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**Teaching Students to Think** Pages 14-19

## Disciplining the Mind

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**Students need more than a large information base to understand their ever-changing world. They need to master disciplinary thinking.**

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 included questions from his weekly quizzes as well as new questions about key events, people, and inventions. This approach had proven comfortable for both him and his students.

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 draw telling comparisons with today's communications revolution? These goals seemed far more important than the usual litany of names, dates, and locations. Yet Phillip worried that his students would see reflective questions of this kind in the final exam as foul play.

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 striking, it reveals two colliding views of what it means to understand history, biology, mathematics, or the visual arts. From the conventional standpoint, students learn *subject matter*. In general, 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 this approach is to instill in the young the disposition to interpret the world in the distinctive ways that characterize the thinking of experienced disciplinarians—historians, scientists, mathematicians, and artists. This view entrusts education institutions with the responsibility of disciplining the young mind (Gardner, 1999, 2006; Gardner & Boix Mansilla, 1994).

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, policymakers, and the general public conceive of curriculum, instruction, and assessment. Indeed, preparing students to understand the world in which they live today and to brace themselves for the future entails a necessary transformation.

## Teaching Subject Matter

Most students in most schools today study subject matter. In science, students memorize animal taxonomies, atomic

weights, and the organs in the respiratory system. In mathematics, they learn algebraic equations and geometrical proofs by heart so 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 school.

Subject-matter learning involves mentally recording such propositions as, "The first Industrial Revolution took place in Britain at the end of the 18th century," "The chemical composition of water is H<sub>2</sub>O," and "Picasso's *Les Femmes d'Alger* is a cubist painting painted in 1907." From a subject-matter perspective, students come to see the subjects of 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.

## The Power of Ingrained Ideas

Clearly, there is much to admire in an individual who knows a great deal of information. Further, there is an appealing sense of efficiency in subject-matter teaching: Teachers can rapidly present large quantities of information to students and easily test this information. The apparent benefits pale, however, when we consider how the young human mind develops and how best to prepare that mind for the future.

In recent decades, cognitive psychologists have documented a phenomenon of vital importance for anyone interested in education. Although 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. Youngsters who have studied the solar system are unable to apply what they have learned to explain why it is warm 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. Centuries of accumulated forms of expertise have simply bypassed these young minds despite a decade or more of formal education. Why is this so?

According to cognitive psychologists, early in life children develop powerful intuitive ideas about physical and biological entities, the operations of the human mind, and the properties of an effective narrative or graphic display. Some of these ideas are powerful precursors of sophisticated disciplinary understanding. For example, by age 5, children understand that narratives have beginnings, turning points, and endings and that the succession of events 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 prefer simple explanations 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 unintended consequences. Moreover, 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.

## The Limitations of Subject-Matter Learning

Regrettably, subject-matter learning does not challenge such robust intuitive theories. Indeed, memorization does not even acknowledge the existence of these entrenched ways of making sense of the world. As a result, in subject-matter classrooms, students tend to momentarily retain the information presented, or they reorganize it in oversimplified linear plots. For example, students may record that the steam engine triggered the Industrial Revolution, then farmers rushed to the cities in search of work, then leading businessmen amassed enormous wealth and soon became abusive robber barons. In response, government and labor organized to regulate working conditions.

The plot demonstrates its fragility when students encounter apparent contradictions. 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. Students who have memorized a plotline—first industrialization, then unrest, then labor unions—cannot assimilate this information. More challenging still, the predisciplinary mind fails to appreciate that aspects of the Industrial Revolution are being recapitulated in the current digital upheavals around the globe.

Subject-matter learning may temporarily increase students' information base, but it leaves them unprepared to shed light on issues that are even slightly novel. A different kind of instruction is in order, one that seeks to discipline the mind.

## The Disciplined Mind

For a historian, a statement such as, "The first Industrial Revolution took place in Britain at the end of the 18th century," is not a fact to remember 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.

For students, learning to think historically entails understanding that historical accounts are sometimes conflicting and always provisional. Students learn that interpretations of the past are not simply a matter of opinion, nor must one

account be "right" and the other "wrong" when differences occur. Rather, the disciplined mind weighs competing accounts through multiple considerations. For instance, a history of the nascent industrial working class will contrast with a history focusing on the captains of industry. Long-term accounts may capture slow population changes, whereas pointed accounts shed better light on the role of individuals and inventions. A disciplinary approach considers the types of sources consulted, such as letters, newsletters, and 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 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, seek to shed novel light on the object of their attention, depict it with masterful technique, and stretch and provoke themselves and their audiences through deliberate ambiguities in their work.

Of course, it is unreasonable to expect all students to become expert scientists, historians, and artists. Nevertheless, quality precollegiate education should ensure that students become deeply acquainted with a discipline's fundamental perspectives on the world by developing four key capacities (Boix Mansilla & Gardner, 1999).

### **Capacity 1: Understanding the Purpose of Disciplinary Expertise**

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 as well as in the rain forest.

Students of history grasp that the purpose of their discipline is to understand past human experience—not to make predictions but to meet the present and the future in informed ways. For example, understanding how novel forms of work accelerated the formation of class consciousness among 18th-century industrial workers prepares students to appreciate the experience of contemporary workers in China, India, or Malaysia. Although students learn to attend to important differences between past and present conditions—contemporary digital calling centers in India bear little resemblance to the early textile factories in Leeds, England—they also understand that rapid urbanization forces these workers, like their predecessors, to juggle economic opportunities with anxiety over challenges to family life and cultural tradition.

### **Capacity 2: Understanding an Essential Knowledge Base**

An essential knowledge base embodies concepts and relations central to the discipline and applicable in multiple contexts. It also equips students with a 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 to be "progress" or "decline." Students can apply this blueprint to technological developments at different points in time, from the printing press, to the sewing machine, to today's Internet.

### **Capacity 3: Understanding Inquiry Methods**

In contrast to naïve beliefs or mere information, disciplinary knowledge emerges from a careful process of inquiry and vetting claims. The disciplined mind considers forms of evidence, criteria for validation, and techniques that deliver trustworthy knowledge about the past, nature, society, or works of art.

In our own research, we have found that high school students trained in history recognize the demands of source interpretation, complex causal explanation, and the provisional nature of historical accounts (Boix Mansilla, 2005). However, becoming a better historian does not make students better scientists, artists, or mathematicians—or vice versa. For example, 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 simply observes the world and writes down one's conclusions. Conversely, award-winning students in science tend to perceive history as all about dates and facts that one need only "find in sources" and "put together in a story." Cross-disciplinary transfer proves elusive.

### **Capacity 4: Understanding Forms of Communication**

Disciplines communicate their expertise in preferred forms and genres. Historians see narratives as the best fit for their work, whereas 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 *On the Origin of Species*, a biblical account of human creation cannot stand the test of empirical evidence, nor can it aspire to consideration as 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 in which clear and 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 as well as in museum exhibits, monuments, and documentary films.

## **How to Nurture the Disciplined Mind**

Teachers can help students develop disciplinary competencies in several ways (Gardner, 2006):

- *Identify essential topics in the discipline.* In our example about industrialization, some topics will address the knowledge base, such as the transformation of production systems and social organization during the Industrial Revolution. Some will address the methods of the discipline, such as understanding conflicting accounts of workers' experiences and worldviews during the early stages of the Industrial Revolution. Some will address the purposes of the discipline, such as understanding how changes in technology lead to changes in ways of thinking both then and now. Some topics will address the forms of communication in the discipline, such as understanding what makes a historical narrative masterful.
- *Spend considerable time on these few topics, studying them deeply.* By encouraging students to examine multiple perspectives on a topic and study them in depth, teachers help students become young experts in different topic areas.
- *Approach the topic in a number of ways.* Students may readily approach the social transformations associated with the Industrial Revolution by reading biographies and life stories. Other students may learn through careful analysis of demographic data or interpretation of artworks of the times. Still others may learn better when asked to debate a question like, Did industrialization mean progress? By providing a variety of entry points, teachers not only reach more students but also invite their students to think about important problems in multiple ways—a mental agility that characterizes the disciplined mind.
- *Develop performances of understanding.* Performances of understanding invite students to think with knowledge in multiple novel situations; they show whether students can actually make use of classroom material once they step outside the door. For example, in the unit on industrialization, teachers may present students with conflicting accounts of workers' experiences in the 1884 planned model industrial town of Pullman in Illinois—a case that students have not yet been coached to examine. In their analysis of the Pullman strike of 1894, some historians contend that Pullman's model community was a malicious design to exploit workers; other historians believe it was the result of naïve paternalism. Teachers might ask students to use what they have learned about historical inquiry to explain how expert historians could disagree. Students with a disciplinary mind in history would understand that they need to examine the conflicting accounts, check the sources used, take into consideration the date of the account, and clarify the historian's perspective. In doing so, students will develop a more informed understanding of historical accounts and will be able to apply their insights in other performances of understanding.

## What the Future Requires

Today, the information revolution and the ubiquity of search engines have rendered having information much less valuable than knowing how to think with information in novel situations. To thrive in contemporary societies, young people must develop the capacity to think like experts. They must also be able to integrate disciplinary perspectives to understand new phenomena in such fields as medicine, bioethics, climate science, and economic development. In doing so, the disciplined mind resists oversimplification and prepares students to embrace the complexity of the modern world.

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