Disciplining the Mind to Prepare the Young for Tomorrow's World

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Introduction

The unit on industrialization was almost over. Phillip, a 10th grade world history teacher began to design the final test. In the past, he had combined questions presented in his weekly quiz with new questions about key events, persons, and inventions—a procedure that had proven comfortable for both the students and for him. But this time he decided to raise the stakes. He wondered whether students' understanding of the process and meaning of industrialization had improved over the last six weeks. Could students explain *why* industrialization took place? Could they recognize how difficult it is for historians to build an empirically grounded portrait of an unfolding past; or to draw telling comparisons with today's communications revolution? These goals seemed far more important than the usual litany of names, dates, and locations. And yet Philip also worried that reflection questions of this kind in the final exam would be seen as *foul play* by his students.

Phillip's dilemma permeates classrooms around the world and across the disciplines. It addresses issues of accountability, the nature of teacher-student interactions, and the rituals of schooling. Most strikingly, it reveals two colliding views of what it means to understand "history", "biology", "mathematics" or the "visual arts." From the conventional stand point, students learn *subject matter*. They and their teachers conceive of the educational task as committing to memory large numbers of facts, formulas and figures. Fixed in textbooks, such facts are taken as uncontroversial, their mastery valued as a sign of cultural literacy. In sharp contrast with teaching *subject matter*, an alternative perspective emphasizes teaching *disciplines* and *disciplinary thinking*. The goal of the latter approach is to instill in the young the disposition to interpret the world through the distinctive ways of thinking that characterize the work of experienced disciplinarians-- historians, scientists, mathematicians

or artists. This view entrusts educational institutions with the responsibility of *disciplining the young mind* (Gardner & Boix Mansilla 1994, Gardner, 1999, 2006).

In our view, Phillip's transition from teaching *subject matter* to nurturing the *disciplined mind* is emblematic of a fundamental shift in the way in which educators, policy makers and the general public conceive of curriculum, instruction, and assessment. Indeed, we argue, it entails a necessary transformation if we are to prepare students so that they understand the world in which they live today and brace themselves for the future.

Teaching *subject matter*

Most individuals in most schools today are studying *subject matter*. In science, students memorize animal taxonomies, atomic weights, and the organs involved in the respiratory system. In mathematics, they learn algebraic equations and geometrical proofs by heart, so that they can 'plug in' the appropriate numbers. In history they are expected to remember key actors, events and periods. In the arts they classify works by artist and schools. *Subject matter* learning involves mentally recording propositions such as: "The first industrial revolution took place in Britain at the end of the eighteenth century;" "The chemical composition of water is H2O;" "Picasso' *les desmoiselles d'Avignon* is a cubist painting of 1907." From a *subject matter* perspective students come to see "history" and "science" as the collection of dates, actors, facts, and formulas catalogued in textbooks and encountered in rooms 458 and 503, in second and third period respectively.

In a unit on Industrialization presented as *subject matter,* successful students can define the "industrial revolution" as a change from hand and home-based production to production with machines and in factory. They distinguish between the first industrial

revolution that took place in Great Britain in the late eighteenth century and the second industrial revolution that unfolded in the United States and Germany a half a century later. They cite important inventions of spinning and weaving machines operated first by water and later by steam. They recall that: "industrialization brought about changes in society and the rise of the modern urban-industrial state." Exemplary *subject matter* students retain more detail. They are able to list inventors and their inventions, from James Watt's steam engine in 1776 to Henry Ford Model T automobile in 1903.

Why is teaching *subject matter* problematic?

Clearly, there is much to admire in an individual who knows a great deal of information. Furthermore, there is an appealing sense of efficiency in *subject matter* teaching—large quantities of information can be rapidly presented to students and easily tested at scale. The apparent benefits pale, however, when we consider how the young human mind develops and when we entertain the question of how best to prepare it for the future.

In recent decades cognitive psychologists have documented a phenomenon of vital importance for anyone interested in education. While students have little trouble spewing forth information that they have committed to memory, they display great difficulty in applying knowledge and skills to new situations—ones that they have not been exposed to before and yet ones where their knowledge and skills should prove adequate to the assignment. Youngsters who have studied the solar system prove unable to apply what they have learned to explain why it is warmer in the summer in the northern hemisphere. When asked to explain how a particular species trait or behavior has emerged, students studying biological evolution revert to pre-Darwinian "intentional' or teleological explanations.

Students who are able to define cubism as a successful challenge to 19th century aesthetic sensibilities, naively equate a classical definition of "beautiful" with "good" when visiting a museum. Despite a decade or more of formal education, centuries of accumulated forms of expertise have simply bypassed these young minds. Why is this so?

As explained by cognitive psychologists, early in life, children develop powerful intuitive ideas about physical and biological entities, the operations of the human mind, the properties of an effective narrative or graphic display. Some of these ideas are powerful precursors of sophisticated disciplinary understanding. For example, by age five children understand that narratives have beginnings, turning points, and ends and that the succession of events in them must "make sense' for the story to work. Historians, too, organize their accounts of the past in the form of narratives-- intelligible accounts marked by turning points and preferred actors' perspectives.

Unfortunately, not all children's ideas are equally auspicious. Unlike historians, young students tend to prefer simple explanation and clear distinctions between "good" and "mean" actors; they believe that events always result from intentional actions—especially the actions of leaders; they have difficulty understanding the unintended consequences of actions. Most strikingly, students often project contemporary knowledge and values onto the minds of actors in the past, making "presentism" one of the most difficult misconceptions to eradicate.

Regrettably, subject matter learning does not challenge such robust intuitive theories—indeed, typically, memorization does not even acknowledge the existence of these entrenched ways of making sense of the world. As a result, the information presented to students in subject matter classrooms is either retained only momentarily or, at best,

reorganized in oversimplified linear plots. For example, students may record that the steam engine triggered the industrial revolution; farmers rushed to the cities in search for work; leading businessmen amassed enormous wealth and soon became seen as abusive "Robber Barons." In response, government and labor organized to regulate working conditions.

The plot demonstrates its fragility when apparent contradictions are encountered: Consider, for example, what happens when students learn that organized efforts to defend the rights of working people preceded the popularization of the steam engine. It turns out that, the London Corresponding Society was founded by artisans and shop workers in 1792, inspired partly by the French Revolution and partly by workers' shared experiences in growing manufacturing districts (Thompson, 1963). Students who have just memorized a plot line (first industrialization, then unrest, then labor unions) cannot assimilate this information. More challenging still, the pre-disciplinary mind fails to appreciate that aspects of the industrial revolution are being recapitulated in the current digital upheavals around the globe. S*ubject matter* learning may temporarily increase students' information base but leaves them unprepared to shed light on issues that are even slightly novel. A different kind of instruction is in order: we claim, one that seeks to "discipline the mind".

The disciplined mind

The disciplined mind works differently. For a historian, a statement such as "The first industrial revolution took place in Britain at the end of the eighteenth century," is not a fact to be remembered but rather a contestable claim that stems from deliberate ways to partition the past. It is constructed through close analysis of sources that capture the lives of Britons over centuries of progressive urbanization.

Disciplined views of Industrialization weigh multiple, sometimes conflicting causal explanations. Historians consider the transformative role of technological inventions but attend as well to cultural, social and economic forces that may explain why, for example, the steam engine appeared in Britain and not elsewhere in Europe or Asia at the time. Some point to low interest rates, saving practices, and trade with Asia and the Americas—markets feeding into and later consuming British manufactured goods. Others argue that a widespread Protestant ethic promoted hard work, frugal spending, accumulation of wealth for investment, slowly preparing the stage for industrialization.

For students, learning to think historically entails understanding that historical accounts are sometimes conflicting and always provisional. Students learn that our interpretations of the past are not "simply a matter of opinion" nor must "one account be right and the other one wrong" when differences occur. Rather, the disciplined mind weighs competing accounts through multiple considerations. For instance it attends to the perspectives emphasized -- a history of the nascent industrial working class will contrast with one focusing on the Captains of Industry. It considers the timeframe selected to explain industrialization -- long term accounts may capture slow population changes while pointed accounts shed better light on the role of individuals and inventions. A disciplinary approach considers the types of sources employed-- letters, newsletters, accounting and demographic records. It also assesses whether conflicting accounts could be integrated into a more comprehensive explanation.

All disciplines embody distinct ways of thinking about the world. Scientists hold theories about the natural world that guide their particular observations, they make hypotheses, design experiments to test them, revise their views in light of their findings, and

make fresh observations. Artists, on the other hand, are less constrained by empirical demands. They seek to shed novel light on the object of their attention, depict it with masterful technique, stretch and provoke themselves and their audiences through deliberate ambiguities in their work. Becoming a better artist does not make students better historians, scientists or mathematicians—or vice versa.

Of course, it is unreasonable to expect all students to become expert scientists, historians and artists. Quality pre-collegiate education should ensure that students become deeply acquainted with the fundamental perspectives on the world that a discipline offers. Teachers prepare to nurture the disciplined mind by reflecting about their disciplines themselves. Why do we teach science, history or the arts? What about these discipline matters most for students to learn? Perhaps most importantly, what constitute the core capacities of the *disciplined mind*?

Core capacities of the disciplined mind

Four core capacities are key to developing a disciplined mind in a given domain. They involve understanding (1) the purpose of disciplinary expertise; (2) an essential knowledge base; (3) disciplinary methods of inquiry; and (4) disciplinary forms of communication (Boix Mansilla & Gardner,1999).

(1) Understanding the purpose of disciplinary expertise

Disciplinary knowledge stems from our need to understand and predict, express a point of view, create products and tools, and/or solve complex problems. Disciplines inform the contexts in which students live. Supply–and-demand principles determine the products that

line the shelves of supermarkets. “Biological interdependence” shapes the life of animals and plants at the local park and in the rain forest. Environmental artworks call society's attention to the importance of preserving our ecosystems.

In recent years, a renewed interest in the study of industrial revolution has been sparked by our experience of the *digital revolution*—the rapid growth of computing and communication capacities transforming the planet. Arguably, understanding how novel forms of work accelerated the formation of class consciousness among eighteenth century industrial workers prepares students to appreciate the experience of contemporary workers in China, India or Malaysia. Like their predecessors’, these workers’ rapid urbanization forces them to juggle economic opportunities with anxiety over challenges to family life and cultural tradition. At the same time, students developing a disciplinary mind learn to attend to important differences between conditions in the past and the present—contemporary digital calling centers in India bear little resemblance to the early textile factories in Leeds, England. These students appreciate that the purpose of studying history is to understand past human experience—not to make predictions but to meet the present and the future in informed ways.

(2) Understanding an essential knowledge base

Each discipline embodies innumerable concepts, examples, and ideas. Educators are challenged to select those that are most significant for students to learn. An *essential knowledge base* embodies concepts and relations that are central to the discipline, and applicable in multiple contexts. An essential knowledge base equips students with *conceptual blueprint* for approaching comparable novel situations. For instance, in a unit on industrialization, students may examine the dynamic interaction between technology and

society to decide whether they deem industrialization “progress” or “decline”. Students must understand social and economic forces that set the stage for industrial advancements in eighteenth century Britain: wide-spread protestant ethics, growing entrepreneurial sprit among artisans and laborers, accumulated capital, largely accessible raw materials and markets. They must also weigh the impact of new technologies on macro-economic growth, living conditions and social cohesion in rapidly overcrowding industrial centers and the rising working class consciousness.

Conceptual blueprints of this kind enable students to link particular incidents of the industrial times with more general interpretations. By capturing central dimensions of technology and society the blueprint can be applied to technological developments at different points in time, from the printing press, to the sawing machine, to today’s internet. Of course in each case, historical context will dictate the particularities of the emerging account.

(3) Understanding inquiry methods

In contrast to naïve beliefs or mere information, disciplinary knowledge emerges from a careful process of inquiry and vetting of claims. The disciplined mind considers forms of evidence, criteria for validation, and techniques that render knowledge about the past, nature, society, or works of art trustworthy. In science students learn that experiments require carefully designed controls and that the coexistence of two phenomena does not mean that one is causing the other. In the arts students develop habits of visualization, observation, critique, technical mastery and perseverance in the study of a subject (Hetland et al 2007).

In history, for instance, students exhibit their understanding of inquiry methods when they weigh competing accounts to assess their acceptability, are wary of simple explanations, consider the sources used, and attend to how actors' perspectives are selected and portrayed. Confronted with conflicting interpretations of the triggers of English organized labor they understand, in the words of historian E. P. Thompson

> Too often, every account must start somewhere and we only see the things which are new. We start at 1789 and English Jacobinism appears as a byproduct of the French Revolution. Or we start in 1819 and English Radicalism appears to be a spontaneous generation of the Industrial Revolution.

These students learn not to be surprised by historians' recognition of the tentative nature of their accounts, nor to discard a historical narrative as a whole when a particular "fact" is called into question.

In fact, in today's societies where knowledge is produced at an unprecedented pace, the capacity to gauge the acceptability of a novel account is at a premium. In our own research we have found that high school students trained in history exhibit a *disciplined mind* in this domain—they recognize the demands of source interpretation, complex causal explanation and the provisional nature of historical accounts (Boix Mansilla, 2004). However, when asked to adjudicate between competing accounts in science –a domain in which they have not been rigorously trained—the same students exhibit a *subject matter* approach to inquiry. They view science as a domain in which one can simply observe the world and write down one's conclusion. Conversely award winning students in science, perceive history as all about dates and facts that one need to simply "find in sources" and "put together in a story." Cross-disciplinary transfer proves elusive.

(4) Understanding forms of communication.

Finally disciplines communicate their expertise in preferred forms and genres. Historians see narratives as best fit for their work while scientists opt for data-heavy research reports. The disciplined mind understands these favored genres because it can place them in the broader context of their disciplinary origins. For example, the disciplined (scientific) mind understands that, unlike Darwin's Origins of Species, a biblical account of human creation needs not (indeed cannot) stand the test of empirical evidence, nor can it aspire to be considered a scientific claim.

Students develop a disciplined mind when they learn to communicate with the symbol systems and genres of a discipline. In science, students learn how to write (and recognize) a well crafted scientific report, where clear testable hypotheses, methodology, results, and discussion are made public for readers to weigh. In history, knowledge about the past is embodied in vivid and well footnoted narratives but can also be encountered in the form of museum exhibits, monuments, and documentary films.

Nurturing the disciplinary mind to prepare the young for the future

With every passing year the societal demands on our educational systems are becoming clearer (Gardner, 2007). The information revolution and the ubiquitous nature of search engines have rendered "*having* information" a much less valuable skill than "knowing how to *think with* information in novel situations". As computers take on information processing tasks at the workplace, expert thinking, the capacity to inquire about novel situations, and to communicate knowledge effectively are increasingly at a premium (Levy & Murnane, 2004). In the same vein, our complex global societies demand that students approach cultural

heritage and identity in well-informed ways (Suarez Orozco & Qin Hilliard, 2004). For example, a disciplinary education enables students to transform simplistic views of “culture” (typically associated with an exotic other) and consider group differences in terms of how people make sense of and organize experience. By resisting oversimplification and emphasizing the uses to which vetted knowledge can be put, the disciplined mind enables the young to participate more fully in shaping their future.

Bibliography

Boix Mansilla, V. (2004). Between reproducing and organizing the past: Students' beliefs about the standards of acceptability of historical knowledge. In *International Review of Research History Education.* London: Fran Cass.

Boix Mansilla, V. & Gardner, H. (1999). What are the Qualities of Understanding? In *Teaching for Understanding, a practical framework.* Stone Wiske Ed. San Francisco: Jossey Bass.

Gardner, H. and Boix Mansilla V. (1994). Teaching for Understanding in the Disciplines and Beyond. *Teachers College Record.* (Winter-1994).

Gardner H. (2007). *Five Minds for the Future.* Boston: Harvard Business School Press.

Gardner H. (1999). *The Disciplined Mind: What all students should understand.* New York Simon and Shuster.

Hetland, L., Winner, E., Veenema, S., and Sheridan, K. (2007) Studio thinking. New York: Teachers College Press.

Levy F. & Murnane R. (2004). *The New Division of Labor: How computers are creating the next job market*. New York: Russell Sage.

Suarez Orozco M. & Qin Hilliard D.B (2004) (Ed). *Globalization Culture and Education in the New Millennium.* Berkeley: University of California Press.

E. P. Thompson (1963). The Making of the English Working Class. Unites States: Random House.

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