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 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.

Notes

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.