

Three Cheers for Teachers

Educational reform should come from within the classroom and science can inform our reforms

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I HAVE SPENT A DECADE IN THE CLASSROOM teaching U.S. History, World History, and Advanced Placement World History (half in middle school and half in high school). This experience, along with ten years of higher education in the study of content, curriculum, instruction, and professional development, has shaped my evidence-based belief that educational reform and change, while necessary, will only come from the bottom up from teachers instead of the top-down from administrators and politicians.

Most large scale educational reform schemes, whether they come in the form of new curricular methods, management reforms, charter school schemes, private school vouchers or teacher professional development alterations are defeated by that simplest of technologies: the *classroom door*. The simple fact is that teachers can close the door and are largely in control of what happens in the classroom, and they are the ones who will choose to implement educational reforms or not. The classroom door is an unending source of frustration for scholars, administrators, reformers, and politicians of the type who view teachers as important only insofar as they can implement whatever educational theory is currently *en vogue*. Often, teachers see the door as being the last line of defense between their students and the myriad of educational fads that sweep through the profession every few years.

Diane Ravitch, in her book *The Death and Life of the Great American School System: How Testing and Choice are Undermining Education*, considers the failure of charter schools, "Teach for America" programs, testing mania, and coercive management styles in trying to reform secondary education.¹ Ravitch is not, as her detractors claim, merely a defender of the status quo, nor does she heedlessly attack the conservative educational agenda, taking pains to note that some of the "new model" schools are wildly successful. Ravitch's



point is that such programs are really no more or less successful than the public schools overall, and that these political debates distract from the more meaningful endeavor of engaging teachers and students in the creation of content-based curriculum, which is the type of work which gets behind the classroom door. A great teacher is a great teacher, no matter what the label of the school.

Thus, my arguments for real reform are aimed at teachers and come from a discipline that provides rich and practical insights: the history and philosophy of science.

A Consilience of Science and Education

The history and philosophy of science provides a deep well of analogies, metaphors and guiding principles for educational theory. One of the most important guiding principles to be gained from the sciences is how invigorating a new field can be if it provides, not a

coercive system, but a framework for allowing others to participate in the creation of new ideas. Great things have occurred in the sciences whenever they have become organic and allowed for the participants to shape and grow new types of knowledge. Such a philosophy of science has been historically fruitful.

Francis Bacon (1561-1626) published his treatise *Novum Organum (New Method)* in 1620. In this book, Bacon questioned the practice of the late medieval world's secular scholars of assuming that knowledge of the world was more or less complete. This knowledge, based upon the intellectually rich traditions of Greek philosophy, had been the basis of Western university education for centuries. Bacon did not disparage the major figure of Aristotle; indeed to do so would be to perjure one of the greatest practitioners of critical thought in the history of philosophy. Instead, Bacon encouraged his readers to *study* Aristotle, but he cautioned them against *worshipping* Aristotle. The point of the intellectual and academic enterprise,

according to Bacon, is to build upon what has been previously known.

It naturally follows, to a natural philosopher such as Bacon, that knowledge is gathered and compiled through the process of experiment. The knowledge that resulted from these experiments would be compiled in an early ancestor of the database that Bacon called the Table of Discovery. By stating this philosophy, Bacon did not create a system of thought to be imposed upon his readers. Instead, he acknowledged the importance of previous sources of knowledge but implored others to engage, not in the rote memorization of Aristotle's findings but in the process of thought that Aristotle used to create his insights. Bacon, more than anyone, is responsible for creating a framework of inquiry that invited practitioners to shape and define a field. This scientific concept has produced great things, and ought to be a guide for educational reform. With that conceit stated; here are the major lessons that education could learn from the history and philosophy of science and how those lessons can be practically (and immediately) applied in the classroom.

Embrace Consilience

The term "consilience" was coined by the 19th century Cambridge don William Whewell (who also invented the term "scientist") and was a concept he defined as the process that occurs when "an Induction, obtained from one class of facts, coincides with an Induction obtained from another different class."² Edward O. Wilson, further shaped the term, describing consilience as a way to link concepts across disciplines.³ Practically speaking, and to paraphrase Wilson, there are two types of thinkers. There are those who research in a single field, pushing the boundaries in search of the all-important scientific discovery, and then there are those who combine discoveries and make connections across disciplines. The second type of thinker sees that certain truths that can be induced from one set of facts (say mathematical) can also be induced from studying a different set of facts (say historical.) Evolutionary biology, for example, has a high level of consilience because the principle of evolution can be induced by studying fossils, genetic evidence, or even technological change.

Secondary education must embrace consilience, since the act of connecting and unifying facts across disciplines to solve problems is central to critical thinking. At the secondary level, we seek not to create researchers, but critical thinkers who

can study and manipulate facts for a purpose. This thinking ability is at the heart of intellectual discovery. It argues against the view, oft-repeated by President Obama's Education Secretary Arne Duncan, that the emphasis in secondary schools should be tilted heavily toward math and science. While clearly math and science are important, it is not historically true that great scientific or mathematical leaps follow from immersing students in those subjects. In fact, the greatest scientific and intellectual breakthroughs in history have come from individuals who have approached mathematical and scientific problems with a fresh perspective, one often gained from having a history of thinking in another discipline.

The noted philosopher of science Thomas Kuhn observed: "Almost always the men who achieve these fundamental inventions of a new paradigm have been either very young or very new to the field whose paradigm they change."⁴ Examples of this in the history of science are abundant. Newton made his leaps by ignoring the stagnant Cambridge curriculum and instead asking big questions about the universe. He then turned to first principles to answer them. Faraday was an interested amateur with a gift for devising experiments. Einstein thought of novel questions and then approached the process of answering them from first principles, almost totally ignoring the scientific and mathematical establishment in his quest. Jared Diamond approached history from the perspective of a biologist and, beginning with principles of evolution, set out to answer some history's biggest questions. August Kekulé, a pioneer in organic chemistry, originally was trained in architecture before entering chemistry, and Peter Watson noted that Kekulé "later... argued that his architectural training (such as it was) had helped him to think in pictures—and this played a vital role when he came to identify the structure of carbon compounds."⁵ Masha Gessen noted that the modern genius Grigory Perelman proved the Poincaré Conjecture by "applying Alexandrov spaces to Geometrization" and uniting various concepts from different mathematical backgrounds.⁶

If it sounds strange to bring the topic of genius, philosophy, and discovery into an article about education, that is because educational bureaucrats have dominated the conversation to the point where the public now thinks that the purpose of schools is to generate test data, not thinkers. If we want better mathematicians and scientists, then teachers should present students with paradoxes and questions, then

challenge them to find answers as they study across disciplines to find answers. Not everyone will be one of Kuhn's paradigm shifters, but learning to think in such a way is a benefit no matter what one chooses to do in life, and such an approach gives equal weight to the various subjects taught in secondary schools, since insights can come from any discipline. The alternative is the rigid study of bland principles for the purpose of testing. This creates not innovative thinkers, but stagnation.

Define Teaching as a Field Separate From Education

In his book on the topic of Germany's tremendous outpouring of intellectual achievements from the 18th century onward, Peter Watson credited a change in the approach of the German universities. He wrote that at the beginning of the 18th century "The norm was the teaching of static truths, not new ideas; professors were not expected to produce new knowledge."⁷ The Germans altered this by inventing the teacher-as-researcher concept, and then brought the same approach to the students, giving rise to the notion that a doctoral dissertation should produce something new and that professors should be engaged in pushing the limits of their fields. At the same time, the academic journal was founded, thus creating an historical record of ideas while at the same time encouraging scholars to seek the prestige of peer-reviewed publication. The result was what Watson calls a second scientific revolution in Germany. That model has been so successful that it is the status quo at every major university in the Western world.

Yet secondary teaching has not embraced such a model. Teaching is not seen as a separate field from education. Thus, teachers have become a population to be convinced or coerced into adopting educational techniques developed by individuals at the university who are engaged in quite a separate endeavor from what classroom teachers are. In fact, teaching has never fit easily inside either the research discipline model or the education model. Teachers are not researchers, nor are we concerned solely with methods (as Education is). Teaching involves the application of methods to research-based content for the purpose of opening minds.

If the field of teaching is defined as the application of methods to content for the purpose of educating students, then teaching involves bridging the gap between university research and the secondary classroom. In other words, it is the job of a teacher to dive deeply into the best scholarship in a

content area and then apply methods training to conceive ways in which to make that content understandable to sleepy teenagers. *This is intense intellectual work.* Yet, there are no academic journals devoted to the field of teaching as defined here, no collection of a body of work where teachers can write about how they applied methods training to specific forms of content (books, articles etc.) to make that content applicable to the secondary classroom.

Defining teaching as an academic field is a crucial step to educational reform. Teachers could then be involved in a dynamic intellectual process by which they can add to and benefit from a body of knowledge in their field. Such an approach would separate teaching from education, which too often involves the repackaging of old ideas for sale to school districts. For example, one widely influential book titled *Whatever it Takes: How Professional Learning Communities Respond When Kids Don't Learn*, seems to do little but rename "tests" as "performance assessments" and "teacher teams" as "Professional Learning Communities."⁸ Another influential work, Ruby Payne's *A Framework for Understanding Poverty*, declares that the job of schools is not to educate, but to teach children of the lower classes the "hidden rules" or expected behaviors of the middle class.⁹ This is quite different from teaching students how to think.

Include Content Area Study as Part of Professional Development

If the field of teaching is defined as the application of methods to content then it makes sense that teachers should be given time to study their content areas as a form of ongoing professional development. This is important because the research clearly indicates that the individual classroom teacher is the most important school-based factor for improving student achievement. A teacher's level of content area mastery is a major factor in determining whether or not she is highly effective.

One study of highly effective college professors, conducted by Ken Bain, found that, despite differences in teaching style and approach, all great professors shared one thing: "Without exception, outstanding teachers know their subjects extremely well. They are all active and accomplished scholars, artists, or scientists."¹⁰ Should we assume the same thing is not true for secondary educators? In Finnish schools, ranked number one in the world by *Newsweek* magazine, teachers must have a degree in both education and in the content area they teach.

Diane Ravitch has noted how the ugliness of politics, particularly in the disciplines of history, has hampered the creation of strong content-based national standards. This same politically correct impulse has led James Loewen, the most vociferous critic of history textbooks, to claim that textbooks present a skewed, false, or just plain bland version of historical events.¹¹ Teachers who know their content well can craft lessons which bring about the best ideas in new scholarship rather than simply teaching students with textbooks and supplementary materials which have the potential to be crippled by political and economic considerations.

The study of content would not necessarily be limited to the subjects the teachers teach. Neuroscience, for example, has a lot to offer secondary teachers. Daniel T. Willingham has made a career of applying findings from neuroscience to education. His book *Why Don't Students Like School?: A Cognitive Scientist Answers Questions About How the Mind Works and What it Means for the Classroom* is a handy resource for any teacher looking for practical applications from modern neuroscience. Importantly, Willingham notes, "Research from cognitive science has shown that the sorts of skills that teachers want from students—such as the ability to think critically—require extensive factual knowledge."¹² The same concept is true for teachers, who should have the opportunity to study facts in addition to methods during their professional development time.

Study from different disciplines, particularly scientific disciplines, can yield new and surprising insights. Studying anthropology, for example, helped me to understand that my students have the same DNA as humans 100,000 years ago. The genes have stayed more or less the same but the environment (civilization) has drastically changed. No wonder certain behaviors, such as flirting, finding safety in groups, jockeying for social position, and making mock war against other tribes come naturally to us. These acts are natural to our genes. Learning to read, write, and analyze facts are things our brains *can* do but are not natural to it. Education is literally the process of civilizing the hunter-gatherer brain.

The brain appears to be hardwired to look for connections in information, to search for something that Michael Shermer calls "patternicity." According to Shermer, highly creative people who make breakthroughs often have a high capability for finding patternicity, but this skill sometimes leads

them astray in that they may find patterns where none exist.¹³ For example, Newton—an ingenious pattern seeker if ever there was one—saw codes and ciphers in everything from the Bible to ancient Greek myths, but finally put his talent to good use when he wrote *The Principia*.¹⁴

The ability to find patternicity is especially important given what Information Theory has to say about the potential pitfalls of information glut. James Gleick recently observed in his book *The Information*: "It is not the amount of knowledge that makes a brain. It is not even the distribution of knowledge. It is the interconnectedness."¹⁵ Schools should be deeply concerned with endowing students with the ability to synthesize information and make leaps across disciplines; otherwise students may not know how to even begin processing the amount of knowledge now available to them. Information is inert without a brain to see meaningful patterns in it.

The history and philosophy of science teaches us that individuals who develop patterns of thought from one discipline, and can superimpose those patterns on problems in a new discipline, often find novel solutions to difficult problems. Typically, this process has been facilitated by randomness and accident, but it is an educational theory that can be taught to students. A good educational theory acts like a greenhouse, creating the conditions by which thoughts and creativity can grow. Given that they will be thinking in a world overwhelmed with information; students should be learning how to find meaningful patterns in the various disciplines as well as being taught how to avoid falling for false patterns or conspiracies.

Immediate Classroom Application

Teachers deserve to see the reasoning behind any presentation of a new educational idea and the preceding arguments, although perhaps somewhat abstract, do distill into a practical philosophy that can be immediately applied into the classroom. A teacher merely has to embrace the idea that her job is to keep abreast of the best new scholarship and then apply her methods of training to that work for the purpose of making the concepts workable in class. If a teacher embraces this definition of the profession, then she will find herself immersed in the study of her content (ideally this would be fostered by formal professional development, but teachers do not need to wait around for this to occur) and constantly engaged in the mentally engaging (and taxing) work of finding ways to

make that content digestible by students.

By way of example, in 2008 a journal produced by the National Council For Social Studies published a paper of mine entitled “Connect-the-Dots: Making Meaning from Historical Evidence.” In that paper, I demonstrated how I applied best practices in pedagogy to the ideas and content of a specific work of history, Jared Diamond’s *Guns, Germs, and Steel*, in order to make Diamond’s ideas accessible to my 8th grade students. The method simply involved “hooking” the students by asking them to compare Pizarro’s 1532 conquest of the Incas in Peru with a video clip from Steven Spielberg’s *War of the Worlds*. The students then generated questions, such as how were Pizarro and his 168 men able to conquer the entire Inca Empire (the same inquiry that sent Diamond on his historical quest). My job as a teacher, then, was simply to lay out all of the information necessary for the students to answer those questions. As in a connect-the-dots game, the students were presented with a seemingly random series of “dots” or pieces of information, but then were invited (or forced, depending on what time of day it was) to connect those pieces of information until a larger, previously hidden, picture emerged. They found a pattern in the information and synthesized it into a narrative. Their understanding of the material was assessed by their ability to analyze a primary document they’d never seen before but was relevant to the lesson.

This rather simple but effective lesson was

only possible because I understood Diamond’s concepts well enough to lead my students in the inquiry. Everything proceeded from personal desire to be kept current of the best new thinking occurring in the field of scholarship and to find a way to make my students interested in it. The lesson fits in with what both best educational practice and the newest neuroscientific findings call for, and it was not necessary to wait on anyone’s approval. Any teacher could have done it. By defining teaching as a field, however, other teachers might see their profession as being a bridge between the academy and the classroom, and come up with creative ways to bring that knowledge to their students. If those teachers had professional journals dedicated to this endeavor then knowledge could be compiled and shared. Teaching, then, would be redefined by the teachers.

Conclusion

Teachers need to be energized and respected, but that cannot happen if they are seen as pawns in political or business management schemes, which are the areas of thought currently shaping the bulk of educational policy. If secondary education is to be revamped, then it must take its lessons from the world of deep thought and intellectual achievement, and those lessons are best derived from the history and philosophy of science. Teachers are the key to educational improvement, and if any philosophy of change is to get “behind the door” it will have to convince rather than coerce. ■

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