the Pacific Ocean is too cold."

"Mr. Brock!" Lexi protested. "Why would you then let us choose this one for our endangered animal?!"

"Yes. Why?" Rebecca added.

I shook my head. "I said 'probably.' Remember, there is always a chance. The whole point of this Issues in Science assignment is that humans have already done too much damage for

us to be able to save everything. So we are going to have to make choices on how we use our power to preserve."

I looked up to see the rest of the class paying attention to the conversation.

"Remember," I announced. "That's the point of this whole project: what will you do with your power?"

There was a moment of silence, and then Emma spoke up.

"Which one would you choose, Mr. Brock?" She asked.

I looked at her and shook my head.

"You know the rules." I reminded her. "You don't get to hear what I think about an Issues topic until after you have all completed the assignment; I don't want me influencing your response."

Lexi was not prepared to let me off the hook.

"Then what about the other big environmental problems you've been teaching us about?" She asked. "Which of them would be your priority over the others?"

There was a general mixed chorus of "Yeah!" and "Come on, Mr. Brock!" from the rest of the class.

I relented.

"Okay. I will allow a brief digression." I told them and turned to direct my response to Lexi. "You want to know my top three priorities for dealing with the environmental crisis and the 'bottleneck' we are headed toward as a species?"

She nodded eagerly, and the rest of the class leaned forward in their seats. I began to count off with my hand.

"First, find ways to empower women in the developing world." I said. "ALL the data shows that where women are educated and economically in control of their own fates, the quality of life for the entire society goes up and the degradation of resources goes down."

I turned away to face the rest of the class.

"Second," I continued. "Find a way to get the phosphate runoff from the fertilizer back out of the water column; we do not have 250 million years to wait for it to cycle back through the geological phase of the phosphorus cycle after we've mined all of it out of the ground."

I looked back at Lexi.

"And third," I told her. "Somehow get the carbon back out of the atmosphere."

She gave me a "thank you" look, and I turned away again to address the class.

"IF we can accomplish those three things," I said to all of them. "THEN I think there is a fighting chance that our civilization will still be here on the other side of 2050. But it is all going to depend on how you answer the question 'What will I do with my power?' A question that you will ultimately answer with the lives you choose to live."

I then glanced back at Lexi and made a sweeping gesture with my arm to indicate everyone in the room.

"As for me," I told her. "That is the one Issues in Science question you already know my answer to."

Lexi just grinned.

The Lives We Live

There is a coda to this story I need to share. Shortly before graduation, the seniors in this class unexpectedly arrived en masse one afternoon at the doorway to my room, looking slightly

sheepish. They handed me a tall bag with a long story about how they had originally hoped to have this done for the AP dinner but that there had been production problems…. They went on until I finally had to hold up my hand to stop them and told them that no one should ever feel the need to be apologetic about giving a gift. There was a lot of nervous laughter in response to that, and I took the bag from them to open it up. Inside was a tall rectangular glass vase with the following inscription:

To Do List

1. *Economically empower women in developing countries*
2. *Fix the phosphorus problem*
3. *Get the carbon out of the atmosphere*
4. *Bring back the Tortoise*

We won't disappoint!
AP Biology 2016-2017

I keep that vase, along with some other gifts from my students from over the years, in a location in my house where I can see it each morning as I am eating breakfast. I do so so that every day, I have a permanent reminder that since actual learning changes who we are, then the act of learning has an innately moral character to it and to remind myself that what that encumbers upon those of us who teach is that we have to get our students thinking about the quality of their knowing. It is not enough to develop their capacity to make meaning using the metaphors of a particular subject. We must also empower them to understand the inherently ethical nature of this activity and the consequent moral accountability they bear for how they pursue it and the kinds of meanings they choose to make.[3] It might be as simple as reminding someone during a test not to look at a neighbor's paper, but in all that we do with our students, we must deliberately and purposefully confront them with the direct link between the quality of their thinking and the quality of their self so that they will learn that how they *think* determines who they *are*. We must make them realize that the life they live exhibits the real knowledge and understanding they possess and that they haven't truly learned something until they have somehow fundamentally altered their life in response to it.

That is why it is just not possible to authentically engage in learning without exploring the essential truth of the knowledge that results. You cannot educate someone in the sciences, for instance, without addressing what counts as experimental evidence and why, and you can't study history without determining your reasons for listening to one account of events instead of another. Math, literature, languages, art–teaching itself–they all require understanding ultimate meanings in some fashion or another.

That means, though, issues and questions about the intangible elements of a subject need to be a core part of the curriculum, and dialoguing about their implications needs to be a central feature of the instructional process. Everything we teach needs to include some exploration of the ultimate values underlying what students are doing in the classroom, and what results may be as axiomatic as speculating about the reality of numbers or as conjectural as pondering whether "myths can be produced by the same sorts of methods...that now lead to scientific knowledge."[4] But only exercises and explorations like these can truly enable students to know what they are

learning fully, and therefore, what we must ultimately do as a consequence of our awareness of learning's moral nature is to seek ways to enable children to "struggle against unthinking submergence in the [current] reality that prevails"[5] and to reflect actively and regularly about what it means to live what we learn.

However, like anything in education, the only way to get kids intentionally and consistently thinking about their own learning is for teachers to do likewise and join in this process themselves. We, too, have to ponder the worthiness of the meanings we make together with our students, and we, too, have to show that the fulfillment of this moral imperative is the essence of true learning, modeling in our own actions what it looks like to embody one's knowledge in one's living. We must, as the old cliché goes, "practice what we preach," and since what those of us who are K–12 teachers ultimately "preach" is how to construct the self, the authentic identity we disclose in our own struggle to become fully human is what truly teaches our students to do the same. Hence, if we fail to recognize the ethical quality of our own thinking, we risk trapping us all in a world "where, in the smallest ways, we find it impossible...to find room for [another] in our minds."[6]

And where there is no room for another, there is never real learning of any kind.

Chapter 6: The Long and Winding Road–Making Authentic Engagement Happen

If we teach today's students as we taught yesterday's,
we rob them of tomorrow.
–John Dewey

A teacher affects eternity;
he can never tell where his influence stops.
–Henry Adams

The Solomonic Moment

It was the end of the day, and several students from my second period class were back in my room, working on their experiments when I discovered a looming disaster.

"Beccy," I said, getting up from my desk to walk over to her. "I noticed in your group's latest draft that you still haven't fixed the serious typo in your experimental protocol."

I leaned over the table where she was conducting chemical tests on her soil samples and set the copy of the report down. She looked at where I was pointing with my pen and then glanced back and forth between me and the open container of extracting fluid.

"Goggles, Mr. Brock?" She chided teasingly.

"Oops." I replied, pulling them on from where they hung around my neck.

She and Katherine both smiled at this momentary lapse in my preoccupation with eye protection, and then they turned their attention to where I had circled the problem on their report. Beccy traced down the page with the tip of her finger, and they both frowned at the same time.

"No, Mr. Brock, this is what we actually did," said Katherine. "We took the first samples from under the mulch on the flowerbeds by the flag pole, the next from under the path back to the woods, and the last set from the playground. Then we took our negative control from the front lawn and the bare patch in the construction site like you suggested."

"Yes, but you took them all on the same day, right?" I responded, pointing at the paper. "That's what's missing from your protocol. You need a step in there telling us that; otherwise, anyone trying to replicate your experiment might take one set of samples one day, another the next, and so forth."

Beccy shook her head, and Katherine now looked worried.

"But Mr. Brock, that's what we actually did." Beccy protested. "We took the samples from the flag pole one day and performed all the tests on that soil. Then took the samples from the backwoods the next class and so on."

It was one of those "Oh my God!" moments as a teacher, and I must not have kept my initial reaction hidden because suddenly there was real fear in their eyes. Fear that only grew as I stood there in silence for several moments frantically pondering what to do.

"Don't you remember me telling all of you the very first day of the project that soil is alive?" I asked them. "And that you therefore have to take all your samples at the same time and perform any test on them at the same time?"

They both nodded and Katherine responded. "We did that. We took all three replications from the flowerbeds at the same time and did the tests on them at the same time. Then we went the next class to the backwoods and did the same thing."

"But Katherine, your group is trying to determine the impact of different types of mulch on the soil!" They both looked puzzled, and I could tell they still weren't getting it. "How," I asked urgently, "can you compare the pH of the soil from the flowerbeds with that of any of your other samples if you didn't control for changes in the environment? What if it rained between the time you took your samples? How can you know that it was the mulch affecting the pH and *not the rain*?"

Now the two of them looked crestfallen as the implication of what I was saying sank in, and I nodded and gestured vigorously with both my hands.

"Exactly!" I implored. "You have no meaningful data whatsoever to discuss your hypothesis! You're entire experiment is effectively worthless."

"But Mr. Brock!" Beccy replied in horror. "What are we going to do? This project is our final exam. It's twenty-five percent of our grade! We've worked so *hard* on this!"

Four weeks. I thought. Four weeks they've all been in here during free periods and after school and even lunch. Four weeks I've been reading drafts, and we didn't catch the mistake until now! I studied their frightened faces and felt defeated. I sighed heavily and gnawed on my lip.

"I'm sorry." I told them, shrugging dejectedly. "There's no way I can avoid penalizing you for this since I so explicitly and repeatedly said something at the start of the project. Your grade's going to take a hit."

I didn't know what else to say, and for a moment, the three of us just stood there, trapped in our own individual silences. Finally, I said, "For now, go ahead and finish these tests and clean up. I don't know what else to tell you."

They were both fighting back tears by then, and Beccy actually sniffled. But they dutifully turned their attention back to the testing equipment in front of them, and I stood up to go back to my desk. I could overhear them talking about how their parents were going to kill them, and I thought to myself: God, I *hate* having to be judge and jury in this job!

I had only taken a total of two steps when I heard "Um...Mr. Brock?"

I glanced over to where another group was working and walked over to them. "Yes?" I asked.

"We think we may have the same problem, Mr. Brock," said Caroline, cautiously.

"Yes, we also took samples on different days." Parilee added.

Worried faces looked back at me, and I shook my head.

"No, your group wanted to see how the weather changes the bacteria levels in the soil, right? You're supposed to be taking samples on different days." I replied.

"But we took the samples from our two sites on different days." Caroline pushed back. "Doesn't that invalidate our ability to compare them just like it does with the other group?"

I shook my head, puzzled.

"No...I don't see why it would." I answered slowly. But they still looked worried, and apparently, I was the one who wasn't getting it this time because suddenly I heard a chair slam down behind me. I glanced over my shoulder to see Beccy angrily storm out of the room and thought, *What's all the sudden up with her?*

"Mr. Brock, I don't think you're hearing what we're saying." Parilee insisted.

I turned my attention back to the three of them and motioned for Shannon to hand me their most recent draft of their report. I leafed through it and started to reread their protocol.

"I understand." I asserted, studying the steps of their experiment. "You took your soil samples from your negative control and your test site on day 1, then went out the next class two days later and...." My gut sank as I came to the word.

"No," said Caroline anxiously. "That's our point. We took three samples of our negative control over three days, took three samples of our grassy site another three days, and then repeated it all two more times."

I stared in horror for a moment and then simply hung my head. I have *failed* as a teacher, I told myself.

Head down, I said, "So you not only didn't replicate your samples at the same time like I told people to do; you took your negative control and your independent variable on different days."

"'Fraid so," replied Parilee.

I raised my head and considered her. "You, therefore, effectively *have* no negative control and therefore *have* no actual experiment either, do you?" I looked away in despair and muttered, sotto voce. "Well, at least I now know why Beccy stormed out of the room."

My brightest students! I thought. I'm looking at failing half a class of my brightest students, and God knows what I haven't caught in the drafts of my weaker kids!

I swung around to Katherine, who was watching us, and asked her to please go find Beccy and bring her back. Then, I turned back to the group I was standing next to and slowly shook my head a couple of times.

"God, I hate Solomonic moments like this one." I muttered.

"Huh?" replied Caroline.

I glanced over at her. "You know? The story of Solomon? The two women and the baby?" I answered.

They all looked confused, and I was bemused.

"Two women both claiming the same baby is theirs are brought before King Solomon to determine who the real mother is." I told them. "He decides to order the baby cut in half knowing that the true mother would rather give her baby up than see it killed. A Solomonic moment."

"You're planning on chopping one of us in half, Mr. Brock?" Parilee tried to joke.

"No," I chuckled sadly. "I *wish* it were that easy."

"Mr. Brock..." Caroline interrupted, nodding for me to turn around. I did and saw that Katherine was back with Beccy, and I motioned for the two of them to come join us.

"Beccy, I need to apologize. You, too, Katherine." I said. "I'm sorry I reacted the way I did a little earlier. I was excessively harsh, and you did not deserve that. My apologies. I should have been a better teacher and I wasn't." I then looked Beccy directly in the eyes. "And I'm particularly sorry that it looked like I was unfairly being so hard on all of you while acting like someone else who had done the exact same thing had done nothing wrong. That had to hurt, and again, I'm sorry."

She gave me a little half-smile in response but remained standing there in silence, clearly still very concerned–as were all the rest of them when I turned around to face all of them. Again, I reflected on how badly I had failed them as their teacher.

Finally, Caroline broke the silence and said, "So what are we going to do, Mr. Brock?"

"I don't know." I answered truthfully, frowning. "Obviously with so many of you making the exact same mistake, at some level I have to own my part of the responsibility for that, and I can't penalize you for something that's my fault." I studied all five of them for a moment

and then continued. "At the same time, the point of this project is to assess how well you've learned to design experiments, and so at some level, I also need to hold you all accountable for your failure to do that."

I shook my head yet again and cupped my chin with my hand, staring off, unfocused. "You're not learning anything if I simply penalize you." I said, thinking out loud. "That's just punishment. And the point of this class is not to avoid getting punished but to gain understanding. For you to learn and grow. And failing all of you does neither..."

My voice trailed off, and I felt the full weight of my power. Then I knew what I had to do for the immediate moment.

"Look," I said. "It's the end of the day, and you're tired; I'm tired. And exhausted people don't make good decisions. So I will go home tonight and think about what's the best solution to this problem, and we'll all talk about it during class tomorrow. I know that won't take away any of your worry or anxiety right now, but I want to do what's best and that's going to require some thought. Okay?"

It was clearly not what they wanted to hear, but they all murmured their assent anyway, and by unspoken agreement, we all went back to what we had all previously been doing. They began packing up to leave while I returned to my desk, and Caroline, Parilee, and Shannon chatted in subdued tones about who would still work on which part of their report; while Beccy and Katherine silently put their chemical testing materials away. I faced the pile of remaining report drafts and had to swallow my fear at what else I might now find lurking in those pages. Watching the girls go, I knew it was going to be a *very* long night.

The Ideals We Espouse

At the intersection of good teaching and real learning is the relationship between the teacher and the student. Authentic instruction may look like students "doing themselves" what they study, and genuine understanding may look like these same children "knowing another as they would be known." But neither of these actions we have discussed in Chapters 4 and 5 can every actually happen in the classroom without the right kind of collaboration between those who do them. The connection between "master" and "disciple" has always been at the very heart of education, and the quality of the community we form in the classroom determines everything about the quality of teaching and learning that take place there. Put simply, those of us in this profession "relate to others for a living,"[1] and the intrinsic character of that relating is what decides how successful any of us are at educating people.

The logical question, then, is what kinds of properties make a teacher-student relationship a good one, and the short answer is: those that produce interdependence and, therefore, true community. Only to the degree that children experience us as needing them for *our* success can we likewise help them to succeed, and the most effective educators see students as the educational colleagues they actually are and treats them accordingly. The adept teacher will always value children as thinkers in their own right, treating them as partners in the educational process, and in fact, rather than posture as a minor deity, this teacher will quite deliberately reveal and own mistakes and the consequent growth from them precisely because doing so shows students that their teacher is also struggling to construct a self and that they play an active role in this struggle. She, he, or they will let students know that they are as much a part of the teacher's own journey to become fully human as the teacher is of theirs. Thus, what makes the teacher-

student relationship a genuinely good one is the teacher's willingness to share his or her humanity with their students rather than hide behind a wall of authority and rank

That's not easy to do, though, when an essential part of the job is "to evaluate and grade the work students do."[2] Those who teach *judge* for a living, and in the face of that fundamental disparity in power, we have to wonder whether the genuine interdependence I'm claiming both teaching and learning need is even possible. After all, how can anyone ever truly experience someone else as an equal if their relationship is hierarchical in its very nature?

Yet, the danger for learning:

> *is not power and status **differences** between teachers and students but the lack of interdependence that those differences **encourage**. [Yes,] students are dependent on teachers for grades–but what are teachers dependent on students for? If we cannot answer that question with something as real to us as grades are to students, [then learning simply] will not happen.*[3]

Thus, what's at issue isn't whether there is a hierarchy of power between teachers and students but how this power gets manifested. If we invite children into dialogue with our own humanity, it *is* possible to assess and guide them in ways that promote equality instead of injustice or disdain. But to accomplish this, we must "abandon our self-protective professional autonomy and make ourselves as dependent on our students as they are on us [if we want to] move closer to the interdependence that [learning] requires."[4] Only then, "when we can say 'please' because we need our students and 'thank you' because we are genuinely grateful for them," can the obstacles to authentic teacher-student relationship fall away and learning "happen for everyone in surprising and life-giving ways."[5]

But what exactly does it mean to say "please" and "thank you" to our students? Or to enter into dialogue with their humanity? The academic answer, ironically, is actually quite simple: invite them into our work. Good teachers are always sharing the stories of their own challenges to master a particular topic, and they regularly ask students for feedback about how a lesson went. They suggest the latest books they are reading in their field, and some even work with students to publish. "I don't know, but let's find out" is a way of life in the classrooms where students are partners in the learning process, and "this is where I found the answer" is always part of the final response–except there never truly is a final response and the accomplished teachers share that about themselves as well.

Thus, by being visible as fellow learners to our students, we reveal that portion of our own self, and as we have our students "read what their teachers have written, join research teams with their teachers, and hear their teachers disclose problems they are wrestling with,"[6] we are saying "please participate with me in my own learning about this subject" and "thank you for helping me know it better myself." Hence, what it means at least scholastically to enter into interdependent relationship with our students is to constantly model and display the life a particular subject or academic discipline lives inside of you.

However, as I have oft repeated throughout this project, the K–12 world is ultimately not about the specific subject being taught but about how to build a self using the metaphors of that subject, and from that perspective, sharing in a dialogue about the struggle to become more fully human takes on an entirely different meaning. Now saying "please" and "thank you" involves not only modeling what it means to be a learner but what it means to be a mature person. In every interaction we have with children, we reveal the full complexity of adulthood and our own choices about it, and whenever we engage a student in anything at all, we demonstrate in how we treat them the values and convictions we hold worthwhile.

Hence, if we think honest self-reflection and respect for others are vital components of the authentic individual, we do like I did with Beccy all those years ago and admit our mistakes and apologize for them. If we believe in the value of love–in "the will to extend one's self for the purpose of nurturing...another's spiritual growth"[7]–then we let our students know that we regard them enough to spend a sleepless night trying to find a way to help them grow from a mistake rather than simply condemning them for it. If we...the list is endless, and it can be as modest an act as grading and returning assignments in a timely fashion as a sign of respect or as difficult a one as counseling a child in crisis. But the good teachers "attempt to live the ideals that they espouse to others,"[8] and in so doing, "they become living examples for students"[9] of what it means to strive to become a complete and authentic person.

The teacher-student relationship at its best, then, is about inviting children to "please join me in practicing what I preach" and sharing with them our "thank you for challenging me to be the best person I can." It is about living with them in the classroom and creating there together the kind of community we would all want our greater society to be, and it is about collaborating with them in their learning to understand what will happen if we don't. It is about working to uncover the potential all of us have to be worthy and wise individuals, and it is about helping to overcome the alienation we feel when we fail to realize this potential fully. Thus, ultimately, the teacher-student relationship is about how we choose to care for one another, and that is why its character is so vital to the process of teaching and learning. The interaction between those who teach and those who learn is a microcosm of all human interaction, and so how educators treat both their subjects and their students will determine how the children do likewise. If we manipulate and deform, students will manipulate and deform; if we love and value, they will love and value. It's as simple as that.[10]

To Learn or Not to Learn

First day of class, and the girls were practicing writing problems and hypotheses on their own while I walked around the room using my seating chart to start to learn names.

Kiki, I said in my head, studying her briefly for her identifying features before shifting my attention to the next girl. *Emma…Whitney…Maggie*…

While I practiced names, I also moved from child to child, observing what their individual answers were, noting who was tackling the assignment faster, who was tackling it slower. When I could tell that most of them had completed the initial solo work, I moved on to the next stage.

"Okay, everyone." I interrupted. "Don't worry if you didn't quite get all five problems and hypotheses written; it's just practice at this point. What I would like you to do now is go around and have each person at your table share your problem and hypothesis for each of the scenarios and then as a group decide who wrote the best one for each scenario. And it might be that one person wrote a better problem but another person wrote a better hypothesis."

I paused. "Any clarification on what I'm asking you to do?" I said. There was a general shaking of heads. "Okay, then get started. I'm going to give you about 5 minutes for this part."

The room came alive with sound then, and I continued to walk with my chart, adding voices to my learning efforts. *Other Emma…Kylie…Christina*…

Keeping my eye on the clock, I eventually started pausing at each of the table groups and telling them, "I want your group to put your best problem and hypothesis for scenario 1 up on

that white board…" until all five groups had been assigned a specific one. I followed behind, putting a series of "plus" marks and "minus" marks next to their efforts.

Same classic mistakes, I thought. But then had to reminded myself, *but the mistakes are new to them.*

"All right," I said, once everyone was done. "We're going to start with problems first. I want you to look around the room at each of the ones you've written, and where there's a plus-sign, there is something good about how that group worded their problem. And where there's a minus-sign, there is something wrong with it's worded. Take five minutes in your group and see if you can figure out why I marked them the way I did."

Again, a chorus of voices filled the room, and I eavesdropped on their conversations, while continuing to keep an eye on the clock. Eventually, I caught their collective attention once more.

I walked over to a board heavy with minus-signs where a group had written, *Why won't Portia Porsche start?* "So what are the mistakes this group made when they wrote this one?" I asked.

A young woman with dark brown hair raised her hand. *Time to start practicing,* I told myself.

"Ladies, I'm going to try seeing how well I've learned your names so far." I said to them. "If I accidentally call you the wrong name, please simply correct me." I pointed at the raised hand. "Ella?"

She nodded. "Because they used the word 'why' in their question?" She responded.

"Good. And no pun intended, but why do we avoid 'why' when writing a scientific problem?" I asked them.

Another young woman with blonde hair raised her hand.

Searching my working memory, I pointed at her and said "Whitney?"

She shook her head. "I'm Lauren." She said.

"Lauren," I responded, deliberately saying her name aloud. "I will work to do better next time. What's your answer?"

"You can't test 'why'." She declared.

"Correct." I affirmed. "It's not that we aren't going to think 'why' in our heads, but we are going to need a 'what' or 'how' or 'Is' or some other kind of wording to a problem to enable us to know what we are actually going to test when we get ready to experiment."

I walked to the next board, and we continued the dialogue, with me getting about a third of the names right and correcting myself on the rest, until we had generated a set of rules for writing good scientific problems. Then I turned to the class.

"Folks, the mantra of this class is 'we learn from our mistakes'." I announced. "Let's see what you've learned. Use the rules you've generated and head back out to your whiteboards and fix those problems."

They scurried to their assigned boards, wiping away their first efforts and re-writing their problems. I followed behind again with my marker, pleased to see I was having to write fewer minus-marks. But their facial expressions told me they were disappointed that I was having to write any at all.

"Much better!" I said, walking to a board where a group had written, *What is the effect of temperature on a bird's feathers?* "But there is no such thing as perfection; there's always room to improve. What's not quite right about this one?" I asked, circling the word, "effect."

A tall girl on the far side of the room raised her hand.

"Meredith?" I said, and she nodded.

"It's kind of vague." She responded. "It doesn't really tell us anything about what we would observe about the bird."

"Excellent!" I replied. "Words like 'increase' or 'decrease'—something that indicates what we think the change is going to be are going to make our scientific problem more precise."

I moved to the next whiteboard, and again, we repeated the dialogue, adding a few more rules to our list. Then I sent them out to their whiteboards one last time to fix their work and nodded my head in satisfaction with the results.

"Okay, people. That's pretty good for now, and we need to move on to the hypotheses to figure out how to improve them." I said to them. "But this is a skill we will be practicing all year long, and you need to always remember: the learning never stops."

Limits Are What You Make Them

In her pivotal research on how individual understandings and beliefs about abilities influence how each of us learn, psychologist Carol Dweck has identified a component of human thought which she terms "mindset."[11] She argues that individuals can have either a "fixed-mindset" or a "growth-mindset" about any aspect of their life, and for those unfamiliar with Dweck's work, a fixed-mindset is the belief that a person's talents, skills, and abilities in a given area of learning are innately hard-wired into the brain, placing fundamental limits on what that individual can accomplish in that area. A person with this mindset thinks people are "born naturals" to do a task or they are not. A growth-mindset, on the other hand is the belief that someone can change and alter—"grow"—his, her, or their talents, skills, and abilities in a specific area of study through hard work and effort, removing limits on what said person can achieve in that field. A person with this mindset thinks people can always get better at a task.[12]

What is interesting and important for us as educators is that Dweck's research has "found that whatever mindset people have in a particular area will guide them in that area"[13] and that a person's mindset can actually vary from one area of endeavor to another; he, she, or they can believe they are a "natural" at one task, limiting their efforts, but be prepared to work hard to improve at another. Dweck has also found that individuals can change their mindset about any task or skill at any time in their lives; a mindset itself is never innate.

I share this brief summation of Dweck's work because I want to argue that the second critical thing it will take to achieve the kind of teaching and learning discussed in Chapters 4 and 5 in our classrooms is the creation of a growth-mindset culture in the work we do with **all** children. I believe that only by cultivating what has been termed the "yet sensibility"[14]—as in "I can't do twenty pushups…yet"—can we generate the resilience a student needs to keep "doing" a given subject until it has changed "how they live in the world," and I believe that only by empowering children with the determination to push through apparent limits can we help them create the futures they want for themselves.

But to establish a growth-mindset culture, we have to do something that has historically made the various stakeholders in education uncomfortable: we must establish genuine opportunities to fail at what we are asking students to do. There is no risk-taking where there are no actual risks, and we must challenge all students with problem-solving situations that take them out of their comfort zone. Indeed, our job is "not to prevent them from failing; it [is] to teach them how to learn from each failure, how to stare at their failures with unblinking honesty, how to confront exactly why they had messed up"[15] so that they can do it better the next time.

Only when we challenge them "to look deeply at their own mistakes, examine why they had made them, and think hard about what they might have done differently"[16] do we enable our students to change to become the individuals they want to be.

This is where the stress we spoke of in Chapter 3 comes into play, and it can demand some meticulous scaffolding to the challenges with which we confront our students to cause them to "bend but not break." But there is a tendency in our schools to set the bar too low rather than too high[17] –creating conditions where real failure seldom actually happens—and the consequent reinforcement of fixed-mindset habits this produces has resulted in "a workforce full of people who need constant reassurance and can't take criticism. Not a recipe for success in [life], where taking on challenges, showing persistence, and admitting and correcting mistakes are essential."[18]

In addition, the reinforcement of fixed-mindsets in our schools creates further difficulties for certain segments of our student population that are already under-represented in the dominant white patriarchy. Known as stereotype threat, it is the internalized message that certain groups of people are innately better or worse at a particular task ("born" to be good or bad at it), and in this fixed-mindset habit, "both positive and negative labels can mess with your mind. When you're given a positive label, you're afraid of losing it, and when you're hit with a negative label, you're afraid of deserving it."[19] Stereotype threat is why "almost anything that reminds you that you're black or female before taking a test in the subject you're supposed to be bad at will lower your test score"[20] –*unless* you have the cultivated growth-mindset to counteract it! Thus, if we want good teaching and learning in *all* our classrooms for *all* our students, we must employ a culture of growth-mindset in *all* our schools. Otherwise, we frankly harm tomorrow because as Dweck herself challenges: "*Great contributions to society are born of curiosity and deep understanding. If students no longer recognize and value deep learning, where will the great contributions of the future come from*?"[21]

The Next Generation

"Mr. Brock, I'm nervous!" said Katie.

I glanced over to where she was helping me set up lab stations for the workshop and tried to reassure her.

"You're going to do fine." I told her. I counted out another set of media plates and lay them on the table. I looked over at her again. "You've been studying your notes for your part of the presentation, right?"

She nodded from across the room. "But what if someone asks me a question I don't know the answer to?" She replied.

I gazed around the conference room of the hotel to make a quick inventory of the supplies at each station and headed back toward the podium.

"Katie, it's not like I'm leaving the room while you give your portion of the presentation." I said as I collected more supplies for the lab stations. "I'll still be here to help you out if you need it."

I studied the box in my hand and then looked over at where she was still counting out plates. "Have you set out all the pipettes yet?" I asked her.

She shook her head. "Only the ones for the sterile water." She answered. "Each place still needs the ones for the dilutions and plating."

I murmured understanding and started to count out disposable pipettes. Walking around to each workstation, I tried to encourage her some more.

"Just remember that it's *your* protocol you're teaching people." I told her. "I doubt very much that anyone's going to ask something that you haven't had to think about already for yourself."

She still didn't look very convinced. But as she finished distributing the last of her plates, she didn't hesitate about going back to the supply box and getting the next item on the materials list to pass out.

We worked in silence then, and pretty soon all ten lab stations were ready to go.

"What do you want me to do now?" She asked, fidgeting a bit.

I scrutinized the room once more and then glanced back and forth between the supply box and the computer screen.

"Why don't you double check each station one last time to make sure they all have the necessary supplies." I told her. "Then go get yourself a glass of water to keep next you and try to relax. You're going to be great!"

"Yeah, right, Mr. Brock." She replied.

She began to turn and then stopped.

"Do you really think we need this many stations?" She asked, nervously.

I looked up at her and answered. "Katie, we have the mid-morning slot on the Friday of the convention. It's the prime time when the maximum number of people will be going to sessions all weekend. I hope we have *enough* stuff."

She glowered as she walked away. "Are you *trying* to frighten me, Mr. Brock?"

I had to suppress a chuckle as I watched her go. We had worked together as teacher and student for a long time, everything from classes to co-publishing to working as one of my teaching assistants in my summer research internship. If there was anyone I trusted to be up to the task of co-presenting a workshop at the national science teachers convention, it was Katie. She would be as poised as an old pro when the time came; she always was.

I turned my attention back to the computer, bringing up both the power point and the project web sites, and then clicked rapidly through the presentation's pages to refresh my own memory. I was doing the introduction and protozoa; Katie was doing bacteria and fungi. I wanted to be sure I had a sense of how I wanted to transition one from the other.

"Everything's in place." Katie told me as she returned to the front of the room. "And I went ahead and passed out the instruction sheet now that people are starting to come in."

She gestured toward the door at the rear of the room.

"Okay!" I replied and moved the mouse quickly to project the title slide. The screen filled with our "Little Things" motif, and I stretched to unkink. "Ready?" I asked her.

She swallowed and nodded.

"Then feel free to wait over with our stuff if you want." I said, pointing toward the table where we had our extra materials organized. "I know how awkward it feels to have a room full of people staring at you in silence, waiting for you to begin; so I understand if you want to sit off to the side until I introduce you."

She nodded nervously again and went to take a seat.

I noticed that a few people were starting to flip through the instruction packets at the lab stations and that others were clearly scanning the room looking for the pile of handouts. Nope folks, I thought; I do things a little differently.

Waiting until precisely our appointed starting time, I exchanged a quick look of 'ready to go?' with Katie and started the workshop.

"Good morning everyone!" I announced. "I'd like to welcome you all to our workshop today on soil ecology. My name is David Brock, and this is my colleague, Katie Loya." I paused to let her wave shyly at the crowd and then continued. "I'm also proud to say that she is a former student of mine, and together, we're both going to be showing you this morning how to study soil microbes and their ecological roles in your classes."

I paused and clicked on the first slide.

"Because I'm a devout believer that not just our students learn best by doing," I told them, "you're all actually going to be practicing the protocols we show you today for yourselves. So for those of you just coming in or for those of you who didn't take a seat near one of the piles of materials, you'll want to take a moment and relocate yourself so that you're next to a lab station."

I gave people time to move and waited for the inevitable hand in the air.

"Do you have any more handouts?" asked a gentleman toward the front.

"Actually, no." I replied. "We've only put a handful of handouts at each workstation for people to share as you follow along with the instructions we'll be putting up on the screen. Everything you will be learning today is available to download free off our website–including this presentation."

I shrugged and smiled.

"We figure if we're teaching environmental science, then wiping out a forest of trees for photocopies sort of sends a mixed message." I said. "Besides, if you're like me when you go to one of these things, you want to be able to reformat everything for your own students anyway. So we simply provide everything to download so that folks can cut and paste to their heart's desire."

I paused to let that announcement actually sink in, and as usual, I saw a mixture of reactions: smiles and nods of approval and understanding from some; frowns and looks of annoyance from others. The latter, I knew from long experience, would never have used anything we were presenting anyway. They were the rabid gatherers of "handouts for the files"–the teachers who go through conventions as if somehow merely collecting the ideas of others made them a better educator. But with the nodders, there was hope because I knew good teachers will work for an idea—fight even—to make it theirs. Those were the people I was really trying to reach here today.

Thinking about all the trees I had just saved, I clicked on the first slide and began "When studying soil microbes, there are essentially four key steps you'll be performing today...."

Practicing What We Preach

Perhaps *the* key challenge to incorporating the kind of teaching and learning discussed in Chapters 4 and 5 into our schools is that we don't employ them in the actual teacher training process itself. In spite of the fact that we already know "what conditions we can devise so that all humans *will* learn,"[22] lecturing still remains the dominant pedagogy in both teacher colleges and at educational conferences, and this passive approach where an instructor talks while others listen–what Roland Barth calls the "sit 'n' git" (as in sit down and get some knowledge)[23]–is then incorporated into the trainees own teaching because "it's how *they* learned."[24]

The "sit 'n' git," though, assumes that our knowledge of the universe consists of a set of propositions for transmitting and receiving like a radio broadcast, and as we have seen throughout this book, that epistemological assumption is a false one. Genuine knowledge, you will recall, can only come from entering into community with the universe's web of relationships, and because "there can be no community when one person is talking all the time and the rest are presumed to be listening,"[25] the "sit 'n' git" can't teach anyone anything. As Barth summarizes well when recounting finding a box full of:

> *all my notes from four years of college, along with syllabi and final examinations…I opened up the box and took out some folders. Despite three-hour lectures for sixteen weeks each, I couldn't even remember* ***taking*** *many of these courses. I then administered myself a couple of final exams. I'd have been very happy to settle for 0.5 percent retention. I found none*.[26]

Hence, because most teachers are themselves trained using a fundamentally flawed method of instruction, their own instructing regularly reflects this fact, and since the majority of professional development that follows during the rest of their careers usually involves one "sit 'n' git" after another, little ever changes. Indeed, research has shown that only 1% of the continuing professional development in this country is of high quality,[27] and because bad epistemology begets bad teaching—*telling* people how to get the kids in their classrooms *doing* is a self-contradiction—the way we instruct educators in their craft just reinforces the teacher-centered classroom.

What we now know is that if we want teachers producing genuine learning, they must actively engage in the process of student-centered teaching, and since teachers are no different than students—they learn best by doing—the only way to learn how to teach in a student-centered fashion is to do exactly that.[28] Therefore, what we need in our schools are systemic mentoring programs where experienced already authentically engaged educators work with those entering the profession to demonstrate how to craft student-centered instruction and provide the opportunity for new teachers to practice such lessons under their mentor's watchful eye. New teachers "need to have an idea of what quality work looks like, have time to practice and work toward it, and take ownership of their next learning steps"[29] if we want to empower them to become authentically engaged educators themselves.

But that takes time and resources, and to do it well takes a *lot* of time and resources. I know. I was once blessed to mentor a former student of mine into the profession who was totally new to teaching, and it was an amazing experience to uncover and unpack all the skills and habits I now did almost instinctively and hold them up for reflection. But the process also took nearly an hour of meeting time every single day of the work week and a few weekend afternoons that year, and while I did it without pay out of love for my former student, that is not a realistic model for the kind of truly systemic change in teacher training our schools so desperately need if we are going to have effective teaching and learning for every child. I will return to the issue of investment in education in Part III of this project, but for now I will put it bluntly: if we want good teaching, it is going to cost.

However, there is an alternative cost as well, and we are already paying it. Our society has clung now for decades to a dysfunctional approach to education that has "lost sight of the basic purposes of schooling, and of the high expectations and disciplined effort needed to attain them. [More than a generation of children have passed through schools] eroded by a rising tide of mediocrity,"[30] and yet here we are billions of dollars in so-called reform later and "most of America's high school students are [still] not ready for either college or work."[31] "Every school

claims to teach its students to think, but few do,"[32] and so we find ourselves in the very crisis this project is seeking to address. Put simply, we have collectively failed as a nation to provide the kind of schooling our children need to engage in the effective learning they will need for their lives. Consequentially, we are actively risking denying them a future, and therefore, I ask us as a society: which cost do we really want to pay?

Part III: “Hier blieb ich...”

I the Lord have spoken; the time is coming, I will act.
I will not refrain, I will not spare, I will not relent.
According to your ways and your doings
I will judge you, says the Lord God.
Ezekiel 24:14

If we already know what good teaching and learning look like, why aren’t we engaging in them already in our schools? How have systemic socio-economic structures contributed to the crisis facing education today? What forces are thwarting the reforms we now have evidence truly work? In other words, as the cliché goes: “what’s wrong with this picture?”

That is the central topic we will examine in this final section of the project, and while the list of potential answers could fill a library, we will focus on what I believe are the three most significant ones: our society’s inadequate investment in our children (Chapter 7); the danger true educational reform presents to our existing social order (Chapter 8); and the impact of the technological revolution on our brains (Chapter 9).

Chapter 7: No Greater Love–the Vital Need for Authentic Engagement

Be careful what you give children,
for sooner or later you are sure to get it back.
–Barbara Kingsolver

If you are here unfaithfully with us,
you are causing terrible damage.
–Jalal Al-Din Rumi

Not Their Fault[1]

I sat across from Brooke in my classroom, talking as we often had that year, when she abruptly blurted out that she had finally shared her secret with her mother.

"Did I tell you? I finally told my mom." Brooke said.

"What did you tell her?" I asked, having a pretty good idea.

"Everything!" She gestured wildly. "We were in the car riding home from school yesterday, and I told her about how I had thought about killing myself and the stuff with my dad and how I hate my life and the night that I went with my friend over to that boy's house when I wasn't supposed to and how I normally never do stuff like; so why doesn't she trust me.... Everything; I told her everything we've talked about."

As usual, it all came pouring out in one emotional torrent, and I had to fight to keep my expression neutral. Having received more than a few of Brooke's intense outpourings myself, I could imagine the scene in the car, and for a moment, I could feel a tiny speck of actual empathy for her mother. But only for a moment.

"So what happened after you told her?" I asked, keeping my tone as impartial as possible.

"Well, at first she just sat there in silence." Brooke replied, agitated, and I nodded. "That's a pretty big revelation to hear." I told her.

"But then she started screaming at me!" Brooke shouted. "Yelling at me about how I'm such a thoughtless and selfish person and it's no wonder I don't have any real friends and how I should be grateful for all the opportunities and privileges I have and why don't I try to be a better person like my sister is...." Her voice trailed off, and she just looked despondent.

As usual, I wanted to eviscerate the damn woman for not loving this child like she should, but what Brooke said next horrified me more.

"I mean I know she's right." Brooke continued, shaking her head and staring off into space. "I'm a selfish bitch. I gripe and complain all the time, and there's all these people who have it so much worse than I do, and I should be grateful for what I have, and...."

I quietly but firmly interrupted.

"Brooke. Stop." I insisted.

She complied but fidgeted silently in her chair. I waited, looking directly at her until she finally stopped and looked directly back at me. I spoke slowly and carefully.

"Do you understand that it is not your fault?" I asked her.

"Mmm?" She mumbled, looking puzzled.

"The way your mother treats you." I stated. "It's not your fault. You have done absolutely nothing to deserve her or anyone else's abuse."

Brooke looked shocked. "My mom doesn't abuse me, Mr. Brock!" She protested.

I tried but couldn't quite prevent the harsh and bitter laugh that escaped my throat.

"Brooke, some of the things you've told me your mom has done make me want to shudder." I told her truthfully. "If we lived in a society that recognized emotional abuse the same way we recognize physical or sexual abuse, I would have hot-lined her six months ago."

She looked stunned, and we both sat in silence while she digested what I'd said.

"She just attacked me." She finally said, a growing sense of realization in her eyes. "I tell my mom that I almost kill myself two years ago and how much pain I'm in, and she screams at me about what a bad person I am."

I could see the anger welling up in her and simply waited.

"Why didn't she pull the car over yesterday?" Brooke suddenly demanded, gesturing wildly again. "Wouldn't you have? How could she keep driving after what I told her?"

She got up and started to pace.

"She didn't even slow down!" Brooke exclaimed bitterly. "Just glanced at me in the mirror and started yelling."

Tears started to well up in her eyes as she stopped to watch my reaction to what she was saying, and then the proverbial damn broke.

"I'm telling her that I've thought about killing myself and how much I hate my life, and she acts like we're just driving home like any other day!" She screamed. "God damn it, Mr. Brock, your mother is supposed to love you! My mom is supposed to love *ME!*!"

She sobbed and collapsed back into her chair.

"How could she love me and treat me the way she does?" Brooke wailed. "Why can't she ever compliment me? Why does she always have to put me down and tell me what a horrible person I am?" She looked up at the ceiling and cursed. *"Damn you! Why doesn't she love me?!* Why did you create me just to punish me all the time? What did I ever do to deserve such a shitty life?!"

She just buried her head in her arms then and bawled. I got up from where I was sitting to walk around the table and gently rested my hand on her shoulder.

As I had throughout that year, I felt again completely in over my head; so I simply let her weep. I had tried repeatedly to convince Brooke that it would be better if she were talking to a professional therapist and not her teacher, but while all the appropriate people at school knew–had in fact been told by Brooke herself with my encouragement–she seemed to refuse to talk with anyone but me. My principal and the school psychologist kept pointing out that that meant that she was at least talking. But as I listened because I cared, I also knew–because I cared–that the someone who should be listening should maybe be someone better at this than me.

Finally, the tears came to an end, and Brooke sniffled and lifted her head.

"God, I hate doing that in front of other people." She said.

"Yes, you've told me that before." I replied, smiling ever so slightly. "Every other time." I patted her shoulder once and walked back around to my seat. "You clearly, though, have a need to cry." I told her seriously. "And you obviously trust me enough to do it around me, or you wouldn't keep coming back and doing it."

Brooke glowered at the truth but nodded. She continued to sniffle and looked around for something to blow her nose.

I got up to go get the box of tissues, and because we had the kind of relationship where I could, I gently teased. "You'd think after all this time, I would know to just go get this."

She snorted and gave me a "ha, ha" look and blew her nose. As she did so, I looked her right in the eyes and told her, "Don't ever be ashamed to cry, Brooke. Crying is how we get the

hurt out and start to heal and to get better. And from everything you've told me, you have a lot of hurting to get out."

I took my seat again and studied how she was doing. She looked back and asked, despondently "Why doesn't my mom love me like she's supposed to, Mr. Brock?"

I studied her some more and shook my head.

"I don't know, Brooke." I answered truthfully. "Perhaps she can't because of issues of her own; perhaps she doesn't know how; perhaps no one's ever loved her like she was supposed to be."

Her eyes widened a little at that, as I'm sure she thought about her father.

"What I'm just challenging you to see," I told her. "Is that love is not something you earn. It is a gift people give to us freely or not at all."

She looked quizzical, and I continued.

"The way your mom treats you now." I said. "And the way your dad used to is not a loving way to treat anyone. But it is also not something you did anything to 'earn.' You're not being punished simply for being you–even though I know from my own childhood how much it can feel that way sometimes."

She nodded in understanding, even if I wasn't sure she believed me, and I paused, then, to emphasize my words.

"Remember, Brooke, no one ever '*deserves*' how your family has treated you over the years and the kind of emotional pain you have endured. It...is...not...your...fault. And the good person you are must always remember that."

She sniffled. "But it's hard to do that when your mother is screaming at you." She said.

"Yes," I answered. "But the only way you'll stop screaming at yourself is if you try."

A Broken Vision

From its very beginning, I have known two entwined truths during my career that haunt me always and that my relationship with Brooke came to epitomize. The first is the validity of education's old truism that the quality of learning is directly proportional to a society's commitment to it–that where children know the adults in their lives are truly invested in them, they really *will* strive to rise to the highest of our expectations. As psychologist Lisa Damour puts it, "the most powerful force for good in a young person's life is having a caring, working relationship with at least one loving adult."[2]

But the second ugly truth I have learned is that ours is arguably the most child *unfriendly* culture in the modern world. When it comes to our investment in them, we declare quite clearly to our children just how important we really think they are: entertainment, consumerism, and self-aggrandizement–these are the 'gods' of *our* communities, and because they are about "me" and "now" while students and learning are about "thou" and "someday" (not exactly commensurable sets of ideas), the children in our society learn quickly just how valuable they truly are to the adults in their lives.

Look merely at how we prioritize our economic (let alone other) resources with respect to education. I could, of course, cite statistics on athlete salaries versus state education budgets, but I would rather make it more personal. At one of the first schools where I once taught, the annual budget for science in the early 1990s was $8,000 for 1,275 students–which sounds like a lot until broken down to $6.27 per child for the supplies needed to run our entire curriculum for the whole year. That's right: $6.27 or three *cents* per child per day to purchase such "exotic" items as

gumdrops and toothpicks to build molecular models ($3.50 in 1995 dollars for a single class period in a six-period day). Compare that expense with the $8 a typical movie ticket cost at that time, and in *one evening*, a family of four would spend enough money (not counting concession costs!) to have financed *five!* additional students at that school. When I think of how many students that hypothetical family's monthly cable bill could have afforded back then, I wince.

Nor have things gotten better. Even as I write these words, the governor of my state is actively raising so-called "dark money" to fight the potential implementation of the educational reforms recommended by a commission he first actively supported—simply because it would involve the necessity to raise taxes. In spite of headlines that the 2019 public school ratings for the state show a further slide toward mediocrity, the leader of one of the wealthiest states in America has declared "war" on what he is calling the "Kirwan Tax Hike Commission," and while the majority of Marylanders polled say they support additional taxes for education, I am either cynical enough or realistic enough to wonder what their response would be if informed that better schools might cost them their Netflix subscription.[3] Even in the private sector of education where I have most recently worked, I had to rely on getting grants whenever I wanted to fund something truly state-of-the-art, and the bottom line is that the funding levels for education tell our children loud and clear what we think of them.

Money, though, is not the only coinage we don't seem to want to expend on education: we don't seem to want to make the necessary sacrifices to parent them either. It can be as simple as disrupting a child's learning by taking him or her out of school for a family vacation that doesn't coincide with a scheduled break simply because it's more convenient for the adults. Or it can be as dramatic as unapologetically instigating legal action against a school for "daring" to punish self-admitted behavior such as cheating or downloading pornography off the school server.[4] But from one extreme of the parental behavior spectrum in our current culture to the other, "the supports vital to child development are in sharp decline"[5] in today's society.

Moreover, drastic changes in technology since I first started working on this project have only made it worse. Today, "teenagers complain that parents don't look up from their phones at dinner,"[6] and "children describe in almost identical ways a sense that their parents are virtually missing in action."[7] Distracted supervision has actually put children at risk of physical injury, and "tech-centered parenting can look and feel to a child like having a narcissistic parent or an emotionally absent, psychologically neglectful one."[8] Put simply, parental support for child development is not just in decline; we now have a society potentially "growing into a world that no longer protects childhood"[9] at all.

Quite rightly, then, do educational sociologists declare that "schools as theater [merely] reveal–in bold relief–the dissonance between...our societal claims that 'children are our most precious resource' and what we are actually willing to expend and sacrifice in order to assure their [successful maturation]."[10] Furthermore, "if it takes a village to raise a child, [then] our children are knocking on a lot of doors where nobody seems to be [at] home, [and indeed, too many of education's so-called stakeholders seem to] regard children as a sort of toxic-waste product: a necessary evil."[11]

A necessary evil. Every time I reread these words I want to weep. They are words that should plague our very souls–especially those of us in schools where the threat of this broken and distorted vision entering our classrooms and our interactions with children is all too real. Students are already "marginalized people in our society...told that they have no experience worth having, no voice worth speaking, no future of any note, no significant role to play,"[12] and in the daily demands and power hierarchies of the classroom, it can be tempting to maintain this

peripheral status. The pressure to prepare kids for state tests and AP exams…the rush to cover the curriculum...the challenges of differentiated instruction in an increasingly heterogeneous society...even the natural estrangement that can arise from generational differences can all cause the most dedicated and caring teachers to start devaluing and distancing themselves from their students, treating them like obstacles to overcome rather than opportunities to share a journey. As a former student of mine once wrote on her end-of-year evaluation, "*most* teachers...only want to be doing other things and this shows through in their classes they teach." While I have worked in education too long not to recognize how unduly skewed my ex-student's comment likely is, the very fact that she could describe her twelve years of educational experience in this way at all should be a "wake up call" to us all.

Good Soil

"…which brings us back to the original question," said Amy, holding up her demonstration once more for the class to see. "Is it baking soda or the vinegar that is the limiting reactant in this beaker?"

Several hands went up, and she called on the very first one. I made a note to speak with her later about wait time.

"Audrey?" She said.

"The vinegar." A girl in the front row replied confidently.

"Good." Amy responded. "And what is your evidence?"

Audrey's was not the only abruptly puzzled expression in the class. But she gamely offered a more hesitant response.

"The calculation told me so?" She half-asked, half-declared.

Amy shook her head. "No, I mean what actual evidence do you have." She stated, pointing at the beaker.

Again, the response was hesitant. "The inflated glove?"

"No." Amy replied, lifting up the beaker again. "See the white powder left at the bottom? That is the remaining baking soda. If the limiting reactant had been it, we wouldn't be able to see anything at the bottom; it would've all been consumed in the reaction."

It was clear from the mixture of expressions that some were getting it and others were not.

"Mrs. Popp?" asked one of the girls in the rear of the room. "Why does that show it's the vinegar that's the limiting reactant? I mean, I can still see the vinegar in the beaker."

Amy did a good impression of someone trying to nod and shake their head at the same time. It was clear she now grasped the source of the confusion.

"No." She replied. "What you are seeing in the beaker is simply the liquid solution left after the acetic acid in it had completely reacted." She paused, and I could tell she was taking stock of the time left. "I can tell that we still have a little confusion about limiting reactants, but we're at the end of class; so we'll come back to this next time."

She dismissed them, then, after reminding the class about their homework, and I stood up from where I had been completing my formal observation at the back of the lab and walked up to her desk.

"Nice lesson," I told her. "I liked the glove over the mouth of the beaker to capture the CO_2. That was a nice touch."

"Thanks." She replied. "But the demonstration obviously didn't work for everyone as well as I had hoped."

"Actually, while we'll sit down later at your next evaluation meeting to go over my formal feedback," I said. "I have a suggestion right now about how to improve that demo that you could use in your very next class."

Amy looked intrigued, and I continued.

"Have you ever thought of turning your demo into an investigation?" I asked her.

"How could you even do that?" She asked, puzzled but clearly open to the idea.

I motioned for us to walk over to a lab bench.

"Look, you're already having them do the calculations, right?" I said, setting out three beakers. "Let's say you have three set-ups, each with the same amount of vinegar and then give them three different amounts of the baking soda. One where you know all the baking soda will be consumed; one where you know all the acetic acid will be consumed; and one right there on the middle."

"But that's basically what I have up there on the desk." Amy replied. "How is what you're describing any different?"

"The difference is that each lab group has their own set of beakers." I told her. "And instead of having them do the calculations afterwards, you have them do them before they add the baking soda amounts to the different beakers."

I quickly poured roughly the same amount of vinegar into the three beakers, and then used three weigh boats to estimate a low, medium, and high amount of baking soda. I turned to her.

"Based on their calculations and their initial understanding of limiting reactants," I said. "you then have them make predictions about what they will observe in the three beakers after they add the baking soda. You could even have them use pH strips before and after to see how the acidity changes."

Amy looked excited. "I could even have them predict which one would produce the most carbon dioxide by how much the glove inflates!"

I nodded. "In fact, you could have them line the beakers up based on which glove they think is going to feel the least puffy to most puffy when squeezed." I replied. "You can't quantify the gas production with the gloves, but you would certainly feel a qualitative difference."

Amy started to smile and nod vigorously, but her expression abruptly turned to one of concern.

"But won't this take a lot longer to teach it this way?" She asked.

I paused to consider my response.

"Yes and no." I answered. "Yes, it probably will take a little more class time to do this as a lab activity rather than a demonstration. But no, think about how much additional time you are already now going to be having to devote next class to clearing up their confusion. Which, by the way, I could tell you clearly picked up on."

She dimpled at the compliment, but it was clear from her expression that she was both very intrigued but still slightly anxious about my suggestion.

"Look, this was your first section covering this topic, correct?" I stated.

"Yes, the other two classes don't get this material until tomorrow." She replied.

"Then try it out with them and see what happens." I recommended. "The worst that happens is that it doesn't quite work out, and since you are already going to have to devote more time on this topic to today's class, you're not risking putting the other two sections behind."

"Which would keep everyone on target for the next test." She said aloud to herself.

"And if it *does* work out," I told her. "You have a cool new lab activity where they are doing the thinking, not you."

Okay," Amy agreed, starting to get that look she has when the mental gears start spinning. "It gives me tonight to figure out how much baking soda for them to measure out for each beaker, and I can have them make their own data tables this first time…."

"I will leave you to it." I said. "And like I said, we'll go over the rest of the feedback at the evaluation meeting. I'm afraid I need to run to get ready for my own class."

I headed off for AP Biology, then, leaving Amy murmuring to herself, knowing I had planted a seed in good soil.

It's Not Just the Parents

While I am confident that a child-unfriendly culture has indeed played a role in sabotaging efforts at the kind of educational reform discussed in this project, I also do not want to overstate its power and influence. Underfunded schools and parental neglect may be impediments to the *effectiveness* of the kinds of teaching methods an authentically engaged educator employs. But they have not been automatic impediments to *instituting* these more effective methods. The simple truth is that the characteristics of our individualist-centered society are not likely to change anytime soon, and though they may hinder good teaching and learning from taking place in our schools, they do not have the power to prevent it from happening at all.

What, then, has been preventing it? Unfortunately, here is where we as educators have also regularly failed to invest adequately in our children's collective lives. One of the dangers in this profession is that when we close the door at the start of every class, it is just us and the kids—for a job where you basically extrovert for a living, teaching is one of the most isolated activities there is. But isolation, as we have seen time and again, is the very antithesis of good teaching and learning. Therefore, it is not enough simply for us to be more authentically engaged with just our own students; we must work together to be more authentically engaged with *every* student.

Parker Palmer puts it well when he says "if I care about teaching, I must care not only for my students and my subject but also for the conditions, inner and outer, that bear on the work teachers do."[13] For those in education already striving to be authentically engaged teachers, changing only "my" classroom is not enough. We must seek to help change every classroom to create the conditions where children will learn, and we must change every teacher's outlook on what those conditions are. Every educator in this country needs to be investing as much in the educational welfare of all students as they are in their own, and they need to be risking "what is familiar, comfortable, safe, and perhaps working well for [them] in the name of better education for others."[14] Only then can we hope to prevent the current downward spiral that our society seems hell bent on riding to the bottom, and only then can our children have what they will need to try to build meaningful tomorrows.

However, we can only make these necessary changes if all of us in this profession help each other strive for as much authentic engagement in our profession as we do in our classroom.

My colleague, Amy, would go on to develop her lesson into one of the most sophisticated intellectual challenges students in my former school's chemistry program tackle; I have been pestering her for ten years to publish it. And I have done so because good teachers need to be writing articles for journals and leading workshops in their districts. They need to be properly mentoring those who are new to teaching and challenging those who are not. They need to be confronting the hypocrisy of a society that–one way or another–actually leaves every child behind, and they need to be fighting the mindless banality that so often passes for educational policy in this country. Without such effective teacher leaders—people committed to authentic engagement in the profession, not just the classroom—schools and learning will remain stuck in their present broken rut, and our entire society will eventually pay the consequences.

Not Good Enough[15]

Things had started out badly and were rapidly growing worse.

"What excuse do you have for yourself this time?!" Lily's mother all but screamed across the table.

"But mom…" came Lily's plaintive response.

"These grades are absolutely inexcusable! I do not pay over $20,000 a year for you to earn Cs!" Her mom shouted.

"But mom…" Lily continued to reply.

"You are grounded." She declared. "And until you get serious about studying, I am revoking all cell-phone privileges."

"But MOM…" Lily pleaded yet again.

"Young lady, do you understand that no college or university is EVER going to look at you with grades like these?!" Her mom continued to shout. "And you are not a good enough athlete like I was to take that route! No coach is ever going to look at someone your size…."

Lily started to tear up, and I held up my hand for attention. It was always a balancing act with an irrational parent between letting them vent enough that they might finally listening and helping my advisee feel safe. Both, I knew, were forms of protection.

"Mrs. Turner," I said. "I think we need to step back for a moment."

Her mom made a deliberate effort to control herself and merely glared at me. Inside my head, I took a metaphorical deep breath.

"First, as an experienced ninth grade advisor, I need to provide some perspective. The adjustment to high school is a challenging one, and this is a solid first quarter report card." I told her.

"How can you possibly say that?" She demanded

"Mrs. Turner," I replied. "Nearly every single one of Lily's grades is a solid B or better. She has only one grade in the 70s, and that's in my class; we'll get to that in a moment. She is doing solid work in every single one of her other classes, and the first quarter grades are simply progress reports; she has all of second quarter to work on improvement."

Mom was not satisfied. "What about so many of her teachers commenting about late and unfinished homework?" She insisted.

I turned to look at my advisee. "Lily and I have discussed what her teachers have said." I replied. "And we have created a plan for how to address this issue." I nodded toward my advisee and continued. "Lily, you and I agreed that you would be the one to share; so please tell your mother what we've come up with."

Lily took an audible breath, and her voice quavered a bit. But she got it out.

"Mr. Brock agrees with me that I'm not using my study halls well." She said. "My study halls are all in the lecture hall where it's easy for me and my friends to distract each other without the proctor noticing."

She paused to take another deep breath, and I gave her a look of encouragement.

"So I'm going to get a study hall pass from Mr. Brock each time so that I can work in the science prep room where I won't get distracted." She finished.

Lily's mom's mouth started to open in what was clearly going to be a protest, and I deliberately interrupted.

"Having her in the prep room allows me to have some direct oversight to see that Lily is managing her time well." I stated. "And we have both agreed that as long as her grades improve by semester's end that we'll then begin to cut back on how often she works in the prep room. Next year, she won't have study halls; she'll have free periods, and so we will need to start helping her work on her own self-management skills."

Mom frowned, but I could tell from the rest of her expression that we had closed this specific Pandora's box.

"What about biology, then?" She barked.

It was my turn to want to take an audible breath, and I had to fight the urge. I glanced over at Lily, and she gave me a shy nod of understanding. The two of us had talked extensively about it, and I could almost see the thought-bubble above her head: "Go ahead; I'm ready."

"Mrs. Turner," I began. "Lily and I have discussed her progress in my class, and we have both come to the agreement that the pace in Honors Biology is something Lily's not quite ready to tackle just yet."

"What do you mean?" Her mom insisted suspiciously.

"I mean," I replied. "That Lily's abstract reasoning skills are not yet as fully developed as some of her peers, and what is best for her is to place her in an educational environment where she can better practice developing them. We need to transfer Lily into standard Biology."

With some deliberate mindfulness, I prepared myself for the response.

"So you're too stupid for honor's science, Lily? Is that it?" Her mother attacked. "Or are you just too lazy? God! Do you **know** what this will do to your college admission chances?!..."

It was clear there was more coming; so I again used my hand to intervene and stop the conversation before continuing the conference.

"Mrs. Turner, my job as an educator is to maximize the learning opportunity for every child in our science program." I told her. "Lily's brain is still in the process of wiring itself, and I would be professionally negligent not to provide her with the learning environment that best matches where she is currently at in that wiring process."

Her mom started to speak, and again, I deliberately interrupted.

"In addition, brain's wire at different rates." I asserted. "It is why we do not track students in our science program; a brain that needs our standard Biology class this year may demonstrate the growth by year's end that means it is ready for Honors Physics next."

I put on my serious 'firm-but-fair' expression and slowed down my cadence.

"It…is…about…optimizing…the learning environment…for the child." I resolutely told her.

Mom frowned at her daughter, but at least there was no verbal attack in response.

I caught her mom's attention again. "Furthermore," I told her. "Since college is clearly so important to you, I can tell you from firsthand knowledge as someone who once worked for

the admission's office of my alma mater, a solid B in standard Biology is going to look a heck of a lot better on Lily's transcript than a C in Honors Biology is."

Sadly, that shut Mom up, and the expression on her face told me that we had at least closed Pandora's box number two, even if we hadn't quite locked it.

The rest of the conference involved practical stuff about what to expect during the coming academic year, and so the remaining conversation was less emotionally charged. But as we all stood up for mother and daughter to leave at its conclusion and I watched them go down the hallway together, all I could do was pray: *Please Lord, don't let that car ride home be a long one.*

"Technically Sophisticated and Highly Skilled Barbarians"

One of the most significant ways we devalue children in this society is our preoccupation with form over substance in our schools. Frequently treating students as pawns for institutions to manipulate to achieve a certain look is the ultimate in dehumanization because it tells a child that she, he, or they is not a worthwhile (or sometimes even a literal!) person until he, she, or they conforms (or should we say deforms?) to preconceived standard for what it means to be human. Thus, as our culture continues to maintain its lack of investment in our children, we don't just discount students as second-class citizens in our educational systems; we regularly don't even treat them as people.

But that's criminal and we all know it. Our children *need* us to transform how we treat them, and that is why I insist that we *need* more authentic engagement from our teachers than we presently have in so many of our schools. I believe that only teachers who join *with* their students as *equal co-participants* in the dialogue of learning can help children fulfill and complete their true natures because only educators who treat the encounter with the world as a "Thou" instead of an "It"[16] can show children how to enter into that eternal conversation with the "Other" out of which all real identity emerges.[17] It is the only way to stop debasing our children: recognizing them as peers in the journey to become fully human and collaborating together to help them all achieve it.

Yet, whenever I say that, my inner skeptic keeps re-emerging, wanting to know what my obsession is with all this existential "crap." Why, for instance, is mastering a specified body of factual knowledge not enough? What's so wrong with teaching children to conform to and comply with certain socially valued and accepted modes of thought and behavior? Why does the quality of the teacher matter more than what gets taught? After all, my skeptic reminds me, never forget "Mrs. Stillman," the veteran teacher who declared that "most kids we teach are worthless, indecent halfwits." Her students probably actively disliked her, but they certainly heeded her well enough to learn the history they needed to pass the state test and graduate. Indeed, my skeptic argues, entire generations have gone successfully through her classroom and thousands like hers without the suburbs all burning down in some apocalyptic Götterdämmerung. How can I possibly claim that education actually *needs* what I have described in this project in order to fight the perilous way our society discounts the value of its children?

Part of my response, of course, we have already seen: that the reason for all this existential "stuff" is that without it, truly successful teaching and learning are quite literally not possible. However, I'm too much the rationalist not to acknowledge that just because the educational process must happen a certain way to be truly authentic does not automatically imply that we need to engage in it that way. Thus, unless I can convince both my skeptic and everyone

else that there is an actual *need* for this kind of genuine teaching and learning–a *need* for why all of us should be investing more in our children and their education–then there is no compelling reason to change what we do in schools. My counsels so far can then be dismissed as inventive fiction, and we can keep walking the dysfunctional pedagogical pathways we always have–the blind leading the blind forever.

However, history documents well what follows when that happens, and in fact, it is the lessons out of history that can show us precisely why we *need* to engage in teaching and learning in the way I have described. The dangers of falling into a "pit" may seem self-evident, but what has not always been as noticeable to many in education is the role schooling can play in creating the "pit" in the first place. The late 19th and early 20th centuries, for instance, saw the rise to prominence of one of the most successful educational systems of the modern era–the German universities. Considered the pinnacles of their day, places like Munich, Frankfurt, Marburg, Göttingen, and Berlin produced some of the greatest minds of a generation. Men and women such as Gödel, Husserl, Brecht, and Noether went on to revolutionize their respective intellectual fields, and by the 1930s, the rigorous analytical so-called "scientific" or reductionist approach the German schools applied to scholarship and teaching had become synonymous with academic excellence.

Yet, at the same time this "superior" system was nurturing a Thomas Mann, it was also cultivating a Joseph Goebbels, an Adolf Eichmann, and a Rudolf Hess. The educational system that gave us Einstein also gave us Nazi Germany, and the reason why it did so is precisely the reason why I believe there is an actual *need* for authentic engagement from our teachers in our schools. Whenever we reduce learning as the German pedagogy did to mastering a set of abstractions and the necessary skills to manipulate them, we always run the risk of generating a belief in the thing-like character of reality and the consequent loss of any sense of accountability which this belief brings with it.

Children exposed to such a strictly "objective" approach to education do not develop an appreciation and understanding of their interdependent participation in the universe's unfolding. Instead, they come to value whatever is in their lives only in terms of how successfully they can exploit and control these "things" to satisfy their individual needs and wants. Students taught this way then "downsize [reality] to the limited scale of their own minds"[18] because they no longer have the necessary regard for any "Other" truth that might challenge their own. As a result, they lose their actual capacity to respect or revere anything or anyone. They cannot truly grow because they cannot change; they cannot change because they cannot truly care. All they can do is to employ and to fear power, making them what theologian Christopher Leighton has called "technically sophisticated and highly skilled barbarians."[9]

Now it may seem unduly harsh to refer to people who have been educated in this manner as "barbarians"–especially when the kind of instruction I've just described is precisely what the standardized tests of the College Board, NCLB, its offspring ESSA, and kindred other endeavors intend to assess and, consequently, to oblige all schools (public or private) to use to teach. But I agree with Leighton that the instance of Nazi Germany makes a powerful case both for his claim and for the dangers inherent in the inauthentic vision of education that produces it. Worse, in the fourteen years since I first wrote these words, studies show that our children have, in fact, become significantly less capable of empathy and caring relationships,[20] and the kind of partisanship and demagoguery that undermined the Weimar Republic have taken a firm foothold in our society.

The simple truth is that education becomes banal when we lose respect for the necessary role our encounter with the "Other" plays in the teaching and learning process. Only in response to the challenge which alien truths make on our sense of identity can any of us broaden our understanding of reality (i.e. "learn"), and unless teachers and the other adults in our children's lives nourish this process through their own faithful "Otherness" in the lives of students, it will not happen in any child, anywhere, anytime, anyhow. No matter how successfully schools may train students to be "technically sophisticated and highly skilled," if the teachers in them are not authentically engaged in the fashion described in this project, the children are not really learning anything; they are simply getting suitably conditioned.

In other words–to put it baldly–unless we actually *want* an educational system that produces habituated beasts, we *need* those who teach to have a more authentic engagement in what they do because ***only such a person treats a child as someone more than a "necessary evil" to manipulate and only a child so treated will learn to do likewise***. Choosing to be authentically engaged in the classroom is the only way our children will ever learn to become truly and fully human, and it is the only way we will make the world a place that silences the "Mrs. Stillmans" and makes future holocausts impossible. Kingsolver is absolutely right that we really will only get back from our children what we give them of ourselves, and until a critical mass of us in this country decide to change what we are currently giving them in our schools and–like with Brooke and Lily–elsewhere in their lives, our culture and our society will remain a place where:

> *Here in the land of plenty a child dies from poverty every fifty-three minutes, and TV talk shows exhibit teenagers who pierce their flesh with safety pins and rip off their parents every way they know how. All these punks started as somebody's baby. How on earth, we'd like to know, did they learn to be so isolated and selfish?*[21]

Chapter 8: Self-evident Truths–Authentic Engagement's Dangerous Challenge

Civilization is a race
between education and catastrophe.
–H. G. Wells

The master's tools will never dismantle
the master's house.
–Audre Norton

Unfinished Business

We were learning about the brain when the topic of equity came up.

"For approximately the first five years of life," I told my AP class. "Your brain grows as many neurons as possible in response to its environment. Then from roughly five years to early adolescence, it takes all those new neurons and makes as many synaptic connections as possible in response to its environment. And finally, starting roughly around thirteen or fourteen until your early to mid-twenties, the brain starts systematically destroying any underused synapses and some actual neurons, again in response to its environment."

A hand went up, and I pointed to Devon.

"Mr. Brock, what do you mean by 'in response to its environment'?" She asked.

"You recall how we've discussed that different parts of the brain are responsible for different functions, different tasks?" I said to her.

She nodded.

"You also remember." I continued. "That we've talked about how expensive the brain is? That it's the number one consumer of energy in the entire body?"

Again, she nodded, and I glanced quickly around to make sure the rest of the class was following along as well.

"Well, when a newborn brain enters this world," I said. "It is going to need to build extra capacity in the parts that *need* extra capacity to cope with the particular environment it finds itself in; while *not* wasting energy growing extra neurons in those parts that are used less in that environment."

There were still some confused looks.

"Here, let me give you a ridiculous example." I said. "Imagine that for some reason, the ability to play piano had survival value in a particular environment, and so from the moment you are born, your environment forces you to start the struggle to learn how to play the piano. Your brain would therefore need additional neurons in the parts of the brain responsible for that process."

Several hands all went up at once.

"Is that why nearly all Olympic gymnasts start when they're, like, four?" Annie asked after I pointed at her.

I nodded. "Yes, in fact, you all are too young to remember this." I responded. "But I can recall a toddler Tiger Woods with his dad on a TV show 'wowing' everybody with his putting. Dad had created an environment that told Tiger's brain: 'this is important; make the additional neurons to be good at it' and so his brain did."

I pointed at another hand.

"Is that also why we take so many different subjects in school?" asked Libby.

"And why our parents played all those games with us when we were little?" Elizabeth added.

They were all beginning to make the connections, and I nodded.

"Right," I told them. "Even if your parents didn't know the biology behind it, they knew that reading to you regularly, playing counting games with you, building blocks with you…all those things would make you better at school."

I turned to Libby. "And yes," I told her. "Part of why you took so many different subjects in elementary school was to make your brain make the extra connections in lots of different parts of it, and it is why you are still taking so many things now: we're attempting to convince your brain that all those extra synapses are important to your survival and therefore worth all the extra energy it costs to keep them."

Serene's hand shot into the air. "But Mr. Brock," she protested. "Knowing how to do calculus is not actually critical to my survival. I'm not going to die if I can't integrate!"

"Yes and no." I replied. "You're right that you can certainly survive perfectly fine without knowing how to solve a differential. But the problem-solving neurons you are preserving by learning how to do so make you smarter and that *does* give you advantages as an adult in this world."

I noticed a hand I had not called on yet and pointed at Maggie, who had a thoughtful, worried expression on her face.

"Mr. Brock, if what you are saying is true, then what about all those kids in a bad environment or one without any resources?" She asked. "From what you just said, the most significant damage may be done before you're even five! I tutor girls struggling to read for my community service at one of the city schools. What if your parents don't have time to read to you when you're little simply because they have to work in order to survive?"

Maggie was clearly distraught, but all I could do in response was nod sadly.

"You're right." I told her. "Children who grow up without the resources most of your parents have provided you quite literally have their brains put at a disadvantage—at least when it comes to learning in schools. But that's also why," I added. "Government programs such as Early Head Start for low-income children are so critical to helping fight the poverty gap in this country; it provides brains with the environment to grow the necessary extra neurons for better success in school."

"Do we have any of those here in Baltimore?" She said eagerly.

"Probably," I replied truthfully. "But I don't know for sure."

"There are nine." Devon interrupted, looking up from her laptop.

Standing in front of the class, it was impossible not to show my reaction.

"Nine." I mused, shaking my head. "In a city of more than 600,000 people, with nearly a quarter of them living below the poverty line and way more than that who are low-income, and we have a total of nine."

There was now a fire in Maggie's eyes, and with that absolute indignation that only a teenager can achieve, she pounded the table where she sat and declared loudly, "That's not fair, Mr. Brock! All my girls deserve to have their best brains, too!"

The Dilemmas for Schools

Throughout its history, a core tension in the United States has always been the struggle between our professed egalitarianism ("all men are created equal") and our pursuit of privilege ("may the best man win"). We want the social justice and political stability that come with the former while we want the material abundance and personal fulfillment of the latter, and in our pursuit of both these potentially mutually exclusive ends, we have traditionally relied on education to resolve their differences. The myth goes that if we simply provide the means for all children in every school to achieve at their highest possible intellectual levels, then any consequent differences in status are simply the results of variable levels of biological talent ("he's a natural") and/or personal will ("Charlie hustle")–both of which an individualist culture like ours believes society can neither dictate nor should control.

The problem with this myth is that it ignores reality. Systemic racism and class privilege have always played a significant role in determining an individual's socio-economic status in our society regardless of his, her, or their degree of access to education, and "if we know the social class and racial background of a child before he or she enters school, then we can successfully predict his or her achievement in school and his or her likely success in society after he or she becomes an adult."[1] Hence, where a child grows up or to whom she, he, or they is born has had far more impact on their, his, or her ultimate place in our culture, and frankly, any notion that schools are not simply "institutions designed to maintain the status quo and reify the social hierarchies in our society"[2] is seldom more than empty rhetoric.

Part of what is at issue is that both the myth and the rhetoric ignore some challenging and inconvenient brain science. As my student recognized in class that day, the genes controlling the developmental process of the brain help contribute to the perpetuation of the socio-economic divisions in our society (and their frequent racial corollary) as the "haves" can provide the resources to maximize this process; while the "have-nots" regularly can't. The consequent impacts on an individual's success in school then plays itself out in the eventual jobs and careers (and even health![3]) of adulthood, and the cycle repeats.[4]

What has an even greater impact, though, than differences in opportunities for brain development is the human brain's instinctive hard-wiring for bias. The simple truth is that back on the savannah when we were evolving, stereotyping had survival value: "tan-with-black-spots" equaled "bad" because the vast majority of the time "tan-with-black-spots" equaled leopard. The human who's brain automatically learned this association erred on the side of running from anything "tan-with-black-spots," surviving to reproduce, and the brain that didn't was eventually lunch. Likewise, in a clan-based hunter-gatherer social system, "us vs. them" served a survival value, and "the brain, it turns out, [actually] engages two [entirely] different clusters of neurons in thinking about other people, and which cluster gets activated depends on the degree to which one identifies with those others."[5] It is a problematic and uncomfortable truth, but we are simply wired for bias.

Unfortunately, the consequence of this for schooling is that all the implicit/hidden biases everyone in our society has about race, wealth, and privilege are, in fact, actively contributing to the erosion and undermining of the professed purpose of our so-called egalitarian educational system, and without deliberate self-conscious interventions (that seldom occur), our schools are actually helping perpetuate the disparities in our society instead of counter-acting them. Indeed, the science on implicit/hidden bias shows that "even in the minds of those who would be disadvantaged by the bias they carry…[their brains] in fact are willing to sacrifice their self-

interest for the sake of maintaining the existing social order."[6] Therefore, in spite of implicit/hidden biases being "yet another instance of a hard-wiring that has lost its relevance [in the modern world],"[7] their ubiquitous character continues to make our current school systems—along with the rest of our culture—essentially a self-replicating organism.[8]

Yet, this same research shows that once a person is made aware of a hidden bias—what Mahzarin Banaji and Anthony Greenwald of Harvard's Project Implicit call a "mindbug"—that individual is fully capable of taking conscious, deliberate, and self-aware steps to "enable [his, her, or their] brain to outsmart the mindbugs that reside within it."[9] What's more, the research has now made it possible for all of us to begin identifying our own individual "mindbugs" (see note 9 for details), and therefore, it possible for each of us to fight the implicit biases found in our educational systems that hinder those systems from effecting positive social change for everyone.

So why are those of us in schools not doing a better job at this?

Pewter Bowls

"So? What do people think? After what you've seen today, can we make this work at Central or not?"

Jack, my principal, tapped his pen expectantly against his open portfolio case and looked around the room at the rest of us for confirmation.

"Personally, I can't wait to use the Socratic seminar approach in my English classes," responded Brenda. "This whole idea of focusing intensely on a smaller body of material more rigorously is exactly what our students need."

There was some general murmur of agreement, and a few heads nodded. However, they came from people like Brenda who were already among the Coalition "faithful;" so Jack merely gave her a quick flickering smile of approval before focusing his attention on those of us at the table who hadn't replied with immediate assent.

"David?" He demanded. "What do you think?"

"Well, Jack, you already know I support the basic principles of an Essential School; I already use them in my classes anyway. I'm just worried that we're trying to fix major problems simply by talking about them with a different vocabulary. I mean what I saw today made me wonder a few things."

I paused and glanced worriedly at our host. She smiled understandingly and nodded in encouragement.

"Please, David. Go on. I specifically asked to sit in on this meeting because one of the important ways we can grow as an existing Essential School is by seeing ourselves through the eyes of others."

I hesitated, searching for words, and then noticed the expression on my principal's face. *Not going to win any "brownie points" this afternoon*, I thought.

"Okay," I replied, frowning a little. "One concern I have is that we're here today to observe what makes a Coalition school different. Yet the biology class I sat in on this morning was one of the most traditional ones I have ever seen."

Sheila, the head of the school where we were visiting for the day, nodded again and pursed her lips.

"Yes, I know the individual you're talking about." She answered. "And you're correct: some of our faculty have embraced the principles of the Coalition of Essential Schools more fully than others."

"But that's my point." I implored, looking at my own principal. "Just because we suddenly declare ourselves an Essential School isn't going to magically transform how the teachers back at our school teach. Nor is it going to suddenly turn all of our students into gifted scholars. We can talk all we want about 'student-as-worker/teacher-as-coach' and 'helping young people use their minds well,' but if the adults at our school won't dramatically change how they act in the classroom and our students keep coming to us unable to read, then all we're doing is fooling ourselves with some 'emperor's new clothes'!"

Jack and some of the others like Brenda scowled at me, but I continued anyway.

"Look," I said, gesturing toward Sheila and in the general direction of the school around us. "The kids in this school come from completely different socio-economic backgrounds than ours. The Coalition principles are going to work well here because these children are ready to learn anyway. They could receive the worst education in the world and still succeed in life. But I've got seniors in some of my classes who are functionally illiterate; there are limits to what I can do with them without the support of learning specialists who are not even in our school."

"But that's the whole point of focusing on a few, essential high expectations for all students, David," argued Brenda. "By doing so, we raise the level of learning for everyone and get our students so that they are able to function in our society."

"Right!" Jack chimed in, looking at me pointedly. "Remember that each Coalition school decides for itself what their students really need to learn–what they think is essential for them to know–and our goals will obviously be very different from the ones here at Oberfeld."

I shook my head.

"But if they are, then we're not really helping prepare our students to succeed in the way the students here can." I argued. "Look, I don't think you understand what I'm trying to say here. Employing Coalition principles in our high school is not going to change the nature of the raw material that arrives on our doorstep. If I were a metalsmith making bowls, I could be the most gifted metalsmith in the world, but if you give me pewter instead of gold...." I once again gestured at the school around me. "The final bowl will still be pewter."

It was my turn to look deliberately at my principal.

"Pewter 'bowls' in a world that values gold ones more." I told him pointedly. "We need alchemy at our school, Jack, not just sophisticated metalsmithing, and all our talk about 'Socratic Seminars' and 'student as worker' may be good 'metalsmithing,' but it won't change pewter into gold–which is what we seem to keep trying to convince ourselves it will."

There was a silence as everyone digested my words, and ironically, the expression on the private school principal's face held more understanding than the one on mine. But then, the look on Jack's face was menacing and suspicious, and those on the rest of my colleagues ranged from bewilderment to distrust. Brenda actually glared openly at me in disgust.

"If you're so doubtful we can make it work, then why are you here?" she asked, barely trying to conceal her contempt.

"Because our kids deserve to have us talking about what it *will* really take to educate them to be as successful in life as the kids here." I responded. "And not another naked con job."

Fulfilling the Niche

As noted educational reformer, Roland Barth has observed, "the problem with schools [today] isn't that they are no longer what they once were; the problem is that they are *precisely* what they once were,"[10] and though we know there are some biological forces that can contribute to perpetuating this fact, we also know that we have the power to uncover and disable "mindbugs" and to provide the early childhood education for all brains to help them grow well. Which, as Barth points out, begs the proverbial question:

> *why, then, are the conditions hospitable to human learning so dramatically unrecognized and conspicuously absent in so much of the thinking and practice in state departments of education, central offices, universities, and all too many schools–all institutions professing a commitment to promoting human learning?*[11]

The answer, I think, is because the authentic engagement of educators discussed in this project—which could transform all our academic institutions into places of genuine learning—poses a potentially powerful threat to the illusions our society wants to maintain about itself. I think that as a society, we want to see ourselves as this grand example of social justice, political egalitarianism, and economic freedom in the world–with universal education providing the foundation for achieving all these things for anyone willing to work hard. But we are only able to maintain this illusion to the extent that this same education does *not* confront us with evidence to the contrary, and good teaching invariably reveals that the emperor may be missing clothes.

To understand how, we first need to recognize that if we employ the "ecological" paradigm for education that produces good teaching and learning, we have to acknowledge that the corollary to the "niche" or role the teacher must successfully occupy in the classroom is the one each student must inhabit as well—meaning that the functional well-being of the classroom "environment" depends as much upon the students as it does upon the teacher. Students are fully accountable for actually participating in the learning process and good teachers will hold them as such accordingly because otherwise, as we have already seen, the "ecological" web of relationships everyone must form with reality in order to have knowledge of it cannot take shape.

To make the analogy explicit, in a healthy ecosystem, no organism can do what it does in the environment without all the other organisms doing what they do in the environment. For example, fungi cannot dissolve minerals in the soil without the energy from the sugars that plants provide, and the plants cannot make these sugars without the minerals the fungi provide. So, too, in order to have a fully functioning classroom, the students as well as the teacher must authentically fulfill their role in the educational "ecosystem." Hence, what the "ecological" paradigm for education confronts us with is the reality that children are in vital ways as accountable for the quality of their education as their teachers are.

But children can only be as authentically engaged in the classroom as the adults *outside* of schools have prepared them to be. Even the most brilliant educator can only accomplish what the raw material who arrives in his, her, or their classroom allows, and in this country that regularly treats children as "necessary evils," the lack of adequate resources, parenting, and other forms of adult support means that the raw material who enter our school doors are all too frequently malnourished, unwanted, ill-prepared, or otherwise maltreated.[12] Eye-popping lessons won't catch the attention of a child who's blood sugar is so low that he, she, or they can barely stay awake, and even at the other end of the socio-economic spectrum, the child who is abusing alcohol to cope with an authoritarian parent's unrealistic demands is not going to be

focusing on a classroom assignment; she, he, or they is going to be wondering how to make it to the next day.

Hence, whenever students *do* perform poorly in a situation where good teaching is providing high quality education, these kids act like a huge, blaring siren in the middle of that community, declaring loudly and unequivocally that no one with the power to do so has addressed the material poverty or street violence or physical abuse or parental neglect or chemical addiction or...anything else that is keeping those children from having what they need to fulfill their "niche" in their school "ecosystem" and engage in genuine learning. Thus, by holding students completely accountable for their role in schools in the way any "organism" in an environment would, what authentically engaged schooling exposes is just how badly the rest of society has failed in any claims to be providing equity, equality, and opportunity for all its citizens—thereby, of course, implicitly criticizing the systemic power structures in our society that bear responsibility for the inequity, inequality, and lack of opportunity in the first place.[13]

Taking a Chance

The annual science department meeting for course placement for next year was wrapping up when I raised my hand.

"Yes, David?" Deb, my department chair, replied.

"I want to recommend Maddi for honors physics." I said.

There was a general stirring among the group.

"She's only recommended for regular math." Deb said. "The department policy has always been that any child taking regular math automatically gets placed into regular physics."

She paused. "It's been that way since even you were head of the department." She reminded me.

"I know." I told her with a quick nod of my head. "But maybe it's time we reconsidered that—at least with this one child."

Ereni, one of the physics teachers, interjected.

"But the reason for the policy is that the girls in regular math don't learn all of the math they will need for honors physics. We could potentially be setting Maddi up to fail if we do this." She stated.

I shook my head vehemently. "This is one of the hardest working students I have ever taught." I replied. "She has one of the most challenging learning profiles of any of my students this year, and she has a 98 in my class! She is the *embodiment* of what grit will get you."

It was Deb's turn to shake her head. "We have *never* had a student move up from standard biology to honors physics." She repeated.

"Well maybe it's time we did." I answered; I had returned from my sabbatical in Santa Fe determined to change some things, and this was one of them.

I turned to Ereni. "Could you teach her any differences in the math between regular and honors?" I asked.

"Yes, if she's willing to put in the extra work." She responded. "The girls in regular math eventually learn what the ones in honors need. They just learn it toward the end of second semester in regular math and we use it in first semester in physics; so the two curriculums don't align."

Ereni sort of bobbed her head, thinking. "But if Maddi is willing to commit to coming for extra academic help, I could certainly teach her the extra material she needs to know for honors."

"This child ***lives*** for academic help." I responded. "I have never had a child want so badly to do her very best all the time."

Ereni shrugged her shoulders. "You know that I'm philosophically on board." She said.

I turned to Deb.

"David, I'm not antagonistic to the idea." She answered. "I just think we need to ask ourselves if we want to set a precedent that could come back to bite us?"

I pushed back.

"Look," I said, gesturing with both arms. "We've been talking for years—under both my tenure and yours—about how we might be better optimizing our placement system. And we've always said we want to stretch our students without crushing them; to have each of them in the section of a course where they can best thrive. Here's our chance." I implored. "Maddi will be bored out of her skull in regular physics!"

"Ereni?" Deb asked.

Again, Ereni shrugged. "I'm on board." She answered.

Deb turned back to me. "And she's the only one you're recommending this way? I'm not saying we can't revisit the entire topic next year, but it is a little late in this year to turn over the entire apple cart."

I nodded emphatically, in part because I knew exactly what she was implying about the larger potential parental response when knowledge of this decision got out.

"She is the only one." I responded. "And her grade average is almost a grade-level higher than any of her classmates in any of my sections. I'm confident we have the necessary data to explain why we made this one exception."

I grinned at Deb. "And I will gladly take on any of those parental conversations directly if you need me to." I told her.

She smiled back. "I think I'll be okay." She replied.

Gesturing to the rest of us in the meeting, she asked, "All in favor of allowing Maddi to take honors physics next year?"

"Aye," came the chorus of replies.

"Then, David, you've won your case." Deb said. "Any other business? No? Then I don't know about the rest of you, but I have plenty of grading to do."

She dismissed us then, and as I e-mailed Maddi to come see me, I couldn't wait to see the excitement on her face when I told her.

"The Master's Tools"

Good teaching and learning do not just have the potential to threaten our egalitarian delusions; the actual nature of the accountability to which it holds students is equally dangerous to the status quo as well. If I am right that real learning is a consequence of both students and teachers *participating* together in the practice of composing reality's metaphors, then what we must assess in a truly functional educational system is how well our pupils engage in this process and *not* necessarily which specific metaphors they actually make. We must stop penalizing misunderstandings and mistakes about a given subject and instead turn evaluation into an on-going transaction of student production and teacher feedback in which a child steadily refines his

or her ability to fashion meaning about the world in a certain way—an evaluation process which, interestingly enough, corresponds *exactly* with what have been identified as the seven key critical 21st Century learning goals.[14]

But such an approach to the assessment of learning means that ultimately accountability is no longer about whether children necessarily construct a specific understanding of the world; it's about how well they actually *participate* in a particular knowledge constructing process. In other words–to use my "bowl" analogy from earlier–what students are accountable for in the ecological paradigm of education and which good teachers hold them to is the struggle to make "bowls" in a certain fashion–*not* what the final "bowl" looks like or what it's made of. Thus, authentic accountability in education is ultimately more about performance rather than product, about "how" instead of "what."

The trouble is: how do you *grade* a "how?" How do you *grade* a struggle? The "What" of learning is a lot easier to grade and a lot easier to test, and since "today, the purpose of U.S. education is to *rank* human potential, not develop it,"[15] then the other danger authentic engagement in schools presents is clear: it employs an understanding of assessment and accountability that undermines the very foundation of the traditional concept of grading on which our society depends for its self-image. For example, if we can't grade people numerically, how will we rank them to justify where they belong in the cultural hierarchy? If we can't assign an "impartial" value to the possession of a random body of knowledge, how will we sort out the "good" students from the "bad" ones? If we can't punish those who have slower memories with "objective" grades placed in permanent records, how will they know their "inferior" worth to the community? If "our children should study what's important to learn, not what's easy for you to test,"[16] how will we maintain the socio-economic echelons that keep the "have's" possessing more and the "have-not's" scrounging for what's left?

What it boils down to is: if we can't *grade* everyone in the traditional way, then how can we possibly justify, vindicate, and defend our "democratic" illusions of a just, free, and equitable society? The answer, of course, is that we can't, and *that* may be the ultimate threat authentically engaged schooling of the kind presented in this project poses: not only does it force us to confront when we have failed as a society to provide our children with what they need to avoid "[leaving] K-12 schools with no hireable competencies;"[17] it strips away the institutional mechanism we use to exonerate this failure in the first place. Good teaching reveals not only the "master's house" for what it is; it reveals the inherent truth of Audre Norton's observation about the nature of the "master's tools" as well.

Little wonder, then, that so many of our educational institutions fear and resist the changes needed to bring good teaching and learning to all students. If they ever actually promoted–or even tolerated–the "conditions that are 'hospitable to human learning',"[18] they would have to reflect, like the character of Dorian Gray, on their true image, and I suspect those in power wouldn't like what they'd see any more than he did. The simple truth is that authentically engaged teachers in properly supported schools can be a threat to the status quo. They are like candles in caves, illuminating not only the inequities and injustices of our society, but—worse from the point of view of those in power—illuminating the way out of this darkness by providing the very tools that *can* "dismantle the master's house."[19]

Interestingly, this fear of change is equally true even in our properly financed schools such as the private and wealthy suburban public ones, if for somewhat different, possibly ironic, and definitely potentially self-defeating reasons. That is because real learning which the kind of reforms I am suggesting produces requires real risk taking. But that demands that students

"attempt something where there is a real and serious possibility of failure,"[20] and since most private and wealthy public schools in this country are about "raising the floor" and not "the ceiling,"[21] the authentically engaged teaching and learning described in Parts I and II of this project can seem very risky to the stakeholders of these institutions. Indeed, in my own experience, I have seen firsthand that there can be a wide-spread culture of "pathological caution"[22] in both the private and public sectors of education in this country.

Yet, as journalist Paul Tough points out, the "kids who worked very hard [in these schools] but never had to make a difficult decision or confront a real challenge"[23] produce "very few world-changers,"[24] and that is where the irony may come in: the resistance to change that would raise the "ceiling" rather than the "floor" has produced a world where "there are fewer entrepreneurs graduating from our best colleges these days, fewer iconoclasts, fewer artists, fewer everything, in fact, except investment bankers and management consultants"[25]—and AI is already coming for those latter two careers.[26] Hence, the very stakeholders in education who are traditionally stereotyped as being most vested in the status quo are simply at risk for a different type of consequence of preserving a dysfunctional education system that clearly harms the "have-nots" significantly more but does not leave even the "haves" unscathed.

The blunt truth is: an ecological paradigm for education threatens the society we currently live in from all sides, and that makes it dangerous. As Parker Palmer reminds us, "part of us prefers being hopeless to taking the risk of new life: if we believed new life were possible, God knows what we might be called to do!"[27] Authentically engaged education shows us we *can* change—that it is possible for us to grow, mature, and transform into the "angels of our better nature"—and that's frightening because it would involve a lot of hard work, sacrifice, and personal change on everyone's part when it is far easier simply to focus on test scores, passing rates, percent attendance, and other "objective" factors more easily manipulated and controlled.

There are people and schools out there trying to do it, trying to make the change toward more authentic engagement in their schools, and I hope you will consider reading their stories (for inspiration and hope if nothing else!).[28] But until there is a critical mass of education's many stakeholders demanding the necessary change, voting the necessary individuals into office, and investing the required proverbial "blood, sweat, and tears" in our children, the looming crisis of which I spoke in the Introduction will become a cliff.

Which, as we will explore next, we might all walk over the edge of anyhow if we don't look up from our screens.

Author's Note: The topic of privilege is a touchy, difficult, and challenging one to talk about in our culture, and I would like my readers to know that as someone who possesses privilege, I am fully aware that some may question the veracity of me as a cisgender, heterosexual, fully-abled, white male discussing the dangers authentically engaged education presents to privilege. But for two decades now, I have strived to use my privilege to address the under-representation of women in the sciences and, in the decade before that, my students of color. Thus, I respect deeply that examining the relationship between privilege and education is always a complex undertaking, and I have endeavored to do so with as much nuance, respect, and self-honesty as possible.

Chapter 9: A Voice in the Wilderness–the Difficult Task for Authentic Engagement

It is not conceivable that our culture will forget that it needs children.
But it is halfway to forgetting that children need childhood.
Those who insist on remembering shall perform a noble service.
–Neil Postman

Facts do not cease to exist just because they are ignored.
–Aldous Huxley

Not Found in App Stores

"Mr. Brock?"

I looked up from where I was refocusing a microscope to see both Paige and Emma with their hands raised. I flashed them an index finger to indicate 'just a moment' and finished fixing the slide I was working.

I turned to Grace and Irina. "There. Someone had bumped the stage. The pointer's back on the right cell again."

"Thank you, Mr. Brock," replied Grace as Irina leaned in to observe the corrected slide.

I walked over to my waiting students, noticing that everyone else seemed to be moving smoothly back and forth across the room as they completed the assignment, and stood next to the lab bench.

"Yes?" I queried.

"Mr. Brock, I don't see how you can figure out which interphase cell comes at the beginning and which one goes at the end." Emma told me. "Number six or number three?"

"Well, what happens during interphase?" I asked her.

"It's when normal cell life happens." She replied.

"And what else?" I asked. She furrowed her brow, and I continued. "What are we studying right now?"

"Mitosis." Paige answered instead of Emma.

"And what critical process has to take place during the interphase stage of a cell's life for mitosis to happen?" I asked.

Two sets of furrowed brows greeted me this time. So I pointed at the board where I had diagramed replication earlier in the class.

"Oh, the DNA gets copied." Paige replied, Emma nodding in agreement.

"So what do you think that might do to the size of the nucleus?" I queried.

"Make it bigger." They both answered together.

I sensed motion and realized that much of the class had wandered over to join the conversation.

"But how does knowing that help?" Mellie questioned from behind me.

"What's different about the two slides?" I asked, pointing at the microscope in front of us and then at the other one across the room. "What do your observations tell you?"

Paige took a quick look in the eyepiece and then down at her drawings and notes. "I think six here is bigger." She answered.

I looked at Emma. "Do you agree?"

She took a quick peek, and responded, "Yes."

I deliberately looked her in the eye, then, and said, "So if you were ordering all of these slides as if you were making one of those flip-book 'movies' you made back in grade school, which slide would come at the *start* of a 'movie' about the cell life-cycle?"

Both girls got a look of sudden understanding on their faces, but Emma audibly gasped. "THIS ONE!" She cried out.

"Very good. Now you have the start of your 'movie' and its ending." I told her. "You just have to put the rest of them in order."

"But Mr. Brock, that's impossible!" complained Grace, who was now standing next to me.

"Yeah, Mr. Brock!" chimed in Irina.

"No. It's not." I responded firmly. "What it does require is that for each of the stages of mitosis where you have two slides in the same phase, you have to think about how the appearance of the chromosomes would be changing over the course of that phase."

"But that means you're asking us to *think*, Mr. Brock!" Irina moaned.

"Yes, and you all know my response to that." I added.

" '*There isn't an app for that*.' " Grace parroted, glaring at me ever so slightly.

"Yup! There isn't." I said. "And that's why you're here."

The Myth of Multitasking

Thinking is in danger. It is under assault from today's technology, and those of us in education are on the front lines. Distracted students and hovering parents, smaller vocabularies and declining reading skills, an inability to concentrate and a loss of empathy…the list of negative impacts the now ubiquitous presence of digital devices in our lives has produced could—and has!—filled books. Furthermore, as a classroom teacher who is both a neuroscientist and a "digital immigrant," I have witnessed the transition and its impact on my students' cognitive abilities firsthand.

Yet, before I get ignored for promoting some Neo-Luddite agenda and my younger readers dismiss me with the mean-spirited meme "*Okay, Boomer*," I need to preface my remaining thoughts in this chapter by pointing out that I am not anti-technology. After all, I am publishing this project on a blog, and for the past two decades, I have designed and maintained three websites at my former school. My father and I enjoy texting back and forth while watching sporting events "together" in our respective cities, and I actually prefer streaming my favorite PBS show, NOVA, to watching it on TV.

But like any form of technology, the Internet of Everything (as it is coming to be) has negative as well as positive consequences for our lives, and we must be willing to confront the potential harmful effects of today's digital world with clear and open minds if we wish to live safe and healthy lives. Cars, after all, have speed limits for a reason, and as renowned neurologist Adam Gazzaley and psychologist Larry Rosen have demonstrated through nearly a decade now of research, the "speeding" danger of the Internet of Everything is that it "degrades our perceptions, influences our language, hinders effective decision making, and derails our ability to capture and recall detailed memories of life events"[1]—all critical and consequential aspects of thinking. What's more, their research has gone on to show that "the negative impact is even greater for those of us with undeveloped or impaired cognitive control, such as children, teens, and older adults."[2] Therefore, those of us in education have an even greater imperative to

deal with any detrimental side-effects of digital technology, and I am here to argue that one of them is a hinderance in our students' capacity to think.

And my reason for doing so once again has to do with the genetically pre-determined hard-wiring of that organ inside our heads. The human brain evolved so that it "naturally focuses on concepts sequentially, one at a time."[3] What that means in practical terms is that every single time a person shifts their focus from one thing to another, they have literally stopped thinking about the first thing. Thus, for example, if you are presently trying to text or e-mail while also trying to read this paragraph, your brain first employs neurons to shift to reading screen #1. Then it next employs the neurons that encode the rules for reading screen-type #1. That is followed by the neurons that disengage from screen-type #1 neurons to shift to reading screen #2, and finally, your brain employs those neurons that encode the rules for reading screen-type #2. This four-stage process in your brain is always linear, always in this order, and your brain does it *every single time you switch attention.*[4]

Thus, while the typical student today believes he, she, or they can juggle 6-7 different forms of media at the same time, the reality is that he, she, or they are preventing his, her, or their brain from thinking in an attentive manner about any of these media. The notion of multi-tasking is a myth; the brain can only single task, and therefore, as the brain is made to switch back and forth repeatedly, this common use of technology actively hinders an individual's ability to think. In fact, to get a sense of just how jarring the myth of multi-tasking is for the brain, I encourage readers to pause here and try a simple activity provided by Gazzaley and Rosen from their research. First, as rapidly as possible, count out loud the numbers 1 thru 10. Then, do the same for the letters A thru J. Now, alternate letters and numbers out loud ("A1," "B2," "C3," etc.), again as rapidly as possible.[5]

Enlightening, isn't it? Not only does so-called multi-tasking slow down the brain's thinking processes, it also costs the brain enormous amounts of energy to engage in all that attention switching,[6] and "that's why a person who is interrupted takes 50 percent longer to accomplish a task and makes 50 percent more errors"[7] while doing so. It is also why when given the task to learn something while a screen was present, "students could not focus for more than three to five minutes *even when they were told to study something very important*."[8] The simple truth is that any over-use of digital technologies lowers an individual's efficiency and productivity, decreases the ability to problem-solve, and interferes with the capacity to learn.[9]

And anyone who doesn't think our children are over-using digital technologies isn't paying attention. They look at their smartphones alone on at least 27 times per day on average, with some looking at them more than 150 times,[10] and 92% of ages 10-18 are on-line as well every day for an average of 9 hours (in addition to any time spent on-line on school work!).[11] Eighty percent of teens report picking up their phones within 15 minutes of waking, and a staggering 24% of them say they keep them within arm's length 24 hours a day, answering texts and tweets even at night. In addition, 95% report multi-tasking at least a third of their day, including texting on average 100 times or more, and if these statistics do not convince you that our children are over-using their digital technologies, then know this: each minute—yes, *minute*—there are on average 284,722 Snapchats, 1,736,111 Instagram photos, and 300 *hours'* worth of YouTube videos downloaded[12]—and who knows what the stats for TikTok will be once researchers start collecting that data!

In the meantime, the consequences for education are clear: that is a lot of thinking being hindered, and as we will see next, those of us in today's classroom have seen the spillover. But from the "35,000 foot perspective," the view is equally clear: unless all of us who are

stakeholders in education start rethinking the role the new digital age should play in our children's lives, we risk a world where the quality of the thinking won't match the difficulty of the challenges confronting it—and even Oz's Scarecrow can tell you what's wrong with that.

What It Takes to Succeed

Standing in front my class, I prepared to say number five on what I've been told was their list of "top ten things you never want to hear from Mr. Brock."

"People," I announced grimly. "We have a problem."

Expressions of concern flashed across faces, and there was a collectively swallowing.

"These are your homework from last class." I said, holding up a pile of papers in my right hand. "And they are *not* good."

"In fact," I declared, starting to pace. "So many of you didn't even come close to passing that after a while, I just stopped grading. There was no point to it. It was so clear that you all had no idea how to answer what I thought were two simple questions that I knew I would only be punishing you if I kept correcting your papers."

Concern turned to worry, and Allegra's hand shot up.

"Mr. Brock, what did we do that was so bad?" She asked anxiously. "I mean, I thought the assignment was pretty simple, too. How could we have all done so badly?"

There were several nervous murmurs of agreement.

"Good question." I replied as I halted my pacing to address the entire class. "Either none of you have figured out yet what kind of work is expected of you in this course, or else none of you seems to know how to use a textbook. Since it was not just a few of you who failed but practically every one of you in both classes, I'm going to assume for now that it's because you just don't know how to read the book."

Puzzled frowns now joined worried looks.

"Therefore," I declared firmly. "Instead of doing what we were originally going to do at the start of class today–which was to begin the next lab on how cells regulate their environment–we're going to spend time learning how to use a textbook to complete a homework assignment."

A few of my very best students struggled not to roll their eyes, and there were the beginnings of some protestations. But I silenced them all with a slight glower.

"I agree, Cassie." I said, looking directly at one of my almost eye-rollers. "I would have thought that by ninth grade that you'd know how to use a textbook correctly, too. But I've got a stack of evidence that suggests otherwise. So please take a moment to get out your textbooks and open them to the pages of the assignment." I said firmly.

They complied as I pulled the projector screen down and brought up the images of the text on my computer. I waited patiently, then, until everyone had her book out and I was certain that I had eighteen pairs of eyes on me.

"Okay," I asked. "Whenever you have any assignment where you have to answer questions from a chapter in the book, what is the very first thing you want to do?"

Various hands went up, and I waited a five-count before calling on Naina.

"You make sure you know what the questions are asking in order to know what you're looking for?" She stated, cautiously.

"Good. You're seeking a body of information and you want to give your search some focus." I answered.

I studied the room, and now the look on their faces was even more bewildered than ever. I could almost hear them thinking: *what has gotten into Mr. Brock? We've known this stuff since the fourth grade!*

I asked what was next and called on another student.

"You write down the answers as you read along?" Christine said slowly, clearly uncertain as to why she was having to say something so obvious.

"Which is exactly what I'm guessing most of you did." I replied. "Right?" They all nodded. "Wrong. That's exactly what you *don't* do." I told them.

The collective look of shock was quite dramatic, as if I had chopped down one of the fundamental pillars of their worldview.

"Why not?" I asked the class.

They sat and thought for a long time before a few hesitant hands began to go up. I saw that one of them was Christine's again, and I wanted to reward her brave willingness to risk another answer; so I called on her a second time.

"Because we might miss something important?" She said uncertainly.

I nodded at her and gave her a big smile. "Very good. If all you do is write down an answer as you read along, you can miss critical information."

I turned to point at the projected page on the screen.

"What was your first question on last night's assignment?" I asked. "Kelly?"

"To compare and contrast the parts of plant and animal cells." She replied.

"And what is on page 128?" I asked rhetorically.

She studied the screen for a moment, glanced down at the open book on her desk and blushed. Then she looked at me in open embarrassment.

"A diagram of an animal cell." She responded quietly.

"And on page 129?" I continued. "Anyone?"

"A plant cell!" came the chorus of groans.

"In fact," I stated. "Both diagrams take up over 80% of the space on these two pages. What's that probably tell you?"

Cassie raised her hand again, and I called on her.

"That the information in them is important." She droned, clearly miffed at herself.

"Uh, huh." I nodded. "And the moral of this story is? Allegra?"

"To remember to go back and look at the diagrams as well as read what's written." She responded glumly.

I gave one of those head shakes that is both a 'yes' and a 'no' and pointed intently toward the screen with an outstretched arm.

"Yes, but it's not just diagrams." I told them. "It's pictures, graphs, and even the text itself. The point is that whenever you're using the book or any resource for an assignment, you always want to use the questions to focus your attention as you read. But you also always want to retrace your steps a second time to make sure you didn't miss anything."

I paused to let that sink in and then held out the pile of their failed homework again.

"*That's* what it is going to take to succeed in this class." I declared. "And that's what's *missing* from these. You didn't go back and double check that you had found all the information you actually needed to complete the assignment."

I pointed at the diagrams to underscore what I was saying once more and then studied their faces for understanding.

"Do you all now see what you should have done?" I asked.

Many nodded and several said "yes," but in addition to the new understanding, I also saw a lot of frustration in their eyes—this was extra work!—and I pondered momentarily about how to address that apprehension.

"Look, I'm not angry, people." I shared sincerely. "I don't blame you for what happened with this assignment because you clearly weren't prepared to do it correctly and that's my job. It's why we took the time today to learn how to read a textbook better, and it's why you're going to redo this assignment tonight. I *want* you to be able to succeed in this class, and it's my responsibility to show you how even when I think someone else ought to have done so already."

That brought a few smiles of relief, but I shook my head; I wasn't finished.

"However," I stressed. "The reason I let you see how disappointed I was today was because I want you to understand the seriousness of what happened. Only *you* are ultimately accountable for how successful you are in this class, and the same is true of everything you do in life. It's my job to help you get ready, but once I *know* that you know how to do something successfully, *you* will be the ones who decide how well you want to accomplish it. I'm simply responsible at that point for determining how good a job you actually did."

Again, I paused to let them absorb what I'd said and then continued.

"Remember," I said. "I grade nearly everything you do in here because the universe ultimately 'grades' *everything* you do out there. And I want you to do a better job than the people before you have been doing."

Their Missing Voice

There is a time honored truism in teaching that you have to meet your students where they're at to get them where you want them to go, and for many years, I think most of us in education–myself included–have met them where we felt we could assume they would be given our own educational experiences and upbringings. However, in today's world, the technological revolution of the past twenty years has changed all that, and I would argue that we can't make this assumption anymore at all. I can still recall almost viscerally how frustrated and discouraged I felt reading that failed homework assignment now fifteen years ago and how hard the entire year was with that class. Yet, unfortunately, one group has simply been followed by another who seemed even more under-prepared to do the work required of them, and I have recently actually had to start deliberately pointing out the diagrams when presenting that particular assignment—and I *still* have students fail a seemingly basic comparison task. It has been enough to compel me seriously as someone who practices scientific observation to wonder if perhaps my students really are getting dumber with each passing year.

Of course, such thoughts are not uncommon as individuals begin to experience the generational differences that come with aging, and I am too much of a historian and philosopher not to recognize that every older generation since there have been such things has regularly dismissed the younger as the inevitable end of civilization. However, that historian in me also knows that sometimes the elders have been right, and perhaps "something *has* gone way wrong"[13] this time. After all, there is ample data that students everywhere "are showing steep declines in their performance, behavior, and values"[14] due to the impact of technology,[15] and in fact:

> *This [impact] has been studied extensively, with researchers linking nearly every type of in-class technology—including email, texting, laptop, social media and more—to* ***decreased*** *classroom performance regardless of how that performance is measured*

(grades, work productivity, etc.), and across all grade levels ranging from elementary school to college.[16]

Hence, maybe the children in our classes genuinely *are* getting dumber.

Yet a decline in standardized test scores and a decrease in intellectual preparedness for school work (including even preschoolers[17]) do not in and of themselves imply a diminishment in student intelligence, and as I have wrestled with the frustrations of this issue, I have come across a paradox in my work that points to what I think is really happening. In examining recent final projects of my 9th grade biology students–a project which is a month long culminating investigation into soil ecology to assesses their mastery of everything they've learned all year[18]–I have found that while my students have been arriving in my doorway less prepared to do the expected work, the overall quality of their projects by year's end has actually been going up! Somehow, they are arriving "dumber" and yet leaving "smarter." How can that possibly be?

It is indeed a paradox, and in finally seeing it, I have come to realize that my more recent students *have* been coming to school "dumber" but not in the sense of more stupid. Instead, they have started arriving in the original sense of that word: mute or voiceless.[19] They don't know how to "speak" as they once did, and it is this silence that is the most significant reason for why the current situation in education "is nothing short of a crisis."[20] Because until we can get kids to "speak" in the first place, any attempt to discuss what gets "said" is utterly pointless.

One cause for this silence, of course, is the disregard and devaluation we have already discussed in Chapters 7 & 8, and this abandonment has only grown worse as the remorseless new economy of the information age has destabilized conventional life cycles[21] to the point where we are all "struggling to maintain meaningful connection with each other."[22] Hence, as our children's marginalized status has only increased "is it any wonder that students, having received such messages from a dozen sources, stay silent in the classroom rather than risk another dismissal or rebuke."[23]

However, in addition to this marginalization, I think there is a deeper, more profound answer to what has changed to make the ones in my classes more voiceless, and that is technology's relentless attack on their inner life. In our always-on world, we not only "seem to have lost the ability to *single task*…we appear to have lost the ability to simply be alone with our thoughts."[24] Yet solitude is critical to the development of the self that is essential to the learning process because, as we have already seen, all authentic learning and knowledge can only happen in the genuine relationship between the self and the "Other." Therefore, anything that introduces barriers to the authenticity of that relationship introduces barriers to these capacities, and thus, the more the technology of the smartphone and the computer screen introduce actual barriers to the intimate interaction that creates a real relationship, the more our modern technological world hinders the educational process and silences the mind's capacity to "speak."[25]

Furthermore, since "not every issue has an answer that can be googled…this lack of internal and external solitude can have negative long-term repercussions."[26] To know something, you have to be able to stand still long enough to enter into community with it and to listen to what it has to say to you; you have to "allow the subject to occupy the center of [your] attention"[27] in the way two friends do with each other when sharing an intimate experience. But because this "requires a level of solitude and reflection that makes [today's youth] feel uncomfortable"[28]—and we cannot understate that discomfort![29]—the external pressures of a digital age leave them nowhere to stand still at all anymore (let alone long enough to realize that they have lost the balance of their inner life that allows for standing still in the first place!).

Thus, unless we change this situation (at least in our schools), our children will continue to grow "dumber" until they are no longer simply "voiceless;" they risk becoming genuinely stupid.

Uncomfortable Conversations[30]

A knocking sound made me look up from where I was grading to see Laura and Suzanna standing at my classroom's door, looking uncomfortable.

"Yes, ladies?" I said. "What can I do for you?"

Laura responded. "Mr. Brock? Do you have second to talk?"

"Certainly." I nodded, setting my pen down.

"Could we please shut the door, Mr. Brock?" Suzanna asked. "It's not something we'd like other people overhearing."

That raised an internal "eyebrow." But I simply replied, "All right."

I stood up from where I had been sitting so that I could be on the same level as the two girls, and Suzanna closed the door. When she turned back, all three of us were facing each other near the front of the room.

"What seems to be the problem?" I asked.

They exchanged a furtive look, and then Laura spoke.

"It's Karen, Mr. Brock." She said, while Suzanna nodded vigorously, repeating. "Yes, Karen."

There was abrupt silence as if that was all there was to the matter. So I gave them both my best "AND…?" look.

"It's the project, Mr. Brock." Suzanna finally continued. "Our presentation on bacteria is due tomorrow, and she still hasn't worked on any of her slides."

Laura nodded. "We split the questions up so that each of us was responsible for our portion of the project, and Suzanna and I have already finished our slides and uploaded them. That's how we know Karen hasn't done anything. She hasn't even opened the shared doc."

I processed this for a moment before responding.

"The documentaries on your pathogens are not due until tomorrow." I told them. "Perhaps Karen needed to finish something else and needed to wait until today to complete her share of your project. Balancing workload is something you know we've spoken about in class all year. Maybe this is one of those times for Karen. Have you asked her?"

Both girls shook their heads firmly.

"No, Mr. Brock," replied Laura. "You don't understand. We all agreed to have our own slides done by today so that we could double-check each other's work tonight before turning it in tomorrow morning."

I repeated myself, emphasizing my words. "Have you asked her? Have you spoken with her about your concerns?"

Again, more head shaking.

"We've tried, Mr. Brock!" They replied, nearly in unison. "She isn't answering her email," said Suzanna. "And she won't respond to texts," added Laura. "She's even ignoring the class group-chat."

I took a moment to process this latest bit of additional data and then responded.

"Have you tried actually *talking* to her?" I said, stating the obvious. Turning to Laura, I added, "The two of you were sitting next to each other in the Nook during lunch today. I saw you as I was walking to the office. And I know you share some of your classes. Since she was

obviously not responding to any of your other attempts at communication, did you take the time to actually speak with her about your concerns?"

From the expressions on both their faces, I might as well have just asked them to place their hands in a jar of spiders. But they tried to deflect their obvious discomfort with an excuse.

"She's already gone home for the day." Suzanna shared. "Her mom picked her up early for an orthodontist appointment."

"Yes, it's too late for us to talk with her today." Laura added.

I knew I was showing my age, but I thought, *how else are they going to learn?*

"You can text Karen, right? You have her number?" I asked.

They both nodded.

"Then pick up your phone and *call* her." I said sternly.

What had been mere anxiety morphed into unspeakable fear as a flood of words spilled out of both girls.

"Mr. BROCK!...Oh my god, I could never do that…NO ONE calls people, Mr. Brock!...My own mother knows better than to try and reach me that way…She'd never answer us…Don't you understand how things are, today?…"

I held up my hand to stop the torrent.

"Ladies, you came to me for advice, and I've given it to you." I said. "The rest is up to you."

"But Mr. Brock, what if she doesn't get her share of the work done and it hurts our grade?" complained Suzanna.

I shook my head.

"Welcome to adulthood, people." I stated. "In the grown-up world, you will spend much of your life needing to work in small groups, and effective communication is going to be a key skill to your success in those situations."

Both girls were too polite to express their exasperation to at me directly, but I had taught too long not to see inside their heads. So I tried a slightly different tack.

"Look, uncomfortable conversations are precisely that, uncomfortable." I said. "I get it. I don't enjoy them either. But to fix real problems—such as yours—they have to happen."

I paused to see that that thought had sunk in before continuing.

"Therefore, the two of you have a choice." I said. "You can struggle to work through your discomfort and learn how to deal with uncomfortable conversations now, while all that's at stake is a school project. Or you can wait until you're my age, when it could be a marriage or a job on the line."

I took the moment to look each of them directly in the eye.

"Your call." I told them.

Their Silenced Voices

The research is quite clear: the demands and structures of our digital age are dismantling the foundations of human relationships of all kinds, and it is not without reason that the titles of most of the citations in this chapter include "Alone Together," "The Big Disconnect," and "The Distracted Mind." As psychologist and educational consultant, Robert Evans, sums it up: "this brave new [world's] impact on the part of people's lives that depend on relationships... has been malignant,"[31] and I will argue that perhaps nowhere has this been more true than in the field of education where the acts of relationship are fundamental to the teaching and learning process and

successful communication is essential to the entire endeavor. As we see with my students, they are not only becoming intellectually "voiceless," they are on the verge of becoming literally voiceless.

Again, though, before the technophiles of this world dismiss me as antiquated irrelevance and my younger readers turn away because "the old guy just doesn't get it," I need to state that I am not denying the positive connectivity that the Internet of Everything has provided. It has saved lives, both literally and metaphorically, and especially for young people still struggling with their sense of identity, technology can provide a community and safe space for them which may simply not exist where they happen to reside.[32] Again, as I said earlier, digital technology is no different than any other: there are pros and cons, and we have to be willing to look openly at both in order to manage its consequences for our health and well-being.

And one of those cons is how the world of screens is negatively impacting how so many of us interact with one another today. As we have repeatedly revisited, this is not the environment in which our brains evolved, and simply put, the "brain comes hardwired for human relationship because that is the most essential connection for survival."[33] Yet, "there is no app for emotional intimacy, no digital shortcut to the deep rich knowing of another human being,"[34] and the research is clear that our "text driven world of rapid response"[35] fails to promote the development of the necessary empathy, emotional intelligence, patience, and intimacy found in mature adult relationships.[36] In fact, our text culture silences to the point where today's children and youth consider it unacceptable to make a phone call or ask a direct question of another person, thereby "[preventing] kids (and adults) from building crucial skills that come from having tough conversations face-to-face, where facial reactions provide nonverbal communication tools typically unavailable through a screen."[37]

What makes matters potentially even worse, though, is that, as we discussed in Chapter 3, the brain gets good at what it practices, rewiring itself to match the environment in which it finds itself. Therefore, our children living in this digital age are altering their neural maps for less empathy, weaker language and speech centers, and poorer socialization skills.[38] Add in the fact that there is strong evidence for the possibility that our always-on world is activating the brain's addiction centers as social media users "chase the high" from all those dopamine hits,[39] and it does not surprise those of us who work daily with children to see sizeable groups of them, sitting together in absolute silence for long periods of time, just staring at their screens.

Moreover, all this silencing has consequences that reach far beyond the realm of simply dealing with the uncomfortable conversations that are integral to education. It is driving children at ever younger ages to seek advice from peers and anonymous online media communities, exposing them to "answers" to life's questions that were once the purvue of the parents and other significant adults in their lives (e.g. many tweens and teens now routinely learn about so-called sexual intimacy through online pornography[40]). Even worse, many adults are "disappearing themselves [into their own technology] and offering that behavior as a model for their children."[41] Thus, absent more authentic communication in their lives, the Internet of Everything is causing potential safety nets and teachable moments to disappear, leaving our children often isolated and unprotected from "our [current] cultural infatuation with treating each other in such profoundly degrading, humiliating, and soul crushing ways."[42] Social media expert, Ana Homayoun, summarizes the situation quite well when she writes:

> *It's perfectly normal for tweens and teens to make mistakes as part of the developmental process. It becomes infinitely more problematic when they make those mistakes anonymously on apps and are exposed to things they might be unprepared for socially,*

emotionally, or otherwise. Without guidance and support, issues can snowball and have increasingly dire consequences.[43]

What this entire state of affairs means for those of us in education is that we have children of all ages arriving at our schools who are exhausted from trying to multi-task all the time (losing the equivalent of 50 complete nights worth of sleep each year according to the CDC[44]), unable to stand still with their own thoughts, terrified of meaningful communication, and all too frequently raising themselves (at least partially) on the Internet of Everything. Is it any wonder there has been a 20-fold increase in anxiety disorders over the past 30 years?[45] Chronic stress levels in adolescents—particularly young women—are now resembling those "that we used to see only in adults,"[46] and between this heightened anxiety and stress, I strongly suspect that the amount of cortisol in the brains of a significant number of our "digital natives" is closing in on the lower edge of the levels once found exclusively in those suffering from PTSD.[47]

An entire generation with potentially 24/7 nearly PTSD brains…. And we expect them to come into our classrooms and learn.

Too Many Screens

As my AP class filtered into the room, I smiled and greeted them.

"You came back!" I said excitedly.

Amber just smiled, but Emma and Lauryn gave me quizzical looks.

"You were expecting us not to, Mr. Brock?" Emma asked, clearly bemused.

"Yeah, Mr. Brock, why wouldn't we come back?" Hailey said, joining the group.

"Because when I have to give the 'Welcome to Hell' speech that very first Day Zero," I told them truthfully. "Not everyone has come back for the actual first official day of class."

"You're kidding, Mr. Brock!" declared Lauryn.

"Nope." I shook my head. "It's only happened once in the twenty years since I started giving that speech, but it has happened."

"Well, we're made of stronger stuff." Emma responded, finishing unpacking for class.

"Yeah!" Adele added, setting her backpack down and joining the conversation. "We're ready for it, Mr. Brock. '*Biology Bootcamp*' you said the other day? Bring it on!"

I smiled in reply and had to fight not to give a shake of my head. *They never really believe you*, I told myself. *Not until they actually experience it for themselves.*

The rest of my students finished unpacking, and I took a quick glance around the room for attendance. It was a mixed group of juniors and seniors this year, and they had sorted themselves out in their seating just about the way I would have expected. *Always interesting to see their friend groupings*, I thought.

After pressing the link that said everyone was here, I walked back to the front of the room, picking up a book along the way, and stood very deliberately at the center of their attention.

"Before we get started today," I said. "I need to share some information with all of you so that as students, you can make some informed decisions about how you tackle this class." I held up the book. "And so you know that I am not just making this stuff up," I told them. "Here is one of the many sources of the research, and you are welcome to borrow it and read for yourself any time you choose."

Katherine politely interrupted. "Like you're going to lie to us, Mr. Brock." She teased, shaking her head with a grin in disbelief.

"Never the less," I replied. "A good scientist knows their sources."

I set the book down and continued.

"First, because I need to get you all ready for science at the next level where lecture is still the main teaching method, unlike ninth grade, there will be lectures in this course." I told them. "I try to keep them to a minimum, and I record them and post them online so that you can go back and revisit them. But it means you will need to take notes in this class, and that is item one from the research: you learn better when you take notes by hand than you do when using a laptop. You are still free to use your laptops for note taking in this class if you wish; just know that doing so will make it harder for your brain to learn the material."

I paused to let that sink in, and there were some nods and intrigued looks.

Then I made a dramatic show of reaching into my left pocket, hauling out my smartphone, and holding it high.

"Second," I stated. "*This* is the enemy of your brain. "We will actually learn the science of why when we study the nervous system and talk more about your hippocampus later in the year, but for now, I am letting you know that simply having this device on your person decreases your working memory by the equivalent of a full letter grade. So if you are striving to operate on a given day with an A-level brain, this device guarantees you are limited to a B-level ability if it is anywhere near your person."

I paused again, letting *that* sink in, and this time, there were expressions of open discomfort on their faces.

"In fact, that is true for every screen you have open." I told them. "So if you are taking notes on your laptop or doing your homework on your computer and you have this device on your person, that A-level brain just became a C-level brain."

Discomfort had turned to anxiety on a couple of faces, and Maddy raised her hand.

"Mr. Brock, why didn't you tell all of us this at the start of ninth grade?" She asked.

I stopped talking, turned, and just gave her my "*Seriously? There ARE dumb questions*" look.

"Oh. Right." She responded, a little self-consciously. "I forgot. Terrified."

"Mm, hm." I reminded her. "It's usually not until late November at the earliest before you all start thinking that maybe this Mr. Brock guy isn't so bad after all."

Those who had had me before all chuckled at the memory, and Maddy grinned.

"Anyway," I continued. "Again, I am not going to tell you what you should or should not do with your digital devices. I just think as students you need to make whatever choice you make in an informed fashion."

I lowered the phone in my hand.

"And because I believe that all of you deserve my A-level brain," I announced. "I'm now going to go put this back in my briefcase in the science prep room, and then we'll get started."

I headed quickly out the door and down the hall the short distance to where my desk resided, making sure as I dropped off the phone that it was muted so that it would not interfere with any of my colleagues working, and then, I headed back to the room—where as I approached the door, I found my entire class putting away their devices in their backpacks.

I won't lie: it was a sight that made me both proud and hopeful.

A Voiceless World?

The statistics on digital technology's impact on education can be both overwhelming and depressing. Research has shown that as a student's multi-tasking and social media consumption go up, there is a direct relationship with how much his, her, or their GPA goes down. Seventy-five percent of school-aged individuals report feeling panic when they cannot immediately locate their smartphones, even when made aware that the absence of this device would actually decrease the amount of time it takes to complete their homework, giving them more free time. Furthermore, though *shown* that their texting during classes had caused college students to perform 30% worse on their assessments, this knowledge did not alter their behavior in any way.[48]

Moreover, statistics such as these only a scratch at the surface. The very tool that distracts our students is now the dominate tool for managing and completing their homework, and as Homayoun has observed, this always-on access to grades and the nearly universal sharing of test scores and other accomplishments has led to a comparison culture of "never enough," where "students now alter their expectations to focus on how they are doing relative to others" and are no longer "concentrating on their own learning process" and how much personal growth they are accomplishing.[49] No longer is academic success identified with achieving personal purpose or potential. Instead, it has become—as the kids say—"all about the 'likes'," leaving our students each day worrying more and more about the rather banal and narcissistic values of celebrity and fame than they do about their schooling and what it could mean for who they become as adults.[50]

Yet, as difficult as it may be to hear all these impacts technology is having on teaching and learning—a situation M.I.T. professor Sherry Turkle has suggested is causing what were once considered pathologies to become normalized[51]—I want to argue that the greatest risk our digital age brings to education is the loss of perhaps thinking's most important function: creativity. To be creative first requires being bored, and our always-on, immediate-response, FOMO-addicted world "leaves little time for reflection, deep thinking, or even just simply sitting back and letting our random thoughts drive us to places we might not have [otherwise] gone."[52] But even more significant, in a world where no one gets lost anymore, we have chosen to upload our memory to the Cloud, and that is even more problematic than not making space for boredom because our brain's capacity for creativity is directly proportional to the amount of information in its long-term memory (LTM).

The reason for this is that at its core, creativity is the novel combination of ideas, and "the more existing ideas you have in your head, the more varied and richer will be your novel combinations of them."[53] But that would seem to suggest—as my skeptical technophiles are no doubt already starting to scream—that since the Internet is a nearly infinite source of ideas, technology should actually be the greatest source for creativity the world has ever known. However, the part of the brain where ideas get brought into our awareness is the hippocampus, and the hippocampus is—you guessed it!—genetically hard-wired by its evolutionary history to look in one location and only one location for its source of ideas: LTM. The hippocampus simply cannot mingle ideas from an external source the way it does ideas from LTM, and therefore, if an idea is not in LTM, the hippocampus cannot use it for purposes of creative thinking. Yet that means that "the emptier our long-term memories, the harder we find it to think. [Hence,] anyone who stops learning facts for himself because he can Google them later is literally making himself stupid."[54] Or to put it another way, in a world of increasingly complex

problems, digital technology has not only made it harder for us to stand still to confront them, it is destroying our actual capacity to tackle them in the first place. As Turkle poetically summarizes the situation, "among all its bounties, here the Internet has given us a new way not to think."[55]

Coda

So where as educators does all of this leave us? Our digital world is not going away, and indeed, I would like to emphasize at this juncture that much of the work and research of the people I have cited so heavily in this chapter is about how to adapt to what Gazzaley & Rosen have called in their book's subtitle our "ancient brains in a high-tech world." The efforts of these psychologists, neurologists, and educators focus as much on how to address the challenges of the digital age as they do on identifying the challenges themselves, and I strongly encourage anyone who teaches to make the time to read their full work.

However, I have deliberately focused on technology's potential perils to an authentically engaged education because, as I think Turkle again says so elegantly:

> *we need to get into new and more disciplined habits where we examine the assumption that we are getting something important from these new technologies. We must ask whether a technology expands our capacities and possibilities or exploits our vulnerabilities…. Technology offered us sugared soda water, and we embraced it. We took over a hundred years to decide it was no good for us at all. But by the time we declared it toxic, [we had an epidemic of obesity and type 2 diabetes on our hands].*[56]

The simple truth is that it is one thing for our adult minds to grapple with the identified hazards of the digital world; it is another for the undeveloped minds of our children. Like Turkle, I believe that we have "already completed a forbidden experiment, using ourselves as subjects with no controls,"[57] and I genuinely do fear that we may have already lost an entire generation to B-level brains (or worse!), struggling in an age of A+ problems.

My prayer is that we do not make it two. We do not have a hundred years this time to discover that we've created digital "soda."

Conclusion: Learning—the Impact of Authentic Engagement

It began in mystery, and it will end in mystery,
but a savage and beautiful country lies in between.
–Diane Ackerman

The Navajo people learned a long time ago
that winter is the ultimate test of applied faith.
–Rex Lee Jim

Life's Many Shades of Gray

I set the chalk down and turned to face my AP students.

"All right." I said. "I deliberately waited until the end of class to pass these back because I wanted to give you some general feedback on them before you read your individual comments."

I set the stack of essays on the center table and pulled over a stool from a lab bench.

"Oh, oh. It must be serious," joked Catherine. "He's sitting down with us."

"Ha. Ha." I retorted.

"Yeah, Mr. Brock, we all already know what you probably wrote on all of them anyway." Olivia fretted impatiently. "I just want to see how badly I disappointed you and get it over with."

I looked at her and replied, "Actually, that's what I wanted to talk with all of you about."

I held up the papers and scanned the room, studying their faces.

"Many of you did exactly what I have come to expect on this assignment." I announced. "You told me you'd buy a new prom dress anyway and then spent the rest of the paper talking about how awful a human being that makes you."

I shook my head with a bit of a melancholy smile.

"I don't give this assignment each year to make you all feel guilty." I told them. "And I don't have you write this Issue's paper just to force you to wrestle with the responsibilities you have for how your choices impact the environment. Knowing what you have learned these last few weeks, I actually challenged you about whether to buy a new prom dress when you don't *need* one because I wanted to see if you could understand the real nature of the question."

That produced puzzled looks and even a frown or two.

"It's not a yes-no question, people." I asserted. "It only looks like one. Several of you came close to seeing that as you attempted to justify buying a new dress because you could reuse it for formals in college or share or donate it. But most of you treated the assignment as a binary, either-or, black-white, yes-no question, and it isn't."

"What do you mean, Mr. Brock?" Lucy asked, brow solidly furrowed.

I had to stop to search for words.

"Look." I changed gears. "For the past few weeks, you've had to learn just how badly humans have managed to damage nearly the entire natural world…to the point where it is not exaggeration to say our own survival as a species is threatened. But that's precisely why you cannot treat questions such as 'Do I buy a dress I don't actually need?' or 'Do I drive when I can walk?' as if the answer is merely 'yes' or 'no.' You can't treat 'Are we doomed?' as a yes-or-no question."

"Of course you can, Mr. Brock!" Sara politely objected.

I was quick to reply.

"Look, what happens if you say the answer to that question is 'no'?" I asked her. "We're *not* doomed."

She was clearly thinking about it for a minute, but it was Lucy who then raised her hand.

"We no longer have to be morally responsible for how we treat the world." She replied.

"Exactly!" I said. "If you truly believe that the answer to the question is 'no,' then you absolve any responsibility to attempt to cope with the problem."

I scanned their faces again. "And if the answer is 'yes'?" I asked.

"Then the problem is beyond solving." Sara responded. "And it doesn't matter what you do."

"Precisely!" I concluded, acerbically. "We might as well all eat, drink, and be merry while the getting's good because nothing else we do is going to matter anyway."

"Either way, nothing happens." Olivia mused thoughtfully.

I gestured emphatically.

"Exactly!" I said again. "If we treat 'Are we doomed' or 'Do I buy a prom dress' or 'Should I walk instead of drive,' etcetera as yes-no questions, then we never have to do anything to address the situations that created them in the first place." I asserted. "Only by recognizing that questions like these are *not* actually yes-no questions can we have any hope of genuinely answering them the way we need to."

I studied their faces and decided I needed to respond further to the concerned worry I still saw there.

"Take the prom dress question." I stated and pointed where Quincy, Winnie, and Noor were all seated. "The three of you are roughly the same size." I said. "So you might decide that you'll each buy one dress for one dance, and then trade dresses for two other dances. You basically get three different looks for the price of one and save the resources needed to make six additional dresses."

Sara protested again.

"But Mr. Brock, even you've pointed out it's more complicated than that." She argued. "Those extra six dresses kept someone employed."

"Okay," I responded, nodding. "So you start a dress exchange for the area schools, using donated dresses, and girls 'rent' their dress by paying for the necessary alterations. Then you're not only saving resources; you've employed someone as well."

I tapped on the table.

"The point," I told them, "Is that you're going to have to start thinking outside the confines of a strict yes-no box if you're going to have any hope of addressing the environmental crisis your generation faces–or for that matter, any of the other issues we have studied this year. The world desperately needs people who know how to do more than answer a simple 'yes' or 'no' to life's really tough problems, and if I've done anything at all of value in this class this year, it has been to challenge each of you to become such a person."

I noticed Keziah was fighting to suppress a grin, and I suddenly realized how strident the tone of my voice had become.

"Sorry." I apologized, rolling my eyes at myself. "It's the danger of being a preacher's kid."

"It's okay, Mr. Brock," said Helen. "We even kind of enjoy that you get so passionate about such things."

"Hm, hm." Maryam added. "We really do appreciate that you care."

Others nodded and exchanged knowing looks, and I chuckled and shook my head at my own sermonizing.

"Anyway," I continued. "I simply wanted to you to see with this assignment that just because a problem *looks* black-and-white doesn't mean that it actually *is*."

I passed back their papers, then, and everyone except Lucy and Olivia started to pack up to leave. The two of them walked over to where I was standing, with Lucy looking clearly agitated.

"Mr. Brock, I *have* to ask." She pleaded desperately. "Learning all of this has made me literally terrified. You can ask my mother! I've actually been having trouble sleeping this past week. I *have* to know: do *you* think we're doomed?"

I turned to see that some of the others in the class were now hanging back, and I knew I needed to be quite intentional in my response.

"Lucy, I want to show you something." I said and went over to where my laptop was located. Quickly googling *Follow the Frog*, I brought the short video up on my screen to play it. "Watch this," I said.

They all did, and soon there was some laughter and chuckling, and even Lucy smiled a bit.

"I know how overwhelming it can feel." I said, turning to face her. "I *get* it. But that's why I always start this unit with that quote from Leopold that I shared with all of you. As he reminds us, just because we will never achieve perfect justice in this world doesn't mean we stop working toward it; likewise, just because we cannot repair all the environmental damage all at once doesn't mean we stop fixing what we can."

"But there's SO much, Mr. Brock!" Lucy bemoaned.

"Which is why we always have to keep perspective," I responded. "It's why I keep a copy of this video. To remind me whenever things start to feel too overwhelming that I still have power to effect change. Follow the frog, Lucy; it'll help you feel better."

She took a deep breath, then, and let out a huge sigh, while Olivia hugged her, and I knew we had walked the abrupt emotional quandary back away from the cliff.

"Can you send us that link, Mr. Brock?" Maryam asked.

"Sure." I answered. "I'll send it out to the entire class. And Lucy? Get some sleep." I encouraged.

Everyone who had remained now started to leave, but when she got to the door, Olivia turned back.

"You never answered Lucy's question, Mr. Brock." She challenged, politely but firmly. "Do you think we're doomed?"

I sighed and pursed my lips.

"A species that kills for pleasure and consumes simply for the sake of consuming does not leave me optimistic." I stated flatly.

"Then why do you work so hard to teach us the way you do?" She requested sincerely.

I answered truthfully.

"Because I can."

Hope is a Verb

Very early in my career, my mother–who is also an educator–shared with me the analogy that teaching is a lot like sowing dates. This particular fruit-bearing palm is notoriously labor

intensive, requiring copious amounts of watering and regular tending in an arid environment conducive to neither of these activities. Yet in its famously long lifespan, it does not produce usable dates to eat until after at least seven years and often many more than that. Hence, those who plant date trees must cultivate them with the knowledge that they may never see the literal fruits of their labors and that what they do, they do for future generations. Of course, teachers must also do their work trusting that their efforts will make a genuine difference in the lives of the people who come after them, and they must believe in the power of the individual to better a world they may never see. Hence, the analogy: to teach is to plant a date seed in the sometimes-arid mind of another and to water and care for it there in the hopes that its fruit will someday nourish the future. Teachers, like date farmers, are investors in infinity.[1]

Today, though, it can feel rather futile at times to be an investor in the infinite, especially if you're an ecologist like I am. As I suggested in the introduction, it is not possible to teach in the life sciences as I do and not be intimately aware of just how dramatically dangerous ignorance and irrationality can be. Any biologist will tell you that extinction is the actual norm for the natural history of this planet, and the equations modeling human populations all agree that keeping our ever growing, ever expanding populace alive is only possible at the expense of permanently consuming resources that cannot be replenished to sustain the process. It would, in fact, take *four* additional entire Earths to provide everyone the quality of material life we in this country take for granted,[2] and I know from my background and training that if we don't do something about the path we're currently on, then collapse into mere economic devastation and social turmoil is the *optimistic* outcome of where the population models say humanity is headed.[3] It is not hyperbole to say that we are facing the gravest crisis of our species[4] because the bottom line is that "homeostasis" is biology's equivalent of physics' "Law of Gravity" and the concept of homeostasis says there are finite limits for every organism—even ours. Sadly, and scarily, my student, Lucy, had every right to be as anxious as she was.

Why, though, start my final thoughts on teaching and learning and authentic engagement in the classroom with what amounts to a biology lesson—and a depressing and rather disturbing one at that? I do so because it dramatizes nicely the existential dilemma we all must face if we wish to strive to be more authentically engaged as teachers: even if I try to attempt everything suggested in Chapters 1-6, will any of it really matter—especially given the obstacles presented in Chapters 7-9? Not all of us will necessarily see a letter such as the one I shared from my student, Mark, and for those who do, think of how many hundreds of other kids got taught that never said a single thing. Therefore, just as each of us must face the possible futility of our own mortality, those of us who teach must ask ourselves whether the effort to help children develop their mind's capacity to "speak" serves any truly meaningful purpose or not.

For example, when I first started teaching environmental awareness 30 years ago, I harbored the hubris that this knowledge would inspire my students to become agents of change who would go out and transform the world. In fact, I can remember as clear as if she were in the room as I write this, one of my students, Parilee, saying "Well, now that we know, we'll fix it, right?" It is 16 years since she graduated, and Southeast Australia is burning to the ground; while people in the Southern states in this country are recovering from January tornadoes that are the new normal. I no longer harbor my hubris and, instead, teach environmental awareness today in the hope that some remnant of my students successfully pass through the coming evolutionary bottleneck to rebuild the world more wisely on the other side.

I still teach it, though, and the critical word in that last sentence is "hope." As I continued my conversation with Olivia that morning, I told her something that I have shared with

my students for years: hope is not something we possess or have; hope is something we *do*. Hope is not a noun; it is a verb. Because to genuinely hope for something is to do the work to make it happen. Hope for a better world? Roll up those sleeves and start the messy work of fixing it one patch of dirt at a time. Hope for better schools? Use what's been written here to authentically engage in the actions necessary to improve what happens in the classroom. Hope for better lives for our children? Invest the necessary time and resources to accomplish it. The simple truth is that the only effective response to life's existential dilemma about futility is to act *as if* what we do has purpose and meaning (to do otherwise would be to fall into despair). Therefore, each day, every day those who would be good teachers hope actively. Hope, do. Hope, do. Hope, do.

Yet all that doing requires hope's sibling, love, and we all know that love is never easy. Indeed, the kind of loving that nurtures "date trees" is arduous, uncertain, and often painful. It means risking lofty ideals such as disclosing who we are to share part of life's journey, and it means showing up regularly to support the more mundane things like dance concerts and sporting events. It means caring "always at least a little bit more about the children" than we do about whatever subject we teach, and yet it also means holding them accountable for living out what they learn in their lives. It is feeling joy and pride when we watch a child overcome and learn from a mistake, and it is knowing the agony of when we have realized that we have failed them. The love that plants the "dates" of human understanding and selfhood is all these things and more, and it is why each spring, I always cry a little when my seniors–many of whom I have taught more than once–say their goodbyes. For where pain is absent, no genuine relationship has been lost, and where there was no relationship, there was no learning. Tears, in a way, are education's very soul: where the heart has not gone, no one will follow.

And the Winner Is…

Ahsha hurried up, breathless, and dumped her backpack on the floor.

"Sorry I'm late, Mr. Brock." She gasped. "I had fourth period over at Bryn Mawr, today."

I shook my head reassuringly. "Don't worry about." I told her. "Sarah and I haven't been able to find a CD player yet anyway."

She glanced around at everyone in the room and frowned.

"What are we going to do, then?" She asked worriedly.

"I guess I'll have to try and *hum* very loudly." I responded, jokingly.

She gave me her "Mr. Brock!" glare, and I held up a hand to ward off any retort.

"Seriously," I said, "the worst that happens is I'll have to clap or bang on a lab counter to make some kind of noise. Why don't you start getting everyone organized? We're going to need to move all the tables out of the way to make a lot of room for this activity."

"Okay." She replied, nodding, and gestured to Jane and Ann Margaret, who were standing nearby. "Everybody, we need to get the tables moved out of the way and to put all the chairs in a big circle facing out."

"Success, Mr. Brock!" I heard as Sarah entered the room, toting a borrowed radio.

"Hallelujah." I murmured and took it from her to plug into one of the lab stations.

She clapped her hands to get everyone's attention and started the meeting.

"Welcome everybody to another exciting year of TTLG!" Sarah announced. "For any of you who don't know us yet, I'm Sarah, and this is Ahsha, and we're your co-presidents."

"And we'd like to thank you all for coming to today's club open house," continued Ahsha, taking over smoothly. "As you know, Ms. Waters is having the school's clubs trying something different this year, and you'll be signing up *after* the first cycle of them so that everyone can have a chance to visit the ones they want and check them out. Therefore, we've planned an activity today which we hope will give you a good idea of what we do in TTLG and make you want to come back for more."

Both Sarah and Ahsha looked in my direction, then, and Ahsha spoke. "Mr. Brock?"

I stood up to explain what they would be doing and studied the room.

"We're going to play musical chairs this afternoon." I informed them. "Only we're going to play it twice using a different set of rules each time."

The new girls all looked bemused, and I could tell they were all thinking: Huh? What does musical chairs have to do with a philosophy club? The regulars, though, all smiled in anticipation.

"The first time, we're going to play using the traditional rules." I said. "So, if you'll all take your places...."

I gestured at the circle of chairs, and the girls all hopped up from where they were sitting and gathered around it. There was some giggling and snickering and some playful pushing and shoving as they jockeyed for the "best" spot, and when they were ready, I turned on the radio.

The students began to circle, still laughing and joking, and I let the music play for a full a minute this first time to get everybody lulled into a sense of complacency. Then, I switched it off, and the dynamics, of course, changed quickly as everyone fought for a chair.

Julie was the first out, and she glared as everybody else laughed and congratulated themselves.

I shrugged, sympathetically and told her, "Grab a seat on a table. Everybody else, stand up!"

They did, and I started the music again.

Twenty-two, of course, became twenty-one, became twenty, and so on. The pushing and shoving got worse, the joviality disappeared, each round's loser left cursing or glaring as she took her seat on the sidelines, and finally, we were down to the last two, Jane and Emily. They circled like warriors as the music played, and everyone else had taken sides.

"Get her Julie!" urged Peale and Ann Margaret.

"You can take her, Emily," shouted another table.

I stopped the music.

Jane body-checked Emily as if the Stanley Cup were on the line and grabbed the remaining seat. Emily was caught by the table full of people she flew into and spun around to confront her rival.

"Damn it, Jane! It's only a game!" She exclaimed angrily. Then she glanced quickly at me. "Sorry, Mr. Brock."

I smiled to let her know the cursing was forgiven under the circumstances, and as Jane stood and preened, I acknowledged her.

"Jane, you're our winner." I declared. "Now everybody, we need to get all the chairs back in a circle again for our second round."

They did and then turned to me expectantly.

"Here's the deal." I told them. "We're going to play again, only this time, the rule is that when a chair is removed, everybody stays, no one is ejected, and you *all* have to take a seat somehow."

There were some nonplussed looks directed at me. But they all got in position, and when the music stopped this time, they all stood around for a moment looking at one another. Finally, various girls signaled to each other to have a seat, and Sarah volunteered to be the one to sit on someone's lap.

"Okay. Everybody up." I instructed. "Take a chair away, and let's start again." The chair was removed; the circle tightened, and I turned on the radio.

They marched for about thirty seconds this round, and already, it was amazing to watch the new dynamics the rule change had introduced. The girls were chatting again, already strategizing who would sit on who's lap this time, and as the rounds progressed and the chairs were removed, different leaders stepped up to take control and guide the sitting process, until at long last there was only the one chair and two column of girls seated on one another's laps, resting on Sarah's knees.

"Good job." I told them, and everyone cheered and stood up, thinking the game was over. "No." I said. "There's one last round this time."

They looked befuddled as I walked over to remove the last chair.

"This time, when the music stops, you have to all sit down with no chair at all." I informed them. "And without touching the floor!" I added.

I only let the music play a few seconds since the marching was no longer the point, and when I stopped it, they all stood around discussing the situation.

"Any ideas, anybody?" asked Ahsha.

"Hey, I remember we did something like this at my church youth retreat once," declared Jane. "What we need to do is all gather in a circle..." She walked them through it, and they all began to gather in a tight circle.

"Oh, I get it!" exclaimed Sarah.

Finally, backs tightly bunched against fronts and hands clasped on hips, they had Jane count it off. "On three." She said. "One, two, three, sit!" Leaning back slowly, each sat on the other until the entire group was one large seated circle.

"And done!" I proclaimed. "Everybody up and take a real seat for us to debrief."

There were a couple of "high fives" and much laughter as the girls all now stood up from the circle, and I waited patiently for each of them to take a seat in one of the chairs. When they had, I nodded at Ahsha and Sarah.

"So what we like to do in this club is activities like these," said Ahsha, "and then we talk about what they mean."

There were some "ah, ha!" looks on the new faces.

"And I'll get us started." Ahsha continued. "What do you think the two ways of playing the game might symbolize?"

One of the new girls responded. "Well, they obviously could represent the different ways we can live our life."

The others all nodded and murmured agreement, and Sarah responded.

"Okay," she said. "Then how did it feel to live the first way?"

"Crappy." Ann Margaret replied. "I felt all stressed out and stopped thinking about anything but getting a chair before anyone else could...and you were the worst, Jane." She said, pointing.

"Yeah, you were seriously out of control, there." Emily agreed, and several other girls all nodded.

"It's a game!" Jane defended, blushing. "You're supposed to try and win."

"Are you supposed to try and win?" I interjected. "Or were you supposed to try and not lose?"

"What do you mean?" She asked, puzzled.

"Look at both games." I said, addressing everyone. "What counts as winning in the first version and what counts as winning in the second?"

Another new girl, Chelsea, responded. "Well, in the first way we played, winning was getting a chair." She said. "In the second one...." Her voice trailed off, and she looked perplexed.

"Ah!" I responded. "What *does* count as winning in the second one?"

They all sat thinking for a moment, and then Ahsha replied.

"Solving the problem." She stated firmly. "Figuring out how everybody can have a seat."

"Okay," I answered. "Then can you *lose* the second game?"

"Yes and no," said Peale from across the room. "If you don't find a way for everyone to sit, then *everyone* loses. At least in the first game, only one person really loses, yourself."

"Oh really?!" Emily reacted. "How many of you think there was only one loser when Jane was the only one left?"

There were some mixed murmurs of both agreement and disagreement, with little side conversations began to break out around the room, and when even Ahsha and Sarah started to quibble with each other, I interrupted.

"How many people think Jane actually lost?" I asked over the buzz.

That quieted everyone, and again, they all sat thinking for a while.

"I do." Someone finally replied very quietly, and the girls all turned to look at Jane in shock.

"Jane, why do you think that?" I asked her, working actively to keep my tone neutral and not nod my head in approval.

"Because everybody hated me at the end." She answered. "I 'won.' But I was all alone. In the other game, we were all together." She turned to Emily. "And let's face it, winning the first time wasn't much fun."

Then I did nod my head as Jane and I looked at each other in understanding for a moment, and I could tell from my peripheral vision that expressions of "oh!" were starting to pop up around the room.

"So if the games are analogies for life, why is it that we almost always seem to play the first one?" I asked, looking around the room.

There was a pause, and then Ahsha spoke. "Because we grow up in it; it's all we've ever known."

"Okay," I replied, gesturing for her to go on.

"Also, the first way is a lot easier to play." She stated. "It's a lot harder, Mr. Brock, for *everybody* to win."

The Reason to Choose the Hard

I want to shift gears here toward the end and be a little less theoretical and scholarly in my tone and a little more intimate and personal in my approach, and I want to start with the word or idea that I'm confident is on the mind of any reader who has made it this far: Hard. It's a term I haven't used much to this point. But anyone who has processed the preceding ten

chapters has got to be wondering by now: who in their right mind would work as *hard* as it is going to take even to *attempt* to accomplish everything that I have challenged needs to happen for our schools to become truly functional again? My readers who are fellow teachers are also going to add: you forgot the mountains of paperwork, the endless grading, the lower pay, and the serious amount of time it takes to plan even a mediocre lesson. Add in the sense of isolation and frequent lack of administrative support for any learner-centered, active classrooms you might try to create in the first place,[5] and yes, the word we all are looking for is "hard."

What is more, compounding all this "hard" is the reality that like parenting, there is no handbook for how to teach well (that there might be is part of the whole Cartesian myth). Being authentically engaged requires actions for which there are no preset guidelines: divulging who you are, setting boundaries, relinquishing center stage, controlling bias…. The list goes one, and like learning to parent, the only way to figure out how to do it is simply to "study it for yourself. Deal with it yourself. There are no curriculum plans or lesson plans. Invent your own way of dealing with it."[6] Good teaching is just doing it–creating from scratch whatever is necessary to succeed at the task at hand–and there is no way around it: all that doing is just plain hard.

Which brings me back to the question we're all thinking, even if we're not saying it aloud: given how demanding this profession is, *what* could possibly compel *anyone* to become a teacher—let alone work hard enough to be good at it?

The answer, I think, lies in that world, "compel." Educators with authentic engagement feel *compelled* to teach the way they do. They feel *compelled* to create classrooms where real learning happens. They feel *compelled* to engage students with their full humanity. They feel *compelled* to bring their "deep gladness" to a world in need. They feel **compelled** to do these things and more because they understand that "*no punishment anyone lays on you could possibly be worse than the punishment you lay on yourself by conspiring in your own diminishment.*"[7] Good teachers know that no matter what the cost to them to be authentically engaged in their schools, the personal price they would pay to do otherwise is infinitely worse. Therefore, they choose the hard because they have to; the alternative is simply unthinkable for them.

And here's why. At the National Teacher Hall of Fame, there are some display cases, and in some of those cases are some letters:

...I learned that failure was ok. It didn't mean I wasn't smart enough or good enough, it just meant I wasn't there ***yet****. This is one of the most valuable lessons I have ever learned. I learned that understanding took hard work and dedication. You have never brushed off any of my* ***many*** *questions; you embraced my curiosity and encourage us all to search for a deeper meaning…*

*...then came some of the best advice I have ever received. It was our first class after winter break, and we were all standing around talking before class started. Someone said, "Now I can't wait for spring break!" and you looked up from whatever you were doing and said, "****Don't wish your life away****." We all looked up in awe as we processed what you said, and then 30 seconds later the conversations continued and class started soon after.* ***I still think about those 5 words almost every day****. Whenever I find myself wishing for the day to be over so that I can go home, or waiting patiently for the weekend, or for summer, or for the next year, I stop myself and think about what you said. "Don't wish your life away," I tell myself, as I try to slow down and live in the moment…*

...one experience with you will always be solidified in my mind, however. When I came to you and asked for your help in the interview process for my scholarship, I never expected the kind and extent of help that I was going to receive. After talking with you multiple times and

doing practice interviews, I was extremely prepared. Your advice was invaluable...and I know I would not have gotten the scholarship if it hadn't been for you…

…you have taught me so much more than just material. It was your teaching and guidance, compassion and morality, that has shown me an example of how to be a good human in this world. Thanks to you, I have become a harder worker, deeper thinker, a better friend, and a better student. You have taught me how to be accountable for my responsibilities, and how to persevere under difficult circumstances. You have taught me the importance of showing compassion and being a bigger person…this year has been one of the most challenging years of my life, and I am eternally grateful for the kindness and understanding you have shown me. Thank you for believing in me even when I did not really believe in myself…I know that wherever my life takes me, and whatever I end up doing, I will be a better person for having met you, and will never stop learning, and never stop trying to use my powers for good….

As is no doubt obvious, these letters are from students, and while it might be ideal that these could be the letters of any teacher, anywhere, my point in sharing what I once read is not to aggrandize or to extol any specific individual. Nor is my point that these should somehow be letters to which every teacher should aspire to receive. No, my point in sharing what somebody's students once wrote is my act of hope that the quality of any child's education would be such to begin with that he, she, or they would be unable to single out a specific individual teacher to write such a letter to in the first place.

That is the ultimate obligation for all of us in education; *that* is the ultimate purpose for authentic engagement in the classroom; and *that* is the ultimate reason for all of us who teach to choose the hard. These letters serve to remind us what education can be, sometimes is, and fundamentally ought to be for all our children everywhere, and I offer them now, here at the end, simply to recall for us what is truly at stake in education. As former Yale scholar, Seymour B. Sarason challenges, "the question is *not* whether most teachers can climb their Mt. Everest the way [the best] have climbed theirs. The question is how far up that Mt. Everest most teachers [decide to] climb."[8]

And until each of us in education chooses the highest ascent possible—to light "candles" against the "darkness" with every lesson taught, every learning embodied, and every student known—our schools will continue to fail to become the authentic centers for teaching and learning we so earnestly need them to be. My hope in offering all that I have with this project is that we will begin to change things for the better.

Afterword: On Being Human Well

Much have I learned from my teachers,
more from my colleagues,
but most from my students.
–The Talmud

The renowned art historian, Norris K. Smith, once remarked that the purpose of life is not so much to be a well human being as to learn to be human well.[1] I have thought about this ideal a lot in my years in the classroom, and at the back of my mind, I have always tried to remember that it is indeed the real task of all teaching and learning to help my students discover the authentic *imago dei* they are each capable of becoming and to aid them in drawing out their true self. It is why I believe "being a teacher is a way of life"[2] and not just a job or even simply a profession.

Yet, what has amazed and humbled me the most in my career is how much "the children themselves [have] offered me what ***I*** needed to [to become human well]"[3] rather than the other way around. There have been so many experiences like the ones recounted throughout this project that I could have devoted my writing to nothing but such recounting, and in fact, the challenge in finding moments in my career to illustrate the various points in my arguments has been to choose among the seemingly infinite number of times I have learned and relearned the same thing. At that point, I think Joseph Joubert grossly underestimated when he wrote that "to teach is to learn twice over"[4] because, in truth, to teach is to learn endlessly.

Furthermore, out of all the experiences that have transformed and molded me into who I am as an educator today has come an insight into a fundamental paradox that lies at the heart of what I think it means to learn to be human well: namely that we must repeatedly experience *both* sin and salvation in order to be whole. "Indeed, [just as] breathing itself is a [biological] form of paradox, requiring inhaling *and* exhaling"[5] for an organism to survive, so too are the cycles of alienation and grace a paradox the self *needs* if it is to endure. The regular moments of despair and redemption we experience throughout life are the soul's spiritual equivalent to respiration, and in the taking in and letting out of the "air" of awareness that allows us to derive meaning from these times, our self finds the nourishment it needs to persist in the face of life's challenges.

However, there is an even larger truth to this paradox that my students have shown me, and that is that just as the purpose of biological breathing isn't the breathing itself, neither is the soul's. Inhaling and exhaling of every kind–literal and spiritual–are simply what it takes to make life *possible*. It is what we then *do* with this life that genuinely matters, and that's where education serves its highest purpose. Teaching and learning at their very essence are about helping people figure out what to do with their "breathing," and that's why the kind of "doing" we engage in in schools is so critical. There are lots of possible ways to make meaning with our lives, and many of them–as history bears out–are not worthy of our veneration and promotion. It is therefore an awesome power and responsibility we have as educators to nurture in our children what it means to be human well, and we must do everything in our capacity to remain worthy of the trust implicit in that charge.

That is why I believe what I have said in this project is so critical. The very survival of our world may genuinely be at stake, today, and we truly will reap what we sow. Only the teacher who is authentically engaged in her, his, or their classroom can create the kinds of higher meanings that will show students how to be human well, and only such an individual can also

maintain such deportment in his, her, or their own life. The qualities of teaching and learning we have discussed here involve the very essence of what it takes to be a worthy and worthwhile person, and only when educators who do their best to embody these ideals engage in regular, on-going dialogue with our children can we have any hope that these same children will someday come to embody them as well.

I grant that it will be neither simple nor easy to achieve this vision of education I have presented here; nothing of value ever is. But our country *needs* people who will fight education's current culture of "pathological caution,"[6] and until all of us who teach seek to make the highest possible meaning with our professional lives that evokes the highest possible meaning making in others, neither the present situation in our schools nor the one in our society will ever change.

We must all seek to become human well, and it is out of my own effort to do so that I hope these words have been worthy of my own walk in that path.

D.L.B.

Acknowledgements

It would not be possible in a career as long as mine to recognize every individual who has made a significant impact on my journey as an educator. Some will find themselves among the pages of this blog while others will remain quietly ensconced in the private corners of my memory.

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On a more personal note, I am grateful to Lucy Wynn and Bill Fagan for mentoring me into the profession and to Amy Popp, Caroline Riina, Kristin Drake, and Elizabeth White for enabling me to pass it on to the next generation. I would also like to thank the decades of parents who entrusted their children to my care; I still feel honored by their faith in me. And I would be remiss not to acknowledge where the biggest recognition of all is due: the more than 2,000 students who passed through my door these past 30 years. Each one of them—even those where we were fingernails on each other's respective chalkboards—caused me to grow, and for that, I am truly grateful for the time shared together.

I must, though, give a special "shout out" to two specific collections of students, the Class of 2003 and the Class of 2010. The years I taught them were very dark ones in my private life, and while I'm sure they never knew it, it was knowing I would get to teach and interact with them yet again that gave me the motivation to get up each day during those times. They saved me, and there are not enough thanks in the world for that.

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Introduction

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Chapter 1

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29. Medina, *Brain Rules*, p. 131.
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32. Brown, Roediger III, & McDaniel, *Make It Stick*, p. 7; their emphasis deleted.
33. Medina, *Brain Rules*, p. 47.
34. Medina, *Brain Rules*, pp. 137, 141, 147, & 155.
35. Brown, Roediger III, & McDaniel, *Make It Stick*, pp. 3-8; Medina, *Brain Rules*, pp. 150-151.
36. Brown, Roediger III, & McDaniel, *Make It Stick*, p. 7; their emphasis
37. Medina, *Brain Rules*, p. 136.
38. Carol Dweck, *Mindset: The New Psychology of Success* (New York: Ballantine Books, 2016)

Chapter 4

1. Palmer, *The Courage to Teach*, p. 10.
2. Ramachandran and Blakeslee, *Phantoms in the Brain* & Antonio Battro, *Half a Brain Is Enough: The Story of Nico (Cambridge Studies in Cognitive and Perceptual Development)* (Cambridge: The University Press, 2000).
3. Jean Piaget and Bärbel Inhelder, *The Psychology of the Child*, (New York: Basic Books, 1969).
4. John Dewey, *Democracy and Education: An Introduction to the Philosophy of Education* (New York: The Free Press, 1944), p. 80.
5. Alfie Kohn, "Offering Challenges and Creating Cognitive Dissonance" in *Teaching by Heart: The Foxfire Interviews*; ed. Sara Day Hatton (New York: Teachers College Press, 2005), p. 103; my emphasis
6. Dewey, *Democracy and Education*.
7. Stuart Palonsky, *900 Shows A Year: a Look at Teaching from a Teacher's Side of the Desk* (New York: Random House, 1986).
8. Paul J. Lin, *A Translation of Lao Tzu's* ***Tao Te Ching*** *and Wang Pi's* ***Commentary*** (Ann Arbor: The University of Michigan Center for Chinese Studies, 1977), p. 49.
9. Ira Shor, "Teaching and Cultural Democracy" in *Teaching by Heart: The Foxfire Interviews*; ed. Sara Day Hatton (New York: Teachers College Press, 2005), p. 109.
10. The Annual Phi Delta Kappa/Gallop Poll Survey; available on-line at http://poll.gallup.com/.
11. Dintersmith, *What School Could Be*, p. 96.
12. Whitman and Kelleher, *Neuroteach*, p. 55

13. Linda Gottfredson, "What Do We Know About Intelligence?" in *The American Scholar*, Winter 1996.
14. Gary Marx, *Ten Trends: Educating Children for a Profoundly Different Future* (Arlington: Educational Research Service, 2000); Thomas L. Friedman, "It's a Flat World, After All" in *The New York Times*, April 3, 2005.
15. Shor, "Teaching and Cultural Democracy," p. 109.
16. Shor, "Teaching and Cultural Democracy," p. 109.

Chapter 5

1. Marshall G. S. Hodgson, *The Venture of Islam: Conscience and History in a World Civilization, Vol. 1: the Classic Age of Islam* (Chicago, 1974), p. 379; my emphasis; all quotes in this paragraph from same page.
2. Karen Armstrong, *The Spiral Staircase: My Climb Out of Darkness* (New York: Alfred A. Knopf, 2004), p. 284; my emphasis.
3. Greene, *Teacher as Stranger*; I provide no single page reference because Greene's entire book is an exposé on the moral character of teaching and learning.
4. Thomas Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970), p. 2.
5. Greene, *Teacher as Stranger*, p. 269.
6. Armstrong, *The Spiral Staircase*, p. 298.

Chapter 6

1. Jeffrey A. Kottler, Stanley J. Zehm, & Ellen Kottler, *On Being a Teacher: the Human Dimension, 3rd ed.* (Thousand Oaks, Ca: Corwin Press, 2005), p. 22.
2. Palmer, *The Courage to Teach*, p. 137.
3. Palmer, *The Courage to Teach*, p. 139; my emphasis.
4. Palmer, *The Courage to Teach*, p. 140.
5. Palmer, *The Courage to Teach*, p. 140.
6. Roland Barth, *Learning by Heart* (San Francisco: Jossey-Bass, 2004), p. 27.
7. M. Scott Peck, *The Road Less Traveled: A New Psychology of Love, Traditional Values and Spiritual Growth* (New York: Simon and Schuster, 1978), p. 81.
8. Kottler, Zehm, & Kottler, *On Being a Teacher*, p. 22.
9. Kottler, Zehm, & Kottler, *On Being a Teacher*, p. 23.
10. As a follow-up to what happened that day with Beccy and her classmates, the reader might be interested to know that out of such momentary ashes, she and I would develop one of the strongest mentor-mentee relationship I have had with one of my students, and I was there for her college graduation, her dissertation defense, and, most recently, her wedding. And for those who would like to know how I ultimately handled the educational situation in this story, each research team was given the chance to explain in their conclusion to their report why the mistakes they had made were, in fact, mistakes, and if they could successfully display the necessary metacognition without any aid from myself, there would be no penalty.
11. Dweck, *Mindset*, p. ix.
12. Dweck, *Mindset*, Chapter 1.

13. Dweck, *Mindset*, p. 47.
14. Whitman and Kelleher, *Neuroteach*, p. 43.
15. Tough, *How Children Succeed*, p. 183.
16. Tough, *How Children Succeed*, p. 121.
17. Dintersmith, *What School Could Be*, p. xix; Tough, *How Children Succeed*, p. 161.
18. Dweck, *Mindset*, p. 137.
19. Dweck, *Mindset*, pp. 75-76.
20. Dweck, *Mindset*, p. 75.
21. Dweck, *Mindset*, p. 220.
22. Barth, *Learning by Heart*, p. 29.
23. Barth, *Learning by Heart*, pp. 31-32.
24. Barth, *Learning by Heart*, p. 33.
25. Barth, *Learning by Heart*, p. 36.
26. Barth, *Learning by Heart*, p. 34.
27. Whitman and Kelleher, *Neuroteach*, p. 149.
28. Lest I be accused of hypocrisy, the irony of my own "telling" about the "doing" has not been lost on me: it's why I have used so many scenes from my own teaching to illustrate what student-centered education looks like.
29. Dintersmith, *What School Could Be*, p. 210.
30. National Commission on Excellence in Education, *A Nation at Risk: the Imperative for Educational Reform* (United States Department of Education: archived at http://www.ed.gov/pubs/NatAtRisk/risk.html, 1983).
31. *Crisis at the Core*, p. 11.
32. Dintersmith, *What School Could Be*, p. 70.

Chapter 7

1. As teachers, we are often privy to some very emotionally sensitive and potentially perilous private information. Accordingly, this vignette from my career has had any identifying elements deliberately changed, and the real "Brooke" has read it and given me permission to share what is written.
2. Damour, *Under Pressure*, p. 58.
3. See *The Baltimore Sun* editorial, "Larry Hogan's legacy: Fighting education with dark money" (Sept. 20, 2019) and for the original announcement of support, visit https://governor.maryland.gov/2016/08/09/governor-senate-president-and-house-speaker-announce-former-usm-chancellor-kirwan-as-chair-of-maryland-education-commission/; the recommendations of the Kirwan Commission can be found at http://dls.maryland.gov/pubs/prod/NoPblTabMtg/CmsnInnovEduc/2019-Interim-Report-of-the-Commission.pdf; the announcement of the 2019 school ratings can be found at https://digitaledition.baltimoresun.com/html5/desktop/production/default.aspx?edid=5c74efdd-71be-49bc-b22b-e3908cfdfd6c; and the data on Marylander's generally positive views about the potential tax hike can be found at https://www.washingtonpost.com/local/education/a-battle-for-the-soul-of-maryland-baltimore-education-advocates-gear-up-for-kirwan-funding-fight/2019/10/27/ba855db6-f8ef-11e9-8190-6be4deb56e01_story.html.
4. Evans, *Family Matters*, pp. 12-13.

5. Evans, *Family Matters*, p. xi.
6. Sherry Turkle, *Alone Together: Why We Expect **More** from Technology and **Less** from Each Other, 3rd Edition* (New York: Basic Books, 2017); p. 164.
7. Catherine Steiner-Adair, *The Big Disconnect: Protecting Childhood and Family Relationships in the Digital Age* (New York: Harper, 2013); p. 11.
8. Steiner-Adair, *The Big Disconnect*, p. 16.
9. Steiner-Adair, *The Big Disconnect*, p. 18.
10. Lawrence-Lightfoot, *The Essential Conversation*, p. 217.
11. Barbara Kingsolver, "Somebody's Baby," in *High Tide in Tucson: Essays from Now or Never* (New York: HarperCollins, 1995), pp. 102 & 100.
12. Palmer, *The Courage to Teach*, p. 45.
13. Palmer, *The Courage to Teach*, p. 182.
14. Barth, *Learning by Heart*, p. 186.
15. While all other stories from my career have been as deliberately authentic as memory recollection allows, this vignette is equally deliberately a composite of several different parent conferences over the many years, and the names are fictious. Unfortunately, the scene described was not a unique one in my career.
16. For those unfamiliar with the philosophy behind the "Thou"/"It" distinction in existentialism, see Martin Buber's *I and Thou* (New York: Charles Scribner's Sons, 1970).
17. See Greene's *Teacher as Stranger* for an in-depth discussion of this idea.
18. Palmer, *The Courage to Teach*, p. 111.
19. Christopher Leighton, Director of the Institute for Christian and Jewish Studies, speaking at the Day of Rembrance address at Roland Park Country School, Baltimore, Maryland on April 7, 2004.
20. Turkle, *Alone Together*, p. 293.
21. Kingsolver, "Somebody's Baby," p. 106.

Chapter 8

1. Lawrence-Lightfoot, *The Essential Conversation*, p. 113.
2. Lawrence-Lightfoot, *The Essential Conversation*, pp. 144.
3. The negative impacts of the chronic stress experienced by people of color in the United States on health are starting to be well-documented (https://www.apa.org/topics/health-disparities/fact-sheet-stress).
4. Dintersmith, *What School Could Be*, p. 103.
5. Banaji & Greenwald, *Blindspot*, p. 138.
6. Banaji & Greenwald, *Blindspot*, pp. 57 & 118.
7. Banaji & Greenwald, *Blindspot*, p. 135.
8. Banaji & Greenwald, *Blindspot*, Chapter 4.
9. Banaji & Greenwald, *Blindspot*, p. 146; the research on bias is quite extensive now, and for anyone wishing to pursue a better understanding of the topic and even of his, her, or their own personal hidden biases, numerous implicit association tests are available at Harvard University's Project Implicit (https://implicit.harvard.edu/implicit/takeatest.html). But as the web site itself points out: be forewarned that you might not like what you find.

10. Barth, *Learning by Heart*, p. 28; my emphasis.
11. Barth, *Learning by Heart*, p. 164.
12. Just to provide some perspective, approximately 17% of the children in this country now live below the poverty line, and about 43% of them rely on the federal Free or Reduced-price Lunch (FRPL) program for a daily meal. One in 30 children in this country are homeless, and the impact of the opioid crisis has resulted in an estimate 8.7 million children (and growing) living in a household with a substance abuse problem (https://www.census.gov/; https://www.aap.org/en-us/Pages/Default.aspx).
13. Tough, *How Children Succeed*, p. 85.
14. Whitman and Kelleher, *Neuroteach*, p. 17; the skills are: critical thinking, curiosity, collaboration, adaptability, initiative, communication, information analysis.
15. Dintersmith, *What School Could Be*, p. xvi; my emphasis.
16. Dintersmith, *What School Could Be*, p. xix.
17. Dintersmith, *What School Could Be*, p. 70.
18. Barth, *Learning by Heart*, p. 164.
19. Audre Norton, *Sister Outsider* (Berkley, CA: The Crossing Press, 1984), pp. 110.
20. Tough, *How Children Succeed*, p. 85.
21. Tough, *How Children Succeed*, p. 85.
22. Barth, *Learning by Heart*, p. 185.
23. Tough, *How Children Succeed*, p. 184.
24. Tough, *How Children Succeed*, p. 85.
25. Tough, *How Children Succeed*, p. 184.
26. A google search can currently bury in you stories; here's one from a reliable news source: https://www.fnlondon.com/articles/dealmaking-on-autopilot-investment-bankers-toy-with-automation-20190107
27. Palmer, *The Courage to Teach*, p. 182.
28. See Kira J. Baker-Doyle's *Transformative Teachers: Teacher Leadership and Learning in a Connected World* (Cambridge: Harvard Education Press, 2017) as well as Dintersmith's *What School Could Be*.

Chapter 9

1. Gazzaley and Rosen, *The Distracted Mind*, p. xiv.
2. Gazzaley and Rosen, *The Distracted Mind*, p. xiv.
3. Medina, *Brain Rules*, p. 115.
4. Medina, *Brain Rules*, pp. 116-117.
5. Gazzaley and Rosen, *The Distracted Mind*, pp. 11 & 79.
6. Gazzaley and Rosen, *The Distracted Mind*, p. 78.
7. Medina, *Brain Rules*, p. 117.
8. Gazzaley and Rosen, *The Distracted Mind*, p. 111; their original emphasis.
9. Medina, *Brain Rules*, pp. 58 & 105; Gazzaley and Rosen, *The Distracted Mind*, pp. 124 & 128; Turkle, *Alone Together*, p. 163.
10. Gazzaley and Rosen, *The Distracted Mind*, p. 108.
11. Ana Homayoun, *Social Media Wellness: Helping Tweens and Teens Thrive in an Unbalanced Digital World*. (Thousand Oaks: Corwin Press, 2018), pp. 5-6.

12. Gazzaley and Rosen, *The Distracted Mind*, p. 108; Ana Homayoun, *Social Media Wellness*, p. 5; Gazzaley and Rosen, *The Distracted Mind*, p. 11; Ana Homayoun, *Social Media Wellness*, pp. 5 & 66.
13. Evans, *Family Matters*, p. 4; my emphasis.
14. Evans, *Family Matters*, p. 5.
15. Steiner-Adair, *The Big Disconnect*, pp. 52, 58 & 197, 250; Turkle, *Alone Together*, pp. 168, 177-179; Ana Homayoun, *Social Media Wellness*, pp. 77-79.
16. Gazzaley and Rosen, *The Distracted Mind*, p. 126; my emphasis.
17. Where students are showing up without the "traits of persistent learners and original thinkers eager to engage;" Steiner-Adair, *The Big Disconnect*, p. 105.
18. For further information about this project, see my chapter in "It Is the 'Little Things' That Can Change the Way You Teach" in *Exemplary Science in Grades 9–12: Standards-Based Success Stories*. (Arlington: NSTA Press, 2005), pp. 1-9.
19. In fact, as a historical note, the famous Medieval philosopher and theologian, Thomas Aquinas, was nick-named "the dumb Ox" for his large size and habit of remaining quiet.
20. *Crisis at the Core*, p. i.
21. Evans, *Family Matters*, pp. 114-116.
22. Steiner-Adair, *The Big Disconnect*, p. 5.
23. Palmer, *The Courage to Teach*, p. 45.
24. Gazzaley and Rosen, *The Distracted Mind*, p. 112.
25. Ana Homayoun, *Social Media Wellness*, pp. 70-71; Steiner-Adair, *The Big Disconnect*, p. 54; Turkle, *Alone Together*, p. 172.
26. Ana Homayoun, *Social Media Wellness*, p. 70.
27. Palmer, *The Courage to Teach*, p. 103.
28. Ana Homayoun, *Social Media Wellness*, p. 71.
29. In fact, "our devices are ever more closely coupled to our sense of our bodies and minds" (Turkle, p. 167) to the degree that a third of people even check their phones while using the bathroom and 9% even do so during sex (Gazzaley & Rosen, pp. 11 & 108). As Catherine Steiner-Adair summarizes it well, "our digital devices have finally come to define us" (p. 4).
30. As with my parent conference vignette in Chapter 7, this one is also deliberately a composite of the many similar conversations I have had over the past 10 years, with fictious names to protect privacy.
31. Evans, *Family Matters*, p. 118.
32. Ana Homayoun, *Social Media Wellness*, pp. 29, 41, & 150.
33. Steiner-Adair, *The Big Disconnect*, p. 69.
34. Steiner-Adair, *The Big Disconnect*, p. 197.
35. Turkle, *Alone Together*, p. 172
36. Steiner-Adair, *The Big Disconnect*, pp. 52, 58, 196.
37. Ana Homayoun, *Social Media Wellness*, p. 16.
38. Steiner-Adair, *The Big Disconnect*, pp. 51, 63; Ana Homayoun, *Social Media Wellness*, p. 17.
39. Turkle, *Alone Together*, p. 163; Steiner-Adair, *The Big Disconnect*, p. 5; Ana Homayoun, *Social Media Wellness*, p. 139.
40. Damour, *Under Pressure*, pp. 131-135.
41. Steiner-Adair, *The Big Disconnect*, p. 11.

42. Steiner-Adair, *The Big Disconnect*, p. 217.
43. Ana Homayoun, *Social Media Wellness*, p. 40.
44. Ana Homayoun, *Social Media Wellness*, p. 165
45. Gazzaley and Rosen, *The Distracted Mind*, p. 170.
46. Damour, *Under Pressure*, p. xvi.
47. There has been some recent push-back from the research community that the studies of digital technology's impact have been strictly observational and have not met the rigor of controlled experiments (see Lydia Denworth, "The Kids are All Right" in *Scientific American*, Nov. 2019, pp. 44-49). However, I agree with David Katz, director of the Yale-Griffin Prevention Research Center at Yale School of Public Health, when he points out that "the idea that you can't learn something from observation is glaringly false. Think about telling kids not to run with scissors. We don't have randomized controlled trials of kids running with scissors, do we? We just know from observation that it's dangerous." *AARP Bulletin*, Dec. 2019, Vol. 60, No. 10, p. 33.
48. Gazzaley and Rosen, *The Distracted Mind*, pp. 11, 111, 124, & 127.
49. Ana Homayoun, *Social Media Wellness*, pp. 8, 69, 110, and 113.
50. Ana Homayoun, *Social Media Wellness*, p. 79.
51. Turkle, *Alone Together*, pp. 177-179.
52. Gazzaley and Rosen, *The Distracted Mind*, p. 170.
53. Ian Leslie, *Curious: The Desire to Know and Why Your Future Depends on It* (New York: Basic Books, 2014), p. 115.
54. Ian Leslie, *Curious*, p. 123.
55. Turkle, *Alone Together*, p. 240.
56. Turkle, *Alone Together*, p. xxii.
57. Turkle, *Alone Together*, p. 293.

Conclusion

1. I have always liked this analogy, and in those horrible moments in the classroom when nothing seems to be going right, I have been known to start repeating to myself like a mantra: *I'm planting dates; I'm planting dates; I'm planting dates*….
2. Wilson, *The Future of Life*, p. 23. Depending on your choice of mathematical equations you use, this number can range from 3.5 to 5.5 Earths, but 4 is the most commonly used number in the environmental science literature.
3. E. O. Wilson, "The Bottleneck" in *Scientific American*, Feb. 2002; pp. 83-91.
4. Peter Ward, *The End of Evolution: On Mass Extinctions and the Preservation of Biodiversity* (New York: Bantam Books, 1994).
5. Sara Day Hutton, ed., *Teaching by Heart: The Foxfire Interviews* (New York: Teachers College Press, 2005), p. 62. Indeed, this experience of isolation and lack of support on the part of teachers was a central theme of the educational journal, *The Active Learner*, for its entire five-year life-span; see also pp. 53, 63, 75, 87, 93, 102, 108, 114, 126, & 133.
6. Paley, "Listening to Children's Stories," p. 55.
7. Palmer, *The Courage to Teach*, p. 171; original emphasis.
8. Seymour B. Sarason, *Letters to a Serious Education President, 2nd ed.* (Thousand Oaks, CA: Corwin Press, 2006), p. 110.

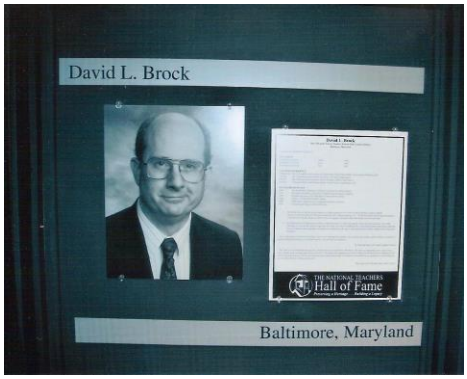
Afterword

1. Norris K. Smith, "Medicine & the New Time" in *Washington University School of Medicine Outlook Magazine,* vol. 20, no. 3; pp.14—19.
2. Kottler, Zehm, & Kottler, *On Being a Teacher,* p. 23.
3. Paley, "Listening to Children's Stories," p. 51; my emphasis.
4. Joseph Joubert, *Pensées,* trans. by Katharine Lyttelton (New York: Dodd, Mead & Co. 1899), 18.18.
5. Palmer, *The Courage to Teach,* p. 63; my emphasis.
6. Barth, *Learning by Heart*, p. 185.

Additional Reading

- Paul De Palma, "http://www.when_is_enough_enough?.com–Putting Microcomputers in Their Place" in *The American Scholar,* Winter 1999.
- Paulo Freire, *Pedagogy of the Oppressed* (New York: Continuum Publishing Company, 1970).
- Carol Gilligan, *In a Different Voice: Psychological Theory and Women's Development* (Cambridge: Harvard University Press, 1982).
- Michael Harris, *The End of Absence: Reclaiming What We've Lost in a World of Constant Connection* (New York: Current, 2014).
- Joyce Kaser, Susan Mundry, Katherine E. Stiles, & Susan Loucks-Horsley, *Leading Every Day: Actions for Effective Leadership, 3rd ed.* (Thousand Oaks, CA: Corwin Press, 2013).
- Pepi Leistyna, Arlie Woodrum, & Stephen A. Sherblom, *Breaking Free: The Transformative Power of Critical Pedagogy* (Cambridge: Harvard Educational Review, 1996).
- Ramin Mojtabai, Mark Olfson and Beth Han, "National Trends in the Prevalence and Treatment of Depression in Adolescents and Young Adults" in *Pediatrics*, December 2016, 138 (6) e20161878.
- Ken O'Connor, *A Repair Kit for Grading: 15 Fixes for Broken Grades, 2nd ed.* (Boston: Pearson, 2011).
- Parker J. Palmer, *Let Your Life Speak: Listening for the Voice of Vocation* (San Francisco: Jossey-Bass, 2000).
- Sharon Parks, *The Critical Years: The Young Adult Search for a Faith to Live By* (San Francisco: Harper & Row, 1986).
- Robert Quinn, *Deep Change: Discovering the Leader Within* (San Francisco: Jossey-Bass, 1996).
- Ira Shor, *Critical Teaching & Everyday Life* (Chicago: The University of Chicago Press, 1987).
- Ira Shor & Paulo Freire, A Pedagogy for Liberation: Dialogues on Transforming Education (Granby, MA: Bergin & Garvey Publisher, Inc., 1987).

About the Author



David Brock is a nationally recognized leader in science education, whose work has earned him the Presidential Award for Excellence in Mathematics and Science Teaching as well as the SeaWorld/Busch Gardens/Fujifilm Environmental Excellence Award. With over two dozen publications and over 65 workshops, this recently retired department chair at an all-girls school in Baltimore has been providing professional development since 1993 on best teaching practices and how to address gender equity issues in the STEM disciplines. In addition, he has served on numerous committees for the National Science Teaching Association as well as other organizations such as the Praxis® Biology National Advisory Committee and the K-6 PAEMST National Selection Committee.

As part of his work on gender equity, David was the founder and project director for 19 years of the Environmental Science Summer Research Experience for Young Women (https://rpcsblogs.net/essre/), serving high school girls throughout the Baltimore region to promote interest in careers in research. And in 2011, he founded a "school-within-a-school," The STEM Institute at Roland Park Country School, which is dedicated to fostering in young women the confidence, passion, and persistence to pursue careers in the STEM fields (://www.rpcs.org/academics/upper-school/stem-institute).

David was inducted into the National Teacher Hall of Fame in 2012.