Being Critically Literate in Science

Kurt Love

Louis Pasteur's famous quote "Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world" demonstrates the widely accepted notion that science is universal and objective. The work of a scientist is generally seen as neutral, unbiased, and transcendent of culture, and science as disconnected from culture, history, gender, race, class, place, economics, and politics. Teaching science tends to take on the same characteristics and follow the same path. However, understanding nature is a process that looks different throughout history, in different places, and in different cultures. For example, science in Western, industrialized cultures has been constructed through patriarchy, classism, elitism, and influenced by capitalism and politics. Yet, teachers, curricula, and textbooks portray science as distinctly separate from any social or cultural relationships. This false construction begets and concentrates power in the form of authority in science-based knowledge. If a person claims that a type of knowledge is "scientific," a host of assumptions, whether explicit or covert, are attached to that statement. This process is one to which teachers and textbooks currently pay little attention, and its omission leads to the positioning of science knowledge as privileged and uncontested by the general public.

Critical Literacy Components

As you've seen in the previous chapter, asking students to be critically literate entails multiple actions while reading; critical readers are consciously active in the process of questioning the author's agenda and purpose for writing the text. Critical readers analyze the author's discourse and metacognitively attend to their own processes of incorporating information and acting in ways that reshape and mold it with their thoughts, prior knowledge, and identity. Finally, critical readers are moved to action in their social and cultural positions to

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disrupt hegemony and to conserve cultural practices that resist loss of power and community.

By performing the aforementioned actions, critical readers are disrupting the power of the one-way, sender-receiver model of reading. In the latter relationship, the author maintains power because the reader views the author as the knower, while the reader positions him or herself as lesser-than and simply "banks" information submissively (Freire, 1970). Thus, readers who passively receive information from texts without questioning the author's intentions and purposes are trapped in a subordinated power position.

If we are to ask our students to become critical readers, teachers must be critical readers and thinkers themselves. Yet, the practice of teaching is becoming more and more controlled by government policies and pressures to create assimilative uniformity. Teachers are increasingly expected to reproduce gram children to be docile, democratically timid vessels for regurgitation in order to prevent social agitation. Similarly, teachers are expected to be ideological mirrors of the dominant discourses and ideologies. Policymakers have found that placing intense pressure on standardized tests (which are reflective of the dominant group's ideologies) keeps teachers from straying away from accepted discourse and into critical positions that might challenge the power structure. In this sense, standardized tests may be intended to ideologically control teachers more than the kids they teach. Controlling the teachers is a fairly effortless task because of the constant fear that is created in the teaching community about closing schools and/or losing jobs if teachers deviate for the authoritarian-designed course. In other words, teachers who do not succeed in having their students ideologically march at a certain rhythm, pace, and frequency can be reprimanded, cited, and even removed from teaching. This presence of fear forces teachers (who are typically not radical) to perpetuate ideologies that they may even be against.

Politicians, state departments of education, education programs in colleges and universities, parents, and even students are demanding that teachers increase their numbers of students who pass state-authored tests; as a result teaching is monolithically becoming a practice of "teaching to the test." Teachers, who generally do not have access or authorship rights to the tests, are forced to teach in ways that strongly favor "learning-as-regurgitation" methods. In this setting, teachers are receiving many consistent messages that knowledge and language are static, linear, monocultural (or in the case of science, acultural), and neatly packaged. Teachers are not encouraged to problematize content, critically question its roots, or challenge assertions in

state and district curriculum standards. The environment for teaching is itself becoming more and more hostile to critical education, pushing teachers away from the very practices that the authors in this book are espousing are vital to developing critical readers, which is essential for a strong and healthy democratic society. The languaging processes in education are literally steering teachers toward greater levels of compliance and colonization. As teachers, we need to resist this kind of movement, at least in part, by becoming more critically literate ourselves.

At the heart of the process of becoming critically literate is understanding the relationships between power and knowledge. The process of constructing knowledge is not a "neutral" process as it is popularly viewed in Western, industrialized societies. There exists no moderate body of "knowledge-constructors" who test and search for every bit of bias for extraction before it "goes to press" so that the public is exposed to bias-free information only. Every text, every piece of knowledge, and every concept is grounded in the politics, history, culture, and power relationships of its time. A simple, yet powerful demonstration of this is seen in science textbooks of the early and middle decades of the twentieth century. Whenever student images were used in the textbooks, White males were shown as active (seemingly performing experiments by their use of lab equipment), while others were shown as either passive (as it often was with females) or altogether absent (as it was with non-Whites) (Bianchini, 1993). These textbooks strongly suggested that only White males had the ability to become career scientists.

Power/Knowledge Relationship

Teaching and knowledge are deeply connected to root power relationships. I view the relationship in my own teaching practice as a two-directional process where each is continually influencing the other. As I teach about a topic, I attend to the power relationships that exist within the topic by providing space for multiple voices and experiences of the students and for analyzing how their value systems and personal histories shape and reshape knowledge. I am much less concerned with my students having to memorize concepts in science and am more interested in providing opportunities for them to critique, ponder, question, and reject concepts. I approach teaching in this manner for two main reasons. First, if students can actively engage with a concept by critiquing, pondering, questioning, and/or rejecting it, I feel comfortable that they have more than a functional understanding of the

the state and corporations are acting on their behalf, which, in effect, reinforces the perceived legitimacy of the state and corporate ideologies. The benefit, then, is the production of a mass of docile students who become socially and politically docile workers. To produce passive people who will not challenge the power structure, "school knowledge" must be uniform, standardized, homogenized, and uncritical. Historical figures need to be described as infallible heroes (Loewen, 1996), and science must be portrayed as value-free to demonstrate and justify the corporate-state's current ideologies as just and fair. To do this, students are largely not exposed to any in-depth analysis that utilizes critical, feminist, or eco-justice perspectives in their assignments, readings, or in the teachers' lectures. There may be the occasional topical analysis that looks critical, but it serves the purpose of doing just that, giving the illusion that the masses have the freedom to question power imbalances so that they feel free. Of course, exceptions do occur when teachers, students, and/or administrators consciously choose to disrupt power structures, which is a process that begins with becoming critically literate.

Therefore, it is imperative that teachers learn theories about how knowledge and power operate if they are inclined to be critical and help their students mediate the power structures, especially of government, corporations, patriarchy, and technological centrism (viewing technology as dominant over the priorities of nature). Teachers often focus heavily on practice and less on theory, as if one can function without the other. However, when one's practices are consciously informed by the theories of how societies and cultures operate, the practices are more likely to serve as both emancipatory (resisting concentrated power by government and corporations) and ecologically just (revitalizing the cultural commons [described below]). Thus, the greatest action that a teacher can do is to help students disrupt power imbalances, promote peace, and create ecological sustainability.

Critically Viewing "Science Knowledge" with Feminist Theory

Feminist theory has provided a wealth of deep analysis and critique of how Western science upholds patriarchy and represents masculine ways of thinking. Sadly, mainstream culture seems to have stigmatized feminists and feminist theorists, stereotyping them as militants or "complainers" who have no connection with the "real world." However, feminists have shown that those in power positions (often males or patriarchical females) greatly affect reality construction, which ultimately affects individual practices, institutions,

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concept. Critical readers cannot engage in the processes of critical reflection without fully engaging in the text. Performing critical actions shows quite readily that students have understanding beyond the fundamentals of the content. Second, I view knowledge creation as an entirely human-dependent process. If that is the case, then it means that culture, history, race, gender, sexual orientation, time, place, class, and an infinite amount of other nuances are attached to knowledge. Therefore, knowledge cannot be static or neutral; it is fluid, temporal, and a function of place—being reorganized, perpetuated, and lost.

Furthermore, the constant degradation of global ecology due to years of colonization and, more recently, globalization is also an ongoing threat to diverse knowledges. Vandana Shiva (2000; 2005) describes the continual reduction of diverse knowledges as being directly connected to the limiting and homogenizing of biodiversity. Just as diverse knowledges diminish as colonization continues through the ongoing process of global Westernization, a simultaneous and equally culturally destructive process is occurring because the destruction of biodiversity (often via Western, corporate practices) pushes earth-based cultures toward dependency upon Western industry and technology. That is, globalization causes destruction of the environments that diverse peoples with diverse knowledges rely upon for sustenance as well as history, tradition, and culture. When an environment is destroyed, so are the cultures of the people who depend upon them.

Yet, certain knowledges are not included in science textbooks and curricula because knowledge is connected to power. Textbooks and curricula largely exclude the teachings of Vandana Shiva, along with many other feminists, ecofeminists, and eco-justice theorists because they challenge the power of the science canon. "School knowledge" remains topical, based on fact "bits" disconnected (seemingly) from ecological and economic issues and focused on getting teachers to march to the same drumbeat. In other words, schools are generally not in the business of producing radical students who challenge systems of power. Schools are sites where assimilation is the first priority, usually to produce "productive" docile workers.

Who benefits from the school's production of acquiescing adults who remain loyal to the corporate-state? Corporations and governments that do not want the masses to question their methods, which could very easily lead to turning over power to the disenfranchised.

Therefore, schools generally reflect the ideologies of the dominant group (Ballantine, 2001). Schools are organized to produce people who believe that

Donna Haraway (1988) describes being "objective" as a process by which a partial truth is portrayed as a whole truth. She calls the claim to objectivity a "god-trick." One would have to be separate from the human experience and view it from a different plane like a god to attain a whole truth. As a consequence, bias is inescapable and always present. When a person is doing an investigation, it is that person's worldview that presents assumptions about nature, social interactions, and systematic processes that inform how that person creates questions for investigation, performs investigations, and reports the investigations. For instance, a person entrenched in a European culture believes that nature is something that can be isolated into variables and tested through manipulation of those variables. A contrasting view from Native Americans states that nature is deeply interconnected, and we are all located in relationships with nature. Therefore, isolating and testing "variables" of nature is antithetical to the organization of nature and an inappropriate, if not impossible, task. Native Americans focus on the relationships and interconnected happenings in nature rather than on atomizing and reducing nature to irreducible parts like that of a machine.

Furthermore, worldviews and ideologies are represented in differences in language. Language creates reality perception (and vice versa). Gregory Bateson (1972) stated that language is like a roadmap because they both select and hide information. For example, the English word "sun" is defined in Western cultures as a physical body at the center of the solar system that provides energy to the planets of the solar system. Similarly, Earth is described as a physical object in the solar system. Language usage focuses on the physical properties and the operations of the sun and the earth. In contrast, many Native American tribal languages describe nature in terms of relationships with nature rather than as physical objects:

> So everything is like a big family. We are children of the Great Spirit, children of Mother Earth, children of the sky, and so on. We have that relationship, that kinship that is part of our identity. That is knowing who we are ... we live in a world of many circles and these circles constitute our identity and they go out to encompass every thing that there is in the Universe. That is our kinship. Those are our relatives. The Universe is a family and we have to deal with other things in that Universe with that in mind. (Forbes, 1979, pp. 5-6)

For example, the word for Earth in some Native American languages is derived from or is the same word for "mother." As Cajete (1994) explained, "The geographical and structural orientations of Indigenous communities to

collective actions, and perceptions of history. Also, there is no one version of feminism. Feminisms have many different foci: gender roles, political processes, race, class, and/or women in developing nations. Still, understanding feminist critiques is, in part, vital to understanding those imbalances that prohibit peace and ecological sustainability.

Feminists have given a great deal of attention to describing how the scientific method creates hegemony between each other and human-over-nature relationships. For example, feminists have historically led the critique on science and science education pointing out that the power that is in the scientific method is often due to how the language of science operates and concentrates power. Since westerners made the argument over 400 years ago that the scientific method is "objective," when a scientific study is reported, it is assumed to be credible if it adhered closely to the scientific method. As described in more detail below, this one word falsely carries with it much power. Critical literacy is the process of questioning how a word or a concept is commonly used and potentially creates worldviews and ideologies that trap us into hegemonic actions.

Many feminist scholars also question to whom science belongs. As is the case in other subject areas, White, European, middle- and upper-middle-class males have benefited from the "story" of science because they have "historically" been the creators. The history of science includes two concepts that can be problematized in the classroom setting. The first is "objectivity," and the second is "neutrality." Both are closely connected to one another, and they are the foundation for constructing science's authority in Western and Westernized (previously earth-based cultures that changed via the colonizing practices of the West) societies. In effect, both objectivity and neutrality legitimize White and male positional views of science.

Critical readers of science will notice immediately and repeatedly that authors claim that the scientific process of investigation is "objective." Objectivity is when bias is removed from investigation and from the reporting of information, claims, assertions, processes, and conclusions. Feminists have asked, "To what extent is objectivity possible?" Is it possible to be completely separate from one's self when observing, writing, reporting, and constructing questions for the investigation? How does one go about not being one's self? Starting with the notion that knowledge is entirely a human-based action, when is it possible to remove the "human experience" from creating knowledge? Being objective is like saying that we can remove ourselves from ourselves and somehow exist nowhere or perhaps everywhere.

their natural place and the cosmos reflected a communal consciousness that extended to and included the natural world in an intimate and mutually reciprocal relationship" (p. 174).

Science content found in science textbooks rooted in Western, industrial culture is largely devoid of relationships outside of the objectified, physical, human-centered views of nature. Children in public schools in the United States are not exposed to multiple views of our relationships with nature in emotional, interconnected, or even spiritual ways. Historically, perceiving nature as an object to be manipulated comes from the dominant, colonizing culture that views nature largely for profit. Native American cultures do not rely on the concept of objectivity because they do not see that separating themselves from nature is possible. Objectivity is not only a false construction but a highly inappropriate one in light of the relationships people have with nature.

In Western, industrial cultures, if one is "objective" during investigations, the results reported are seen as "neutral" and not connected to cultural values or biases. The results are even seen as "Truth." Claiming neutrality (in partnership with objectivity) leads to a construction of knowledge that is representative of Divine knowledge—another "god-trick." Additional sociocultural benefits exist in the form of power. Once neutrality is associated with information, that information is hierarchically placed as universal, superior, and transcending human activity. Sandra Harding (1986) points out that Western scientists have seen science as the path to truth because of their claims of being value free and objective. Yet, the creation of any information is completely human dependent.

How are we to consider thinking of science investigations, then? Feminist theorists have pointed to two possible alternatives. Sandra Harding (1991) suggests that objectivity can be strengthened as multiple voices become included in the investigative process. "Strong objectivity" is when underrepresented peoples investigate and create knowledge. However, this is problematic because it still involves people choosing the underrepresented peoples, which creates yet another privilege for the dominant group.

Donna Haraway (1988) presents a second alternative to objectivity. She suggests that knowledge is "situated" because information always comes from humans and is never free from culture, values, and history. In other words, knowledge-creation is a process that is filtered through the cultures, values, and history of those who are creating the knowledge. Being transparent illuminates the ways in which scientists may be limited in their creation of

knowledge. This process openly addresses the ways in which knowledge has been influenced during its investigation, creation, and reporting stages.

Science textbooks do not provide discussions of scientists situated in history, culture, class, gender, race, or sexual orientation when they developed their research questions/philosophies, performed their experiments, and interpreted and reported their findings. Textbooks do not address scientists' value-laden assumptions and assertions, nor do the textbooks provide contrasting situated knowledges from diverse peoples. Western science is presented as the only science. Many examples exist in history of scientists creating conclusions that were tied to the values of the dominant value system of its time. Galileo Galilei, Johannes Kepler, Rene Descartes, and Isaac Newton all described the universe as either a machine or a clock, implying that life is mechanistic, lifeless, and rigorously controlled in its performance. This provided much latitude for scientists to view nature as a large machine with individual parts that can be isolated and inspected. This also encouraged Westerners to view nature as separate from humans. Francis Bacon asserted that science, not the church, had governance over "wonders" and "marvels" (Daston, 1994). Bacon, who was in good favor with nobility and King James I, used his assertion to help the monarchy in its power "tug-of-war" with the church. Bacons' theories provided a rationale for repositioning power away from the church and closer to the monarchy. Charles Darwin, revered by the Victorian elite, used "survival of the fittest" to support the class-driven idea that impoverished people should not reproduce (Rosser, 1986). Additionally, countless scientists have described homosexuality as a disease, women as biologically inferior to men, and Blacks as a different subspecies than Whites (Harding, 1986, 1991; Rosser, 1986).

Each of these scientists cloaked themselves in "neutrality" and "objectivity" when making these assertions. That gives uncritical (and perhaps "unconscious") teachers and students license to do the same and hegemonically perpetuate power relationships with practices of domination and colonization. For teachers and students, Paulo Freire (1973) and Ira Shor (1992) suggest that gaining "critical consciousness" is the focus of an emancipatory education.

Connecting individual experiences and meaning with social structures is at the heart of critical consciousness. Again, science textbooks lead students and teachers down a different path. Their push for memorization of facts and assimilation into the dominant worldview of nature (i.e., humans disconnected from nature, nature objectified for purposes of experimental manipulation, and nature for-profit only) explicitly directs students and teachers without

opportunity for uncovering the power relationships that exist within that knowledge.

Critical readers and feminists also ask, "Whom does this worldview serve?" The majority of scientists in modern-day, Western, industrial cultures rely upon either corporate or government funding for their research. Is teaching science in ways that are uncritical of Western science servicing corporations' and governments' desires? Looking at the bigger picture, local, state, and national governments have mandated and approved standards and curricula. Since the 1970s, teachers have increasingly come under the control of standardized tests and closely aligned curricula. Politicians and government officials have used the word "accountability" so frequently that the popular movement of closing down schools is becoming more accepted. Additionally, students, teachers, administrators, and politicians commonly view the purpose of education as a way to support corporations and the national growth domestic product. Science is taught and textbooks are written in this context with these pressures.

Eco-Justice—Commons Practices

To be a critical reader of science, teachers and students also need to problematize the languaging processes in the text or in any form of communication. Language is rooted in metaphorical processes, and these "root metaphors" drive meaning and construct reality. The root metaphors provide organization and structure for communication to occur, but this also means that ideologies are part of the languaging process (Bowers, 2003, 2005a, 2005b, 2006a). Much of this goes unnoticed in everyday communications. For example, technology is often described with words such as "progress" and "advancement." However, this uncritical description of technology as a positive movement for society is quite discriminatory against indigenous cultures, assumes Western superiority, and drives a wedge between humans and nature, making humans the center of existence as they "progress" away from nature.

Science textbooks (as well as other media in the form of videos, Web sites, and science magazines) put technology on a pedestal, often portraying it as transcendent of the human experience. Yet, technology is a direct extension of ideology. Military technologies are extensions of war ideologies and serve as applications of that ideology. The use of robotics on the assembly lines is ideologically grounded in capitalistic practices in search for the greatest profit.

Computers are also part of the same ideology of capitalism as the use and practice of language turns toward value systems that respect the written word over oral traditions and over face-to-face interactions (Bowers, 2006a). More and more colleges are offering online courses in place of in-person classes because monetary profit takes priority over interpersonal processes of learning. Teachers from pre-school through high school are trying to find more ways for students to become techno-savvy without critically looking at what languaging processes are affected as they become increasingly technologically dependent.

Another problematic root metaphor in science is "individualism." This is tied to competition and profit, as well as to a human-centered (or human-over-nature) perspective. Science textbooks often turn scientists into individual heroes or intellectual "capitalists." James Watson and Francis Crick are revered as superheroes for the description of the structure of the DNA molecule. Yet, Rosalind Franklin—who developed the first x-ray crystallographies of the DNA molecule, which James Watson so coyly played politics to possess—received no mention during Watson and Crick's receiving of the Nobel Prize, even though Franklin's photographs were integral for them to figure out the DNA molecule. This kind of competitive behavior is parallel to the business practices of Microsoft and Apple, especially in the beginning stages of the development of the personal computer. The same competitive and profit-driven practices are present with pharmaceutical companies. In this context, the competitive individual is a corporation in the business of competitive investigations tied to billions of dollars of profit.

Becoming critically literate in science education requires understanding the power relationships embedded in science knowledge. An area of pedagogical work called eco-justice not only includes language and power relationships as they are tied together in metaphors, but also includes looking at how industrialization (and technology-based cultures) reduces the cultural commons of a society. The current industrial cultural practices work to maximize profit at the expense of the health of the environment and the people. Seeking this kind of profit also means privatizing practices that were once communal, such as growing food in common locations, or having access to basic, life-sustaining resources, such as clean, fresh water. The cultural commons are, or have been, linked to ecological sustainability (such as small, local farming practices that both feed the community and leave a negligible ecological footprint), to art (such as murals on buildings and public performances), to crafts and craft knowledge, as well as to food preparation and health practices.

Because privatization and competition are so pervasive in the West, they seen both natural and morally appropriate, making it initially difficult to imagine the possibility of cultural commons. The cultural commons— which exist because of centuries or even, and in many cultures (especially indigenous cultures), thousands of years of knowledge and traditions—are increasingly being replaced by the most temporal and nomadic forms of knowledge life cycles. The knowledge that *was* once used to perform the task is then lost because of the technology that automates the task with minimal human action. For example, many of our foremothers and forefathers in the U.S. were quite skilled in working with the land to regularly produce food and predicting weather based on many elements besides looking to the clouds. As we in the U.S. have become more reliant on technology and experts who interpret data, recent generations of people are far less capable of understanding how to cultivate the earth and read the signs to predict weather. These knowledges that were once considered "common sense" are quickly becoming extinct knowledges in the West.

In effect, living experiences in the West are not tied to thousands of years of knowledge about the rhythms and cycles of nature; rather, they are being reinvented in the name of maximizing profit. Living experiences are continually thinning to that of consuming rather than producing, technology in place of nature, media instead of interrelationships, and individuals before community. Living experiences are being reduced to consumerism, with the constant reminder that the very next product that we buy will make us (as seen in daytime television advertisements) *Cheer, Shout, Snuggle,* and be *Whisk*(ed) away with a *Bounty* of *Joy* and *Zest.* However, bringing these fantasies to *Life* the only *Depends* on whether or not we *Totally*) "buy" into the idea that products can actually link the material and the emotional.

Science curricula and science textbooks are deeply connected to the industrial culture's use of the all-powerful individual who succeeds by consuming. The major push in science education is through the use of inquiry methods in problem-based learning. Inquiry methods center the individual as the producer of knowledge, and problem-based learning positions nature as an object for manipulation. Therefore, the human dominates and manipulates nature, reinforcing that humans are paramount and nature can and should be separate and objectifiable. This is the rationale that allows for our industrial culture to view maximized profit (not sustainability of environment and human health) as the ultimate goal. Both capitalism (derived from competitive individualism) and consumerism (or individuals causing depletion) ignore that

living experiences are tied to ancient earth-based knowledges and the existence of cultural commons and commons-based practices. In the presence of strong cultural commons and ancient earth-based knowledges, capitalism and consumerism are minimized to levels that maintain sustainability of environment and health, as opposed to monetary profit for the sake of the few at the expense of the health of the planet.

Taking Action

The old adage "we teach how we've been taught" reminds today's teachers that we must be creative and continually adjust our classroom practices. Currently, critically teaching science is not common in secondary classrooms, but with some reflective thought and imagination, change can occur. The major steps involve questioning putative objectivity and neutrality, rethinking how we teach the history of science, including voices from multiple perspectives (including those of women and different cultures), and connecting with our cultural commons.

Questioning Common Ideologies of Science

Despite the common belief that science appears as the least likely place for critical work, critical literacy is both possible and necessary. Included here are several ways in which to teach students to be critically literate in science. First, begin by grounding science in culture and history. To do this, invite students to question the intentions of the author: Is this text trying to portray itself as neutral, disconnected from history and culture? Is the author pushing technology as unequivocally good? Is there a dilution of controversy? Consider the background of the authors. Authors who take a critical approach will often position themselves in culture and history, and acknowledge the ways in which class, race, and gender affect the production of knowledge. Therefore, if authors are not reflexive about the cultural and social conditions in which they write, they are more than likely not approaching their work critically.

Second, focus on the ideologies that were used to develop the text. *What ideologies underpin this text?* Is it rooted in capitalism? Individualism? Anthropocentrism (human-centered worldview)? Human-nature dualities?

Third, focus on creating space for multiple viewpoints. Is the science exclusively described from a Western, industrial culture point of view? *What voices are missing in the text?* Is there an attempt to include differing paradigms in understanding nature? Are there indigenous knowledges that address

similar concepts in nature that can be used as a counter-text? What issues emerge when a feminist lens is applied to the reading?

Fourth, what actions can students engage in to better understand the differing voices, community practices, and intergenerational knowledges that exist in their communities? And how can use intergenerational knowledges to resist the destruction being done to our planet?

A Multicultural Science

A critical teacher who is helping students to become critically literate in science can start by discussing women's contributions to science. (Marie Curie is often the "token" woman). The "Wings of Discovery" is a group that has an extensive collection on women's contributions to science research and knowledge. Additionally, Clifford Conner's book *A People's History of Science* documents those scientists of different races, cultures and socioeconomic backgrounds who have made uncountable contributions over thousands of years to science, ecology, navigation, engineering, and health. Of course, being critically literate in science means more than acknowledging the contributions of women and marginalized groups. Doing so might be considered an "add-on" approach, which still positions White, European males as the norm with occasional contributions from "other" peoples.

At the core of being critically literate in science is acknowledging that understanding and investigating nature does not occur exclusively through the five senses of vision or secondarily through the other four senses. Clifford Geertz (1973) suggests that having a deep knowledge occurs when we engage in developing "thick descriptions." Thick descriptions are those that make explicit what is generally taken-for-granted information and, because of this status, can go unnoticed and thus ignored as a part of critique and critical reflection. Chet Bowers suggests that students from early elementary through college can engage in activities that incorporate developing deep understandings of ecology and culture by using thick descriptions. Activities could include comparing local farms to cities, zoos to wildlife refuges, and social interactions via different media such as instant messaging versus in-person communications.

These activities have similar processes that are inherent in science investigations, such as observations, analysis of data, and communicating conclusions. Science lessons readily lend themselves to students exploring and generating thick descriptions because of the use of observation and inquiry. Having

students develop their own investigative questions, especially those that compare different environments, strengthens students' abilities to potentially analyze their own social relationships, histories, and privileges, as well as making deeper connections between their cultures and relationships with nature. Teaching science can be an empowering experience for students, especially if the questions that they investigate are not just limited to the "hard" or traditional sciences (biology, chemistry, physics, and earth sciences). The social sciences (sociology, anthropology, and cultural studies) all rely on similar processes of investigation and the communication of those findings. Critically literacy is strengthened when students have frequent opportunities to employ research methods to understand both natural and sociocultural phenomena and relationships.

Revitalizing the Cultural Commons in our Communities

Critical readers do not depend on what Noam Chomsky (1992) called the social condition of "expertocracy," whereby the general masses give up their power to the "experts" who become the decision makers. The last and most powerful stage of being a critical reader involves taking action toward social (and ecological) justice. Chet Bowers (2006b) discussed what schools are already doing in order to revitalize the public commons through science education.

In a few elementary and middle schools students are introduced to what is now called "slow food". That is, they are learning to care for vegetable gardens, to prepare meals that utilize the vegetables from the school gardens, and to share the food with the needy in the community. In other middle and high schools spread throughout the country, and located mostly in rural areas, students are learning environmental stewardship through involvement in community-centered environmental problem solving. Students are working with other members of the community in addressing such issues as restoring the local watershed, promoting more ecologically sound approaches to waste disposal, mapping the green areas of the community, and so forth. (p. 27)

In the lengthy quote above, Bowers describes several ways in which students are engaging with community members, elders, and their peers in order to connect with nature, protect the environment, and resist large corporations by democratically participating in local environmental decision making and producing food in local gardens. These actions are grounded in the ancient knowledges of the nonindustrialized, non-Western cultures, as for thousands of years they were ecologically sustainable and largely uninvolved in systems that relied upon money.

Bowers argues that critical teachers need to take care when attempting to emancipate their students because, although power is unequally organized and worth disrupting, there are many aspects of intergenerational knowledges from cultures all over the world (including indigenous peoples in colonized areas such as the United States, Canada, Australia, and Africa) that have healthy relationships with the environment and cultural practices that strengthen communities. Bowers argues that it is a colonizing action to label nonindustrialized, non-Western cultures and societies as "backward." Many aspects of the "backward" cultures have ecologically sustainable practices that are grounded in traditions. Traditions, Bowers argues, are not oppressive by default, which is why Bowers states that every culture must decide what needs to be conserved in order to protect the environment and community processes (Bowers, 2006a).

The current commons-based projects in Detroit demonstrate Bowers's argument for conserving and revitalizing the cultural commons. Over 30,000 people are involved in the creation and maintenance of over 500 community gardens. This situation has provided many opportunities for children to interact with elders to learn about traditional ethnic recipes, traditions connected to food preparation, and familial traditions. Additionally, spaces that were once empty lots with trash and sites for criminal activities such as drug-related crimes are being reduced in number as these become the sites for the community gardens. The educational aspects connected to the community gardens are numerous. Students learn about plants and their needs, soil types, soil nutritional levels, plant life cycles, food preparation, and cultural history. Many gardens in Detroit are specific to ethnicities. There are African, Korean, Puerto Rican, Filipino, and Italian gardens, each with their respective plants and herbs that characterize their styles of cooking (Bowers, 2006a).

In addition to gardening, craft making involves a great deal of scientific knowledge. During the early stages of the Enlightenment Period, scientists often studied the work of ironsmiths, coopers, tanners, and other craft-workers to understand how they made their products. However, craft-workers did not welcome the scientists' inquiries and investigations mainly because the secrets of their craft would then become public knowledge and would decrease their profits in the marketplace (Conner, 2005). Yet, science courses generally do not ask students to learn a craft. This is isolated to the vocational education courses such as woodworking and automobile maintenance, or to art courses such as photography, drawing, or painting. Teachers can make connections with craft-makers in the local community and setup mentorship relationships

with their students as part of the learning experience. Making crafts involves local production and local relationships (as well as potential global customers via the use of the Internet to sell the product). Teaching science can include making connections to craft experts in the community to teach science fundamentals of materials, physical properties, force and motion principles, botany, farming, animal care, sound and light principles, and chemistry.

Conclusion

Being critically literate in science can be a challenging task due to the popular views of science as being neutral, universal, and objective. However, teachers can readily engage their students in critically viewing and questioning the power structure and knowledge-construction processes of science by beginning with the following: problematizing the history of "science" as defined by White, Western males; showing how science-based knowledge is socially constructed and highly contextualized; and engaging students in community-based projects that revitalize the public commons. The process of learning science does not have to be isolated from the current practices of the teacher as the authoritative figure, delivering "packages" of facts that are disconnected from culture, society, and meaningful purpose (aside from the exclusive reason of passing evaluations). Science education can be a process of questioning the text and of acting in ways that develop healthier ecological conditions and stronger community relationships.

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Merry White

Japanese Education
How Do They Do It?

Japan has become the new reference point for the developing nations and the West, and comparisons with Japan cause increasing wonder and sometimes envy. Travel agents continue to profit from the curiosity of Americans, particularly businessmen, who take regular tours of Japan seeking the secrets of Japanese industry. They come back with photographs and full notebooks, convinced they have learned secrets that can be transplanted to their own companies.

Even the Japanese have entered the pop-sociological search for the secrets of their own success; their journalists suggest that they emphasize problem *prevention* while Americans make up for their lack of prescience and care through *remediation* (in the case of cars, recalls for flawed models). The explanation given by a European Economic Community report—that the Japanese are workaholics willing, masochistically, to live in "rabbit hutches" without complaint—was met with amused derision in Japan. But it seems that those who do not look for transportable "secrets" are nonetheless willing to believe that the source of Japanese success is genetic, and thus completely untransferable. There are alternatives to these positions, and an examination of Japanese education provides us with a backdrop for considering them.

The Social Consensus

The attention given to the decline of both American industry and American education has not yet led to an awareness here of the close relationship between the development of people and the development of society, an awareness we see everywhere in Japanese thought and institutions, and whose effects we can see in the individual achievements of Japanese children. If Americans realized how powerful the relationship is between Japanese school achievement and social and economic successes we might see the same kind of protectionist language aimed at the Japanese educational system that we see directed at their automobile industry. ("The Japanese must stop producing such able and committed students because it isn't fair.")

The Japanese understand how important it is to have not just a high level of literacy (which they have had since well before modernization), but also a high level of education in the whole population. It has been said that the Japanese high school graduate is as well educated as an American college graduate, and indeed it is impressive that any worker on the factory floor can be expected to understand statistical material, work from complex graphs and charts, and perform sophisticated mathematical operations. This consensus that education is important, however simple it may sound, is the single most important contributor to the success of Japanese schools. Across the population, among parents, at all institutional and bureaucratic levels, and highest on the list of national priorities, is the stress on excellence in education. This is not just rhetoric. If the consensus, societal mobilization, and personal commitment—all focused on education—are not available to Americans, the reason is not genetic, nor are we locked in an immutable cultural pattern. We simply have not mobilized around our children.

There are clear advantages to being a Japanese child: a homogeneous population focused on perpetuating its cultural identity; an occupational system where selection and promotion are based on educational credentials; a relatively equal distribution of educational opportunities; a universal core curriculum; highly trained and rewarded teachers; and families, especially mothers, devoted to enhancing the life chances of children and working cooperatively with the educational system. Finally, there are high standards for performance in every sector, and a carefully graded series of performance expectations in the school curriculum.

It is clear from these assertions that the measurable cognitive achievements of Japanese education represent only part of the picture. The American press stresses these achievements and accounts for them in terms of government expenditures, longer school years, and early use of homework. While the International Association for the Evaluation of Educational Achievement (IEA) test scores certainly indicate that Japanese children are testing higher than any children in the world (especially in math and science), and while some researchers have even claimed that Japanese children on average score 11 points more than American children on IQ tests, the social and psychological dimensions of Japanese education are similarly impressive and are primary contributors to cognitive achievement. The support given by family and teachers to the emotional and behavioral development of the child provides a base for the child's acquisition of

knowledge and problem-solving skills. But beyond this, the Japanese think of education as a major function of education is the development of a happy, engaged, and secure child, able to work hard and cooperate with others.

Inside the Japanese School

In order to understand the context of the Japanese educational system, some basic information is necessary:

1. Education is compulsory for ages six to 15, or through lower secondary school. (Age is almost always correlated with grade level, by the way, because only rarely is a child "kept back" and almost never "put ahead.") Non-compulsory high school attendance (both public and private) is nearly universal, at 98 percent.

2. There is extensive "non-official" private education. Increasing numbers of children attend pre-schools. Currently, about 95 percent of the five-year olds and 10 percent of three-year olds. Many older children attend *juku* (after school classes) as well. These are private classes in a great variety of subjects, but most enhance and reinforce the material to be learned for high school or college entrance examinations. There are also *yobiko* (cram schools) for those taking an extra year between high school and college to prepare for the exams.

3. While competition for entrance to the most prestigious universities is very stiff, nearly 40 percent of the college-age group attend college or university. (The rates are slightly higher for women, since many attend two-year junior colleges.)

4. Japanese children attend school 240 days a year, compared to 180 in the U.S. Many children spend Sundays in study or tutoring, and vacation classes are also available. Children do not necessarily see this as oppressive, and younger children often ask their parents to send them to *juku* as a way of being with their friends after school. Homework starts in first grade, and children in Japan spend more time in home study than children in any other country except Taiwan. In Japan, 8 percent of the high school seniors spend less than five hours per week on homework, compared to 65 percent of American seniors.[1]

5. Primary and lower secondary schools provide what we would call a core curriculum: a required and comprehensive course of study progressing along a logical path, with attention given to children's developmental levels. In elementary and lower secondary school, language learning dominates the school curriculum, and takes up the greatest number of classroom hours, particularly from second to fourth grade. The large number of characters to be learned requires an emphasis on memorization and drill that is not exhibited in the rest of the curriculum. Arithmetic and

[1] Thomas Rohlen, *Japan's High Schools* (Berkeley: University of California Press, 1983), p. 277.

math are next in number of class hours, followed by social studies. The curriculum includes regular physical education and morning exercise as part of a "whole-child" program. In high school all students take Japanese, English, math, science, and social studies each year, and all students have had courses in chemistry, biology, physics, and earth sciences. All high school students take calculus.

6. Computers and other technology do not play a large role in schools. The calculator is used, but has not replaced mental calculations or, for that matter, the abacus. There is no national program to develop high technology skills in children. Americans spend much more money on science and technology in the schools; the Japanese spend more on teacher training and salaries.

These features should be seen in the context of a history of emphasis on education in Japan. To begin with, an interest in mass (or at least widespread) education greatly antedated the introduction of Western schools to Japan. Literacy, numeracy, and a moral education were considered important for people of all classes. When Western style universal compulsory schooling was introduced in 1872, it was after a deliberate and wide-ranging search throughout the world that resulted in a selection of features from German, French, and American educational systems that would advance Japan's modernization and complement her culture. While uniform, centralized schooling was an import, it eventually brought out Japan's already refined powers of adaptation—not the ability to adapt to a new mode as much as *the ability to adapt the foreign mode to Japanese needs and conditions.*

Also striking was the rapidity with which Japan developed a modern educational system and made it truly universal. In 1873, one year after the Education Act, there was 28 percent enrollment in primary schools, but by 1904 enrollment had already reached 98 percent—one percent less than the current rate. The rush to educate children was buttressed both by the wish to catch up with the West and by a cultural interest in schooling.

A Truly National System

Tradition, ideology, and international competition are not, however, the only motive forces in Japanese education: other factors are as significant. First, Japan has a relatively homogeneous population. Racially and economically there is little variety. Minority groups, such as Koreans and the former out-castes, exist and do suffer some discrimination, but all children have equal access to good schooling. Income is more evenly distributed in Japan than in America and most people (96 percent in a recent Prime Minister's Office poll) consider themselves middle class. There are few remaining regional differences that affect the educational system, except perhaps local accents.

Second, educational financing and planning are centralized. While American educational policy sees the responsibility for schooling as a

local matter, Japanese planners can rely on a centralized source of funding, curriculum guidance, and textbook selection. In terms of educational spending as a percentage of total GNP, the U.S. and Japan are not so far apart. The U.S. devotes 6.8 percent of its GNP to education, and Japan devotes 8.6 percent. But in Japan about 50 percent of this is national funding, while in the U.S. the federal government provides only 8 percent of the total expenditure on education, most of which is applied to special education, not to core schooling. Moreover, in the U.S. there exist no national institutions to build a consensus on what and how our children are taught. The most significant outcome of centralization in Japan is the even distribution of resources and quality instruction across the country. National planners and policymakers can mobilize a highly qualified teaching force and offer incentives that make even the most remote areas attractive to good teachers.

Third (but perhaps most important in the comparison with the United States), teachers enjoy respect and high status, job security, and good pay. More than in any other country, teachers in Japan are highly qualified: Their mastery of their fields is the major job qualification, and all have at least a bachelor's degree in their specialty. Moreover, they have a high degree of professional involvement as teachers: 74 percent are said to belong to some professional teachers' association in which teaching methods and curriculum are actively discussed.[2]

Teachers are hired for life, at starting salaries equivalent to starting salaries for college graduates in the corporate world. Elementary and junior high school teachers earn $18,200 per year on the average, high school teachers $19,000. Compared to other Japanese public sector workers, who earn an average of $16,800, this is a high salary, but it is less than that of managers in large companies or bureaucrats in prestigious ministries. In comparison with American teachers, whose salaries average $17,600, it is an absolutely higher wage. The difference is especially striking when one considers that over all professions, salaries are lower in Japan than in the U.S. In fact, American teachers' salaries are near the bottom of the scale of jobs requiring a college degree. Relative status and prestige correlate with salary in both countries. Japanese teachers' pay increases, as elsewhere in Japan, are tied to a seniority ladder, and older "master teachers" are given extra pay as teacher supervisors in each subject.[3]

Japanese teachers see their work as permanent: Teaching is not a waystation on a path to other careers. Teachers work hard at improving their skills and knowledge of their subject, and attend refresher courses and upgrading programs provided by the Ministry of Education. While

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[2] William Cummings, *Education and Equality in Japan* (Princeton: Princeton University Press, 1980), p. 159.

[3] There is a debate in Japan today concerning rewarding good teachers with higher pay. Professor Sumiko Iwao, of Keio University, reports that when quality is measured in yen, the commitment of teachers to good teaching declines.

there are tendencies, encouraged by the Teachers' Union, to downplay the traditional image of the "devoted, selfless teacher" (since this is seen as exploitative), and to redefine the teacher as a wage laborer with regular hours, rather than as a member of a "sacred" profession, teachers still regularly work overtime and see their job's sphere extending beyond classroom instruction. Classes are large: The average is about 40 students to one teacher. Teachers feel responsible for their students' discipline, behavior, morality, and for their general social adjustment as well as for their cognitive development. They are "on duty" after school hours and during vacations, and supervise vacation play and study. They visit their students' families at home, and are available to parents with questions and anxieties about their children. The Teachers' Union protests strongly against this extensive role, but both teachers and parents reinforce this role, tied as it is to the high status of the teacher.

Fourth, there is strong ideological and institutional support for education because the occupational system relies on schools to select the right person for the right organization. Note that this is not the same as the "right job" or "slot": A new company recruit, almost always a recent graduate, is not expected to have a skill or special identity, but to be appropriate in general educational background and character for a company. The company then trains recruits in the skills they will need, as well as in the company style. Of course, the basic skill level of the population of high school and college graduates is extremely high. But the important fact is that the social consensus supports an educational system that creates a committed, productive labor force. And although the emphasis seems to be on educational credentials, the quality of graduates possessing these credentials is indisputably high.

Mom

The background I have presented—of national consensus, institutional centralization, and fiscal support—alone does not explain the successes of Japanese education. There are other, less tangible factors that derive from cultural conceptions of development and learning, the valued role of maternal support, and psychological factors in Japanese pedagogy, and which distinguish it from American schooling.

The role of mothers is especially important. The average Japanese mother feels her child has the potential for success: Children are believed to be born with no distinguishing abilities (or disabilities) and can be mobilized to achieve and perform at high levels. Effort and commitment are required, and, at least at the beginning, it is the mother's job to engage the child. One way of looking at Japanese child development is to look at the words and concepts related to parental goals for their children. A "good child" has the following, frequently invoked characteristics: He is *otonashii* (mild or gentle), *sunao* (compliant, obedient, and cooperative),

akarui (bright, alert), and *genki* (energetic and spirited). *Sunao* has frequently been translated as "obedient," but it would be more appropriate to use "open minded," "nonresistant," or "authentic in intent and cooperative in spirit." The English word "obedience" implies subordination and lack of self-determination, but *sunao* assumes that what we call compliance (with a negative connotation) is really cooperation, an act of affirmation of the self. A child who is *sunao* has not yielded his personal autonomy for the sake of cooperation; cooperation does not imply giving up the self, but in fact implies that working with others *is* the appropriate setting for expressing and enhancing the self.

One encourages a *sunao* child through the technique, especially used by mothers and elementary school teachers, of *wakaraseru*, or "getting the child to understand." The basic principle of child rearing seems to be: Never go against the child. *Wakaraseru* is often a long-term process that ultimately engages the child in the mother's goals, and makes her goals the child's own, thus producing an authentic cooperation, as in *sunao*. The distinction between external, social expectations and the child's own personal goals becomes blurred from this point on. An American might see this manipulation of the child through what we would call "indulgence" as preventing him from having a strong will of his own, but the Japanese mother sees long term benefits of self-motivated cooperation and real commitment.

Japanese mothers are active teachers as well, and have a real curriculum for their pre-school children: Games, teaching aids, ordinary activities are all focused on the child's development. There are counting games for very small babies, songs to help children learn new words, devices to focus the child's concentration. Parents buy an average of two or three new books every month for their preschoolers, and there are about 40 monthly activity magazines for preschoolers, very highly subscribed. The result is that most, at least most urban children, can read and write the phonetic syllabary before they enter school, and can do simple computations.

Maternal involvement becomes much more extensive and "serious" once she and the child enter the elementary school community. In addition to formal involvement in frequent ceremonies and school events, PTA meetings and visiting days, the mother spends much time each day helping the child with homework (sometimes to the point at which the teachers joke that they are really grading the mothers by proxy). There are classes for mothers, called *mamajuku*, that prepare mothers in subjects their children are studying. Homework is considered above all a means for developing a sense of responsibility in the child, and like much in early childhood education, it is seen as a device to train character.

The Japanese phenomenon of maternal involvement recently surfaced in Riverdale, New York, where many Japanese families have settled. School teachers and principals there noted that each Japanese family was purchasing two sets of textbooks. On inquiring, they found that the second set was for the mother, who could better coach her child if she worked

during the day to keep up with his lessons. These teachers said that children entering in September with no English ability finished in June at the top of their classes in every subject.

The effort mothers put into their children's examinations has been given a high profile by the press. This is called the *kyoiku mama* syndrome—the mother invested in her children's progress. In contrast to Western theories of achievement, which emphasize individual effort and ability, the Japanese consider academic achievement to be an outgrowth of an interdependent network of cooperative effort and planning. The caricature of the mother's over-investment, however, portrays a woman who has totally identified with her child's success or failure, and who has no separate identity of her own. The press emphasizes the negative aspects of this involvement with accounts of maternal nervous breakdowns, reporting a murder by a mother of the child next-door, who made too much noise while her child was studying. But the press also feeds the mother's investment by exhorting her to prepare a good work environment for the studying child, to subscribe to special exam-preparation magazines, to hire tutors, and to prepare a nutritious and exam-appropriate diet.

High-schoolers from outlying areas taking entrance exams in Tokyo come with their mothers to stay in special rooms put aside by hotels. They are provided with special food, study rooms, counselors, and tension-release rooms, all meant to supply home-care away from home. The home study-desk bought by most parents for their smaller children symbolizes the hovering care and intensity of the mother's involvement. All models have a high front and half-sides, cutting out distractions and enclosing the workspace in womb-like protection. There is a built-in study light, shelves, a clock, electric pencil sharpener, and built-in calculator. The most popular model includes a push-button connecting to a buzzer in the kitchen to summon mother for help or for a snack.

How Do You Feel about Cubing?

Not much work has been done yet to analyze the relationship between the strongly supportive learning atmosphere and high achievement in Japan. In the home, mothers train small children in a disciplined, committed use of energy through what Takeo Doi has called the encouragement of "positive dependency"; in the schools as well there is a recognition that attention to the child's emotional relationship to his work, peers, and teachers is necessary for learning.

A look at a Japanese classroom yields some concrete examples of this. Many Westerners believe that Japanese educational successes are due to an emphasis on rote learning and memorization, that the classroom is rigidly disciplined. This is far from reality. An American teacher walking into a fourth grade science class in Japan would be horrified: children all talking at once, leaping and calling for the teacher's attention. The typical

American's response is to wonder, "who's in control of this room?" But if one understands the content of the lively chatter, it is clear that all the noise and movement is focused on the work itself—children are shouting out answers, and not gossiping, teasing, or planning games for recess. As long as it is the result of this engagement, the teacher is not concerned over the noise, which may measure a teacher's success. (It has been estimated that American teachers spend about 60 percent of class time on organizing, controlling, and disciplining the class, while Japanese teachers spend only 10 percent.)

A fifth grade math class I observed reveals some elements of this pedagogy. The day I visited, the class was presented with a general statement about cubing. Before any concrete facts, formulae, or even drawings were displayed, the teacher asked the class to take out their math diaries and spend a few minutes writing down their feelings and anticipations over this new concept. It is hard for me to imagine an American math teacher beginning a lesson with an exhortation to examine one's emotional predispositions about cubing (but that may be only because my own math training was antediluvian).

After that, the teacher asked for conjectures from the children about the surface and volume of a cube and asked for some ideas about formulae for calculation. The teacher asked the class to cluster into its component han (working groups) of four or five children each, and gave out materials for measurement and construction. One group left the room with large pieces of cardboard, to construct a model of a cubic meter. The groups worked internally on solutions to problems set by the teacher and competed with each other to finish first. After a while, the cubic meter group returned, groaning under the bulk of its model, and everyone gasped over its size. (There were many comments and guesses as to how many children could fit inside.) The teacher then set the whole class a very challenging problem, well over their heads, and gave them the rest of the class time to work on it. The class ended without a solution, but the teacher made no particular effort to get or give an answer, although she exhorted them to be energetic. (It was several days before the class got the answer—there was no deadline but the excitement did not flag.)

Several characteristics of this class deserve highlighting. First, there was attention to feelings and predispositions, provision of facts, and opportunities for discovery. The teacher preferred to focus on process, engagement, commitment, and performance rather than on discipline (in our sense) and production. Second, the han: Assignments are made to groups, not to individuals (this is also true at the workplace) although individual progress and achievement are closely monitored. Children are supported, praised, and allowed to make mistakes through trial and error within the group. The group is also pitted against other groups, and the group's success is each person's triumph, and vice versa. Groups are made up by the teacher and are designed to include a mixture of skill lev-

els—there is a hancho (leader) whose job it is to choreograph the group's work, to encourage the slower members, and to act as a reporter to the class at large.

Japanese teachers seem to recognize the emotional as well as the intellectual aspects of engagement. Japanese pedagogy (and maternal socialization) are based on the belief that effort is the most important factor in achievement, and that the teacher's job is to get the child to commit himself positively and energetically to hard work. This emphasis is most explicit in elementary school, but persists later as a prerequisite for the self-discipline and effort children exhibit in high school.

American educational rhetoric does invoke "the whole child," does seek "self-expression," and does promote emotional engagement in "discovery learning." But Japanese teaching style, at least in primary schools, effectively employs an engaging, challenging teaching style that surpasses most American attempts. In the cubing class, I was struck by the spontaneity, excitement, and (to American eyes) "unruly" dedication of the children to the new idea, and impressed with the teacher's ability to create this positive mood. It could be a cultural difference: We usually separate cognition and emotional affect, and then devise artificial means of reintroducing "feeling" into learning. It is rather like the way canned fruit juices are produced—first denatured by the preserving process and then topped up with chemical vitamins to replace what was lost.

The Role of Competition

The frequent accusation that Japanese education involves children in hellish competition must also be examined. In the elementary school classroom, competition is negotiated by means of the han. The educational system tries to accommodate both the ideology of harmony and the interest in hierarchy and ranking. The introduction of graded, competitive Western modes of education into societies where minimizing differences between people is valued has often produced severe social and psychological dislocation (as in Africa and other parts of the Third World). In Japan, the importance of the modern educational system as a talent selector and the need to preserve harmony and homogeneity have produced complementary rather than conflicting forces. The regular classroom is a place where the individual does not stick out, but where individual needs are met and goals are set. Children are not held back nor advanced by ability: the cohesion of the age group is said to be more important. Teachers focus on pulling up the slower learners, rather than tracking the class to suit different abilities. For the most part, teachers and the school system refuse to engage in examination preparation hysteria. Part of the reason for this is pressure from the Teachers' Union, a very large and powerful labor union which consistently resists any moves away from the egalitarian and undifferentiating mode of learning. Turning teachers into drill

Mothers in Minneapolis and in Sendai, roughly comparable cities, were asked to evaluate their children's school experiences. The Minneapolis mothers consistently answered that the schools were fine and that their children were doing well, while the Sendai mothers were very critical of their schools and worried that their children were not performing up to potential. Whose children were, in objective tests, doing better? The Sendai group—in fact so much better that the poorest performer in the Japanese group was well ahead of the best in the American group. Mothers in Japan and the U.S. have very different perspectives on performance: Japanese mothers attribute failure to lack of ability. Japanese children have an external standard of excellence to which they can aspire, while an American child normally can only say he will "do his best."

Problems have surfaced, of course. Psychotherapists report a syndrome among children related to school and examination pressure. School phobia, psychosomatic symptoms, and juvenile suicide are most frequently reported. Japan does lead the world in school-related suicides for the 15- to 19-year old age group, at about 300 per year. Recently, the "battered teacher" and "battered parent" syndromes have received much attention. There are cases where teenagers have attacked or killed parents and teachers, and these have been related to examination pressure. The numbers involved in these cases are very small—at least in comparison with American delinquency patterns and other juvenile pathologies. Dropouts, drug use, and violent juvenile crimes are almost non-existent in Japan. The crimes reported in one year among school-age children in Osaka, for example, are equal to those reported in one day in New York.

Criticism leveled at Japanese education by Western observers focuses on what they regard as a suppression of genius and individuality, and a lack of attention to the development of creativity in children. The first may indeed be a problem—for the geniuses—because there is little provision for tracking them to their best advantage. There has been discussion of introducing tracking so that individual ability can be better served, but this has not been implemented. The superbright may indeed be disadvantaged.

On the other hand, creativity and innovation *are* encouraged, but their manifestations may be different from those an American observer would expect. We must look at our own assumptions, to see if they are too limited. Americans see creativity in children as a fragile blossom that is stifled by rigid educational systems or adult standards. Creativity involves a necessary break with traditional content and methods, and implies the creation of a new idea or artifact. Whether creativity is in the child or in the teaching, and how it is to be measured, are questions no one has answered satisfactorily. Why we emphasize it is another question, probably related to our theories of progress and the importance we attach to unique accomplishments that push society forward. The fact is that, if anything, our schools do less to encourage creativity than do the Japanese, especially in the arts. All children in Japan learn two instruments and how to read

instructors is said to be dehumanizing, and the process of cramming a poor substitute for education.

So where is the competitive selection principle served? In the *juku. Juku* are tough competitive classes, often with up to 500 in one lecture hall. The most prestigious are themselves very selective and there are examinations (and preparation courses for these) to enter the *juku*. Some *juku* specialize in particular universities' entrance exams, and they will boast of their rate of admission into their universities. It is estimated that one third of all primary school students and one half of all secondary school students attend *juku*, but in Tokyo the rate rises to 86 percent of junior high school students. The "king of *juku*," Furukawa Noboru, the creator of a vast chain of such classes, says that *juku* are necessary to bridge the gap of present realities in Japan. He says that public schools do not help children. The Ministry of Education usually ignores this non-accredited alternative and complementary system, and permits this functional division to take the pressure off the public schools. While there is considerable grumbling by parents, and while it is clear that the *juku* introduce an inegalitarian element into the process of schooling (since they do cost money), they do, by their separation from the regular school, permit the persistence of more traditional modes of learning, while allowing for a fast track in the examinations.

It is important to note that in Japan there really is only one moment of critical importance to one's career chances—the entrance examination to college. There are few opportunities to change paths or retool. Americans' belief that one can be recreated at any time in life, that the self-made person can get ahead, simply is not possible in Japan—thus the intense focus on examinations.

The Problems—In Context

This rapid tour through the Japanese educational system cannot neglect the problems. However, two things must be kept in mind when considering these well-publicized difficulties: One is that although problems do exist, the statistical reality is that, compared to the West, Japan still looks very good indeed. The other is that the Japanese themselves tend to be quite critical, and educational problems are given attention. But this attention should be seen in context: Not that people are not truly concerned about real problems, but that the anxiety seems related to a sense of national insecurity. The Japanese focus on educational issues may emanate from a sense of the importance of intellectual development in a society where there are few other resources. Any educational problem seems to put the nation truly at risk.

Japanese parents are critical and watchful of the schools and are not complacent about their children's successes. There was a telling example of this in a recent comparative study of American and Japanese education.

music in elementary school, have regular drawing and painting classes, and work in small groups to create projects they themselves devise. It is true, though, that if everyone must be a soloist or composer to be considered creative, then most Japanese are not encouraged to be creative.

It is not enough to claim that the Japanese have been successful in training children to take exams at the expense of a broader education. And it is not at all appropriate to say that they are unable to develop children's individuality and create the geniuses who make scientific breakthroughs. The first is untrue and the second remains to be shown as false by the Japanese themselves, who are now mobilizing to produce more scientists and technologists. In fact, the scales are tipped in favor of Japan, and to represent it otherwise would be a distortion.

The success of the Japanese model has led to its use in other rapidly developing countries, including South Korea, Taiwan, and Singapore. There, education is seen as the linchpin for development, and attention to children has meant the allocation of considerable resources to schools. The results are similar to those seen in Japanese schools: highly motivated, hard-working students who like school and who have achieved very high scores on international achievement tests.

Seeing Ourselves through Japanese Eyes

What *America* can learn from Japan is rather an open question. We can, to begin with, learn more *about* Japan, and in doing so, learn more about ourselves. Japanese advancements of the past 20 years were based on American principles of productivity (such as "quality control"), not on samurai can principles of productivity (such as "quality control"), not on samurai management skills and zen austerities. Looking for Japanese secrets, or worse, protesting that they are inhuman or unfair, will not get us very far. They have shown they can adjust programs and policies to the needs and resources of the times; we must do the same. We need to regain the scientific literacy we lost and reacquire the concrete skills and participatory techniques we need. We should see Japan as establishing a new standard, not as a model to be emulated. To match that standard we have to aim at general excellence, develop a long-term view, and act consistently over time with regard to our children's education.

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Why Do American Kids Learn So Little?

American children learn far less in school than European and Japanese children do, although America spends far more per pupil. Why is so little education achieved for so much money? The answer may lie in a major oddity in the American creed.

Europeans have always regarded children as barbarians to be painfully civilized by schooling. Childhood is thought to be merely, or mainly, a means to adult achievement. Children are apprentice adults. Schools are to teach them what they will need, even if they cannot see the use of it: language (including grammar), arithmetic, science, history, classics. In Europe there are hardly any of those undemanding classes so frequent in the U.S., such as current events, or home economics.

Of course, the young have never liked the stern demands the schools made. They have preferred to enjoy being young—*gaudeamus igitur juvenes dum sumus*,[1] the students sang—instead of using their young years to prepare for adult careers. But the young could sing all they wanted (in the Latin they learned in school), they had little choice. Without parental support—inheritance and connections—they could never hope to make their way in the world, for which the schools served as gatekeepers. Thus, in Europe—and in Japan, which has swallowed the European idea hook, line, and sinker—the power of the older generation is used to make children spend most of their time doing schoolwork. Occasionally they have rebelled, but, on the whole, they have submitted, become literate, and gone on their way.

In America, however, youth is seen as an end in itself, never merely a means to adult achievement. Children rarely are expected to work at anything they don't enjoy. Teachers are expected to "motivate" their students and to make learning a pleasure, even if this means going easy on unavoidably tedious stretches. The young themselves tend to see adulthood as a hard-to-avoid postscript, almost a decline. Many adults nostalgically agree.

Parents seldom can make unwilling children do homework, and teachers wisely don't ask for what they can't get. To demand vexatious schoolwork of children seems almost immoral in the American context.

Unlike Europeans, Americans do not expect their children to continue in their own social position: they regard their children as the hope of the future. Far from imposing the civilization of the past, education is to help the young to "find themselves," to unfold their innate creativity. The young

[1] *gaudeamus igitur juvenes dum sumus*, let us be joyful while we are young (Latin, from medieval university song).

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will do better if less encumbered by the past. Margaret Mead even told parents that they must learn from the young, who "have the knowledge."

To most Americans the future always has been more real than the past. This notion makes teaching hard, for teaching requires, at least temporarily, submission to the authority of ancient ideas, and of teachers who transmit them. All learning initially must rest on the authority of the past; after all, the past is all that can be learned.

Pupils must first accept the teachers' authority. Teachers cannot explain to an eight-year-old why words are spelled as they are, or why two and two make four, not five. It is only after much material has been absorbed by rote—children fortunately like learning by rote, although progressive teachers don't like to let them—that students can begin to examine critically and usefully what they are learning. If the authority of the older generation is weak, little knowledge will be absorbed.

We largely let students elect the classes they prefer, assuming that they know enough to fashion their own curriculum, although they cannot yet have learned how to evaluate the importance of various kinds of knowledge. Of course, they elect the easy classes, sometimes of dubious value. They get the same credit toward a diploma for easy classes as they get for harder ones, the same for Contemporary Drama as for Advanced Algebra.

Via Media[2]

There must be a reasonable middle way between a joyous childhood and an exclusively instrumental use of it, a way of combining the civilizing influence of science, history, and literature with the enjoyment of youth. The young must learn to learn as well as to play. Some even may enjoy learning once they try it. Is there anything that can be done to bring about the necessary changes? Consider some beginning steps.

Public schools currently have a monopoly on tax money, which they jealously guard, and because public schools do not compete with one another—pupils are assigned—each public school is in a near monopoly position. The usual effects of monopoly occur: shoddy products at high cost to the involuntary purchasers (taxpayers). A voucher system, entitling parents to choose any public school in the state for their children—and, later on, any approved private school as well—would introduce some competition and might eliminate the worst effects of the monopoly. Schools never should be subsidized; *schooling* should be, by granting vouchers to parents.

Other monopoly features should be dismantled as well. Currently nobody, however capable, is allowed to teach without first attending courses in education. This functions as a barrier to entry, strengthening the entrenched monopoly defended by unions. Private schools hire teachers

[2] *Via Media*, the middle way (Latin).

able to teach their subjects well, in spite (or because) of not having attended a school of education. Usually these teachers are much less well paid than public-school teachers; yet their students, on the average, learn more according to all available tests.

In other countries children spend more time in school. It has been suggested therefore that the school day should be lengthened and summer vacations shortened. I doubt that this will help much. It is not that children spend too little time in school; rather, they learn too little in the time they spend. More homework might indeed help, if only marginally.

What ails American schools is not lack of money. We spend much more per pupil (adjusted for inflation) than we did in the past, and far more than other countries do. But the returns in learning are remarkably low. Where does the money go? Far too much goes into non-teaching activities. There is far too much administration, as can be shown irrefutably by comparing the ratio of teaching to non-teaching personnel in private and public schools. I do not claim that these administrators, counselors, et al. do not work hard. Rather, the work doesn't contribute much to the education of children. They keep each other busy.

Then there is the quality of the teachers themselves. Children cannot learn much from teachers who do not command basic skills. Scandalously few do.

Teachers have some reasonable complaints. They get many children from homes to which learning is as alien as discipline. Still, most children can learn to spell and to read, can learn elementary grammar and arithmetic—if teachers are allowed to impose the necessary discipline, as they are not now. There are some things that can be learned by doing—in fact, only by doing: carefulness, punctuality, manners, discipline are among them. Anybody can acquire these; but schools make little effort to help. They do not feel they are charged with helping to forge the character of students, many of whom graduate functionally illiterate, with slovenly work habits and manners.

Minimum requirements for a high-school diploma (to which each school should be able to add its own) should be imposed by every state, fulfilled only by passing examinations, including essay tests, graded by teachers from schools other than the one attended by the student.

Public schools also should be allowed to expel students unwilling to learn (or to submit to discipline), as private schools are now. Contrary to much opinion, not only would the schools be better off, the expelled students themselves are likely to do better by not being kept when schooling is unproductive for them.

We should stop assuming complacently that our children are being educated just because we have many schools with lots of teachers and myriad administrators. Currently they learn very little, not because they are stupid, but because they are taught very little. It is easier that way for everybody, the kids, the teachers, the parents. But we can't afford it any

longer. If we want to avoid a rapid decline of America we must make sure that our children are educated rather than just entertained and kept in school. This will require more changes than I proposed. But we have to begin somewhere.

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Fan Shen

Fan Shen came to the United States from the People's Republic of China. A translator and writer, he also teaches at Rockland Community College in Suffern, New York.

The Classroom and the Wider Culture

Identity as a Key to Learning English Composition

One day in June 1975, when I walked into the aircraft factory where I was working as an electrician, I saw many large-letter posters on the walls and many people parading around the workshops shouting slogans like "Down with the word 'I'!" and "Trust in masses and the Party!" I then remembered that a new political campaign called "Against Individ-ualism" was scheduled to begin that day. Ten years later, I got back my first English composition paper at the University of Nebraska—Lincoln. The professor's first comments were: "Why did you always use 'we' in-stead of 'I'?" and "Your paper would be stronger if you eliminated some sentences in the passive voice." The clashes between my Chinese back-ground and the requirements of English composition had begun. At the center of this mental struggle, which has lasted several years and is still not completely over, is the prolonged, uphill battle to recapture "myself."

In this paper I will try to describe and explore this experience of rec-onciling my Chinese identity with an English identity dictated by the rules of English composition. I want to show how my cultural background shaped—and shapes—my approaches to my writing in English and how writing in English redefined—and redefines—my *ideological* and *logical* identities. By "ideological identity" I mean the system of values that I acquired (consciously and unconsciously) from my social and cultural background. And by "logical identity" I mean the natural (or Oriental) way I organize and express my thoughts in writing. Both had to be modi-fied or redefined in learning English composition. Becoming aware of the process of redefinition of these different identities is a mode of learning that has helped me in my efforts to write in English, and, I hope, will be of help to teachers of English composition in this country. In presenting my case for this view, I will use examples from both my composition courses and literature courses, for I believe that writing papers for both kinds of courses contributed to the development of my "English identity." Although what I will describe is based on personal experience, many Chi-nese students whom I talked to said that they had had the same or similar experiences in their initial stages of learning to write in English.

Identity of the Self: Ideological and Cultural

Starting with the first English paper I wrote, I found that learning to com-pose in English is not an isolated classroom activity, but a social and cul-tural experience. The rules of English composition encapsulate values that are absent in, or sometimes contradictory to, the values of other societies (in my case, China). Therefore, learning the rules of English composition is, to a certain extent, learning the values of Anglo-American society. In writing classes in the United States I found that I had to reprogram my mind, to redefine some of the basic concepts and values that I had about myself, about society, and about the universe, values that had been imprinted and reinforced in my mind by my cultural background, and that had been part of me all my life.

Rule number one in English composition is: Be yourself. (More than one composition instructor has told me, "Just write what *you* think.") The values behind this rule, it seems to me, are based on the principle of pro-tecting and promoting individuality (and private property) in this country.

I have to wrestle with and abandon (at least temporarily) the whole system of ideology which previously defined me in myself. I had to forget Marxist doctrines (even though I do not see myself as a Marxist by choice) and the Party lines imprinted in my mind and familiarize myself with a system of capitalist/bourgeois values. I had to put aside an ideology of collectivism and adopt the values of individualism. In composition as well as in literature classes, I had to make a fundamental adjustment: If I used to examine society and literary materials through the microscopes of Marxist dialectical materialism and historical materialism, I now had to learn to look through the microscopes the other way around, i.e., to learn to look at and understand the world from the point of view of "idealism." (I must add here that there are American professors who use a Marxist approach in their teaching.)

The word "idealism," which affects my view of both myself and the universe, is loaded with social connotations, and can serve as a good example of how redefining a key word can be a pivotal part of redefining my ideological identity as a whole.

To me, idealism is the philosophical foundation of the dictum of English composition: "Be yourself." In order to write good English, I knew that I had to be myself, which actually meant not to be my Chinese self. It meant that I had to create an English self and be *that* self. And to be that English self, I felt, I had to understand and accept idealism the way a Westerner does. That is to say, I had to accept the way a Westerner sees himself in relation to the universe and society. On the one hand, I knew a lot about idealism. But on the other hand, I knew nothing about it. I mean I knew a lot about idealism through the propaganda and objections of its opponent, Marxism, but I knew little about it from its own point of view. When I thought of the word "materialism"—which is a major part of Marxism and in China has repeatedly been "shown" to be the absolute truth—there were always positive connotations, and words like "right," "true," etc., flashed in my mind. On the other hand, the word "idealism" always came to me with the dark connotations that surround words like "absurd," "illogical," "wrong," etc. In China "idealism" is depicted as a ferocious and ridiculous enemy of Marxist philosophy. Idealism, as the simplified definition imprinted in my mind had it, is the view that the material world does not exist; that all that exists is the mind and its ideas. It is just the opposite of Marxist dialectical materialism which sees the mind as a product of the material world. It is not too difficult to see that idealism, with its idea that mind is of primary importance, provides a philosophical foundation for the Western emphasis on the value of individual human minds, and hence individual human beings. Therefore, my final acceptance of myself as of primary importance—an importance that overshadowed that of authority figures in English composition—was decided, dependent on an acceptance of idealism.

My struggle with idealism came mainly from my efforts to understand and to write about works such as Coleridge's *Biographia Literaria* and Emerson's "Over-Soul." For a long time I was frustrated and puzzled

The instruction was probably crystal clear to students raised on these values, but, as a guideline of composition, it was not very clear or useful to me when I first heard it. First of all, the image or meaning that I attached to the word "I" or "myself" was, as I found out, different from that of my English teacher. In China, "I" is always subordinated to "We"—be it the working class, the Party, the country, or some other collective body. Both political pressure and literary tradition require that "I" be somewhat hidden or buried in political writings and speeches; presenting the "self" too obviously would give people the impression of being disrespectful of the Communist Party in political writings and boastful in scholarly writings. The word "I" has often been identified with another "bad" word, "individualism," which has become a synonym for selfishness in China. For a long time the words "self" and "individualism" have had negative connotations in my mind, and the negative force of the words naturally extended to the field of literary studies. As a result, even if I had brilliant ideas, the "I" in my papers always had to show some modesty by not competing with or trying to stand above the names of ancient and modern authoritative figures. Appealing to Mao or other Marxist authorities became the required way (as well as the most "forceful" or "persuasive" way) to prove one's point in written discourse. I remember that in China I had even committed what I can call "reversed plagiarism"—here, I suppose it would be called "forgery"—when I was in middle school: willfully attributing some of my thoughts to "experts" when I needed some arguments but could not find a suitable quotation from a literary or political "giant."

Now, in America, I had to learn to accept the words "I" and "self" as something glorious (as Whitman did), or at least something not to be ashamed of or embarrassed about. It was the first and probably biggest step I took into English composition and critical writing. Acting upon my professor's suggestion, I intentionally tried to show my "individuality" and to "glorify" "I" in my papers by using as many "I's" as possible—"I think," "I believe," "I see"—and deliberately cut out quotations from authorities. It was rather painful to hand in such "pompous" (I mean immodest) papers to my instructors. But to an extent it worked. After a while I became more comfortable with only "the shadow of myself." I felt more at ease to put down *my* thoughts without looking over my shoulder to worry about the attitudes of my teachers or the reactions of the Party secretaries, and to speak out as "bluntly" and "immodestly" as my American instructors demanded.

But writing many "I's" was only the beginning of the process of redefining myself. Speaking of redefining myself is, in an important sense, speaking of redefining the word "I." By such a redefinition I mean not only the change in how I envisioned myself, but also the change in how I perceived the world. The old "I" used to embody only one set of values, but now it had to embody multiple sets of values. To be truly "myself," which I knew was a key to my success in learning English composition, meant *not to be my Chinese self* at all. That is to say, when I write in English

by the idealism expressed by Coleridge and Emerson—given their ideas, such as "I think, therefore I am" (Coleridge obviously borrowed from Descartes) and "the transparent eyeball" (Emerson's view of himself)—because in my mind, drenched as it was in dialectical materialism, there was always a little voice whispering in my ear "You are, therefore you think." I could not see how human consciousness, which is not material, could create apples and trees. My intellectual conscience refused to let me believe that the human mind is the primary world and the material world secondary. Finally, I had to imagine that I was looking at a world with my head upside down. When I imagined that I was in a new body (born with the head upside down) it was easier to forget biases imprinted in my subconsciousness about idealism, the mind, and my former self. Starting from scratch, the new inverted self—which I called my "English Self" and into which I have transformed myself—could understand and *accept*, with ease, idealism as "the truth" and "himself" (i.e., my English Self) as the "creator" of the world.

Here is how I created my new "English Self." I played a "game" similar to ones played by mental therapists. First I made a list of (simplified) features about writing associated with my old identity (the Chinese Self), both ideological and logical, and then beside the first list I added a column of features about writing associated with my new identity (the English Self). After that I pictured myself getting out of my old identity, the timid, humble, modest Chinese "I," and creeping into my new identity (often in the form of a new skin or a mask), the confident, assertive, and aggressive English "I." The new "Self" helped me to remember and accept the different rules of Chinese and English composition and the values that underpin these rules. In a sense, creating an English Self is a way of reconciling my old cultural values with the new values required by English writing, without losing the former.

An interesting structural but not material parallel to my experiences in this regard has been well described by Min-zhan Lu in her important article, "From Silence to Words: Writing as Struggle" (*College English* 49 [April 1987]: 437–48). Min-zhan Lu talks about struggles between two discourses, a mainstream Marxist discourse and a bourgeois discourse her parents wanted her to learn. But her struggle was different from mine. Her Chinese self was severely constrained and suppressed by mainstream cultural discourse, but never interfused with it. Her experiences, then, were not representative of those of the majority of the younger generation who, like me, were brought up on only one discourse. I came to English composition as a Chinese person, in the fullest sense of the term, with a Chinese identity already fully formed.

Identity of the Mind: Illogical and Alogical

In learning to write in English, besides wrestling with a different ideological system, I found that I had to wrestle with a logical system very different from the blueprint of logic at the back of my mind. By "logical system" I mean two things: the Chinese way of thinking I used to approach my

theme or topic in written discourse, and the Chinese critical/logical way to develop a theme or topic. By English rules, the first is illogical, for it is the opposite of the English way of approaching a topic; the second is alogical (nonlogical), for it mainly uses mental pictures instead of words as a critical vehicle.

The Illogical Pattern In English composition, an essential rule for the logical organization of a piece of writing is the use of a "topic sentence." In Chinese composition, "from surface to core" is an essential rule, a rule which means that one ought to reach a topic gradually and "systematically" instead of "abruptly."

The concept of a topic sentence, it seems to me, is symbolic of the values of a busy people in an industrialized society, rushing to get things done, hoping to attract and satisfy the busy reader very quickly. Thinking back, I realized that I did not fully understand the virtue of the concept until my life began to rush at the speed of everyone else's in this country. The concept of a Chinese composition, on the other hand, seems to embody the values of a leisurely paced rural society whose inhabitants have the time to chew and taste a topic slowly. In Chinese composition, an introduction explaining how and why one chooses this topic is not only acceptable, but often regarded as necessary. It arouses the reader's interest in the topic little by little (and this is seen as a virtue of composition) and gives him/her a sense of refinement. The famous Robert B. Kaplan "noodles" contrasting a spiral Oriental thought process with a straight-line Western approach ("Cultural Thought Patterns in Inter-Cultural Education," *Readings on English as a Second Language*, ed. Kenneth Croft, 2nd ed., Winthrop, 1980, 403–10) may be too simplistic to capture the preferred pattern of writing in English, but I think they still express some truth about Oriental writing. A Chinese writer often clears the surrounding bushes before attacking the real target. This bush-clearing pattern in Chinese writing goes back two thousand years to Kong Fuzi (Confucius). Before doing anything, Kong says in his *Luen Yu* (*Analects*), one first needs to call things by their proper names (expressed by his phrase "Zheng Ming"). In other words, before touching one's main thesis, one should first state the "conditions" of composition: how, why, and when the piece is being composed. All of this will serve as a proper foundation on which to build the "house" of the piece. In the two thousand years after Kong, this principle of composition was gradually formalized (especially through the formal essays required by imperial examinations) and became known as "Ba Gu," or the eight-legged essay. The logic of Chinese composition, exemplified by the eight-legged essay, is like the peeling of an onion: Layer after layer is removed until the reader finally arrives at the central point, the core.

Ba Gu still influences modern Chinese writing. Carolyn Matalene has an excellent discussion of this logical (or illogical) structure and its influence on her Chinese students' efforts to write in English ("Contrastive Rhetoric: An American Writing Teacher in China," *College English* 47 [November 1985]: 789–808). A recent Chinese textbook for composition

lists six essential steps (factors) for writing a narrative essay, steps to be taken in this order: time, place, character, event, cause, and consequence (*Yuwen jichu Zhishi Liushi Jiang* [*Sixty Lessons on the Basics of the Chinese Language*], ed. Beijing Research Institute of Education, Beijing Publishing House, 1981, 525–609). Most Chinese students (including me) are taught to follow this sequence in composition.

The straightforward approach to composition in English seemed to me, at first, illogical. One could not jump to the topic. One had to walk step by step to reach the topic. In several of my early papers I found that the Chinese approach—the bush-clearing approach—persisted, and I had considerable difficulty writing (and in fact understanding) topic sentences. In what I deemed to be topic sentences, I grudgingly gave out themes. Today, those papers look to me like Chinese papers with forced or false English openings. For example, in a narrative paper on a trip to New York, I wrote the forced/false topic sentence, "A trip to New York in winter is boring." In the next few paragraphs, I talked about the weather, the people who went with me, and so on, before I talked about what I learned from the trip. My real thesis was that one could always learn something even on a boring trip.

The Alogical Pattern. In learning English composition, I found that there was yet another cultural blueprint affecting my logical thinking. I found from my early papers that very often I was unconsciously under the influence of a Chinese critical approach called the creation of "yijing," which is totally non-Western. The direct translation of the word "yijing" is: *yi,* "mind or consciousness," and *jing,* "environment." An ancient approach which has existed in China for many centuries and is still the subject of much discussion, yijing is a complicated concept that defies a universal definition. But most critics in China nowadays seem to agree on one point, that yijing is the critical approach that separates Chinese literature and criticism from Western literature and criticism. Roughly speaking, yijing is the process of creating a pictorial environment while reading a piece of literature. Many critics in China believe that yijing is a creative process of inducing oneself, while reading a piece of literature or looking at a piece of art, to create mental pictures, in order to reach a unity of nature, the author, and the reader. Therefore, it is by its very nature both creative and critical. According to the theory, this nonverbal, pictorial process leads directly to a higher ground of beauty and morality. Almost all critics in China agree that yijing is not a process of logical thinking—it is not a process of moving from the premises of an argument to its conclusion, which is the foundation of Western criticism. According to yijing, the process of criticizing a piece of art or literary work has to involve the process of creation on the reader's part. In yijing, verbal thoughts and pictorial thoughts are one. Thinking is conducted largely in pictures and then "transcribed" into words. (Ezra Pound once tried to capture the creative aspect of yijing in poems such as "In a Station of the Metro." He also tried to capture the critical aspect of it in his theory of imagism and vorticism,

even though he did not know the term "yijing.") One characteristic of the yijing approach to criticism, therefore, is that it often includes a description of the created mental pictures on the part of the reader/critic and his/her mental attempt to bridge (unite) the literary work, the pictures, with ultimate beauty and peace.

In looking back at my critical papers for various classes, I discovered that I unconsciously used the approach of yijing, especially in some of my earlier papers when I seemed not yet to have been in the grip of Western logical critical approaches. I wrote, for instance, an essay entitled "Wordsworth's Sound and Imagination: The Snowdon Episode." In the major part of the essay I described the pictures that flashed in my mind while I was reading passages in Wordsworth's long poem, *The Prelude.*

I saw three climbers (myself among them) winding up the mountain in silence "at the dead of night," absorbed in their "private thoughts." The sky was full of blocks of clouds of different colors, freely changing their shapes, like oily pigments disturbed in a bucket of water. All of a sudden, the moonlight broke the darkness "like a flash," lighting up the mountain tops. Under the "naked moon," the band saw a vast sea of mist and vapor, a silent ocean. Then the silence was abruptly broken, and we heard the "roaring of waters, torrents, streams/Innumerable, roaring with one voice" from a "blue chasm," a fracture in the vapor of the sea. It was a joyful revelation of divine truth to the human mind: the bright, "naked" moon sheds the light of "higher reasons" and "spiritual love" upon us; the vast ocean of mist looked like a thin curtain through which we vaguely saw the infinity of nature beyond; and the sounds of roaring waters coming out of the chasm of vapor cast us into the boundless spring of imagination from the depth of the human heart. Evoked by the divine light from above, the human spring of imagination is joined by the natural spring and becomes a sustaining source of energy, feeding "upon infinity" while transcending infinity at the same time.

Here I was describing my own experience more than Wordsworth's. The picture described by the poet is taken over and developed by the reader. The imagination of the author and the imagination of the reader are thus joined together. There was no "because" or "therefore" in the paper. There was little *logic.* And I thought it was (and it is) criticism. This seems to me a typical (but simplified) example of the yijing approach. (Incidentally, the instructor, a kind professor, found the paper interesting, though a bit "strange.")

In another paper of mine, "The Note of Life: Williams's 'The Orchestra'," I found myself describing my experiences of pictures of nature while reading William Carlos Williams's poem "The Orchestra." I "painted" these fleeting pictures and described the feelings that seemed to lead me to an understanding of a harmony, a "common tone," between man and nature. A paragraph from that paper reads:

The poem first struck me as a musical fairy tale. With rich musical sounds in my ear, I seemed to be walking in a solitary, dense forest on a spring morning. No sound from human society could be heard. I was now sitting under a giant pine tree, ready to hear the grand concert of Nature. With the sun slowly rising from the east, the cello (the creeping creek) and the clarinet (the rustling pine trees) started with a slow overture. Enthusiastically the violinists (the twittering birds) and the French horn (the mumbling cow) "interpose[d] their voices," and the bass (bears) got in at the wrong time. The orchestra did not stop, they continued to play. The musicians of Nature do not always play in harmony. "Together, unattuned," they have to seek "a common tone" as they play along. The symphony of Nature is like the symphony of human life: both consist of random notes seeking a "common tone." "For the symphony of life"

Love is that common tone
shall raise his fiery head
and sound his note.

Again, the logical pattern of this paper, the "pictorial criticism," is illogical to Western minds but "logical" to those acquainted with yijing. (Perhaps I should not even use the words "logical" and "think" because they are so conceptually tied up with "words" and with culturally-based conceptions, and therefore very misleading if not useless in a discussion of yijing. Maybe I should simply say that yijing is neither illogical nor logical, but alogical.)

I am not saying that such a pattern of "alogical" thinking is wrong—in fact some English instructors find it interesting and acceptable—but it is very non-Western. Since I was in this country to learn the English language and English literature, I had to abandon Chinese "pictorial logic," and to learn Western "verbal logic."

If I Had to Start Again

The change is profound: Through my understanding of new meanings of words like "individualism," "idealism," and "I," I began to accept the underlying concepts and values of American writing, and by learning to use "topic sentences" I began to accept a new logic. Thus, when I write papers in English, I am able to obey all the general rules of English composition. In doing this I feel that I am writing through, with, and because of a new identity. I welcome the change, for it has added a new dimension to me and to my view of the world. I am not saying that I have entirely lost my Chinese identity. In fact I feel that I will never lose it. Any time I write in Chinese, I resume my old identity, and obey the rules of Chinese composition such as "Make the 'I' modest" and "Beat around the bush before attacking the central topic." It is necessary for me to have such a Chinese identity in order to write authentic Chinese. (I have seen people who, after learning to write in English, use English logic and sentence patterning to

write Chinese. They produce very awkward Chinese texts.) But when I write in English, I imagine myself slipping into a new "skin," and I let the "I" behave much more aggressively and knock the topic right on the head. Being conscious of these different identities has helped me to reconcile different systems of values and logic, and has played a pivotal role in my learning to compose in English.

Looking back, I realize that the process of learning to write in English is in fact a process of creating and defining a new identity and balancing it with the old identity. The process of learning English composition would have been easier if I had realized this earlier and consciously sought to compare the two different identities required by the two writing systems from two different cultures. It is fine and perhaps even necessary for American composition teachers to teach about topic sentences, paragraphs, the use of punctuation, documentation, and so on, but can anyone design exercises sensitive to the ideological and logical differences that students like me experience—and design them so they can be introduced at an early stage of an English composition class? As I pointed out earlier, the traditional advice "Just be yourself" is not clear and helpful to students from Korea, China, Vietnam, or India. From "Be yourself" we are likely to hear either "Forget your cultural habit of writing" or "Write as you would write in your own language." But neither of the two is what the instructor meant or what we want to do. It would be helpful if he or she pointed out the different cultural/ideological connotations of the word "I," the connotations that exist in a group-centered culture and an individual-centered culture. To sharpen the contrast, it might be useful to design papers on topics like "The Individual vs. The Group: China vs. America" or "Different 'I's' in Different Cultures."

Carolyn Matalene mentioned in her article (789) an incident concerning American businessmen who presented their Chinese hosts with gifts of cheddar cheese, not knowing that the Chinese generally do not like cheese. Liking cheddar cheese may not be essential to writing English prose, but being truly accustomed to the social norms that stand behind ideas such as the English "I" and the logical pattern of English composition—call it "compositional cheddar cheese"—is essential to writing in English. Matalene does not provide an "elixir" to help her Chinese students like English "compositional cheese," but rather recommends, as do I, that composition teachers not be afraid to give foreign students English "cheese," but to make sure to hand it out slowly, sympathetically, and fully realizing that it tastes very peculiar in the mouths of those used to a very different cuisine.

Measuring Up: **The National Report Card on Higher Education**
http://measuringup.highereducation.org/commentary/introduction.cfm

Commentary: Current Year

Introduction: International Comparisons Highlight Educational Gaps Between Young and Older Americans

by Patrick M. Callan

Measuring Up 2006 is the fourth national report card on higher education in the United States.[1] As in earlier editions, the 2006 report card evaluates the progress of the nation and all 50 states in providing Americans with education and training from high school through the baccalaureate degree. Unlike other evaluations of higher education and college guides that address the effectiveness or prestige of particular colleges and universities, *Measuring Up* examines the status of postsecondary education and training from a state-by-state and national perspective. In *Measuring Up 2006*, we evaluate, compare, and grade the states on their higher education performance in six key areas:

- *Preparation for college*: How well are young people in high school being prepared to enroll and succeed in college-level work?
- *Participation:* Do young people and working-age adults have access to education and training beyond high school?
- *Completion:* Do students persist in and complete certificate and degree programs?
- *Affordability:* How difficult is it to pay for college in each state when family income, the cost of attending college, and student financial assistance are taken into account?
- *Benefits:* How do workforce-trained and college-educated residents contribute to the economic and civic well-being of each state?
- *Learning:* How do college-educated residents perform on a variety of measures of knowledge and skills?

Today's knowledge-based global economy is highly competitive and will only become more so in the foreseeable future. The nations, states, and communities that are the most successful in developing human talent, particularly college-level knowledge and skills, will enjoy significant advantages. Conversely, those nations, states, and communities that fall behind educationally are likely also to fall behind in competing for good jobs and in achieving or maintaining high standards of living. Accordingly, a major challenge for our nation and states is to incorporate international benchmarks and advances into educational policy considerations and into our assessments of progress and success. To this end, in addition to comparing states with each other, *Measuring Up 2006* introduces international comparisons for states and the United States as a whole.

Older Adults (Ages 35 to 64)

Country	Percentage
Canada	41%
United States	39%
Finland	31%
Japan	31%
Sweden	31%
Denmark	31%
New Zealand	29%
Australia	28%
Norway	28%
Switzerland	26%
Belgium	26%
Iceland	25%
United Kingdom	25%
Germany	23%
Netherlands	23%
Ireland	22%
Korea	22%
Spain	20%
France	19%
Greece	17%
Hungary	15%
Luxembourg	15%
Austria	14%
Mexico	14%
Czech Republic	12%
Poland	12%
Slovak Republic	11%
Italy	10%
Portugal	9%
Turkey	7%

Younger Adults (Ages 25 to 34)

Country	Percentage
Canada	53%
Japan	52%
Korea	47%
Finland	40%
Norway	40%
Sweden	40%
Belgium	39%
United States	39%
Spain	38%
France	37%
Ireland	37%
Australia	36%
Denmark	35%
United Kingdom	33%
New Zealand	32%
Switzerland	29%
Iceland	28%
Netherlands	28%
Greece	24%
Germany	22%
Poland	20%
Luxembourg	19%
Mexico	19%
Hungary	17%
Portugal	16%
Austria	15%
Slovak Republic	13%
Czech Republic	12%
Italy	12%
Turkey	11%

Figure 1: The United States is still among the top nations in the proportion of older adults holding a college degree ... but it drops to 7th in the educational attainment of young adults.

Source: Organisation of Economic Co-operation and Development (OECD). Data represent the percentage of adults with an associate's degree or higher in 2003.

How Does American Higher Education Measure Up Internationally?[2]
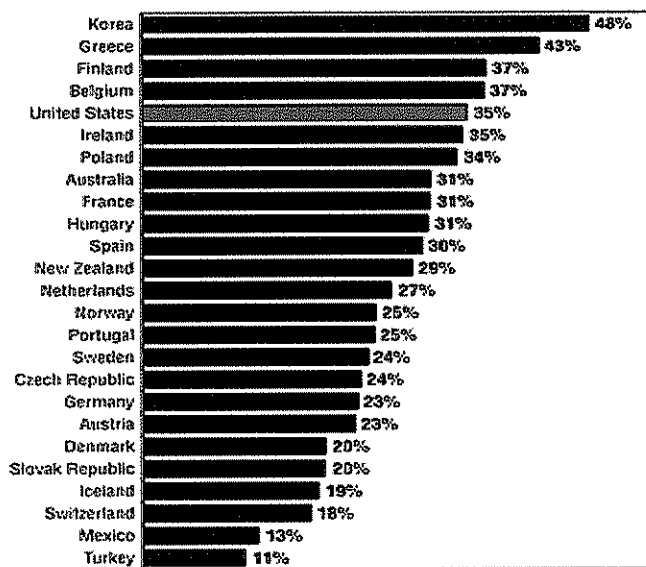
The United States is still among the world leaders in the proportion of 35- to 64-year-old adults with college degrees, which reflects the spectacular gains of the four decades following World War II, first through the educational efforts of the G.I. Bill and continuing with the population explosion of the baby boomers. In the 1990s, however, as the importance of a college-educated workforce in a global economy became clear, other nations began making the kinds of dramatic gains that had characterized American higher education earlier. In contrast, by the early 1990s, the progress the United States had made in increasing college participation had come to a virtual halt. For most of the 1990s, the United States ranked last among 14 nations in raising college participation rates, with almost no increase during the decade.[3] This U.S. performance has continued into this decade.

What is at risk is America's future educational and economic leadership, if the nation's younger population does not keep pace with the educational attainment levels of earlier generations and with the accelerating pace of higher education around the globe. The United States has already lost ground in several areas:

- Internationally, the United States still ranks among top nations in the educational attainment of older adults (ages 35 to 64); but it drops to seventh in the educational attainment of younger adults (ages 25 to 34) (see figure 1).
- In 16 states, the proportion of younger adults (ages 25 to 34) with an associate's degree or higher has fallen behind that of older adults (ages 35 to 64). These 16 states include those that account for most of the projected population growth in the United States, such as Arizona, California, Colorado, Florida, Nevada, and Texas.
- In 16 states, including Maryland, Massachusetts, Minnesota, North Carolina, and Virginia, the educational attainment of younger adults (ages 25 to 34) equals or surpasses that of older adults (ages 35 to 64), but still trails that of the best performance internationally.
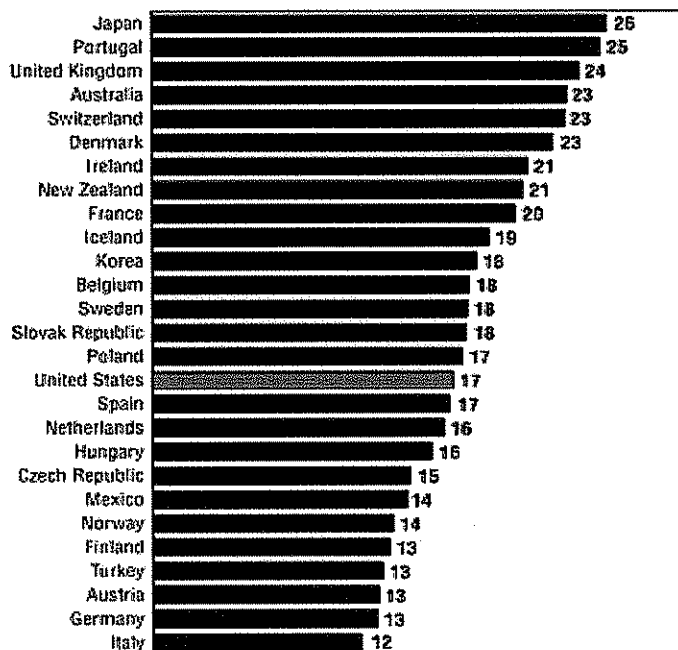
- While the United States is no longer the world leader in the proportion of young adults (ages 18 to 24) enrolled in college, it remains one of the leading countries on this measure. However, the United States ranks in the bottom half—16th among 27 countries compared—in the proportion of students who *complete* college degree or certificate programs (see figure 2). Even states that compare relatively well with other states in college completion fare poorly in international comparisons. For example, when compared with other U.S. states, the best-performing state on degree completion is Georgia. When compared internationally on this measure, however, Georgia trails Japan, Portugal, the United Kingdom, Australia, Switzerland, and Denmark. Moreover, California, Texas, Maryland, New Mexico, and New Jersey rank near the very bottom when compared internationally on degree completion.

College Participation

Country	Percent
Korea	48%
Greece	43%
Finland	37%
Belgium	37%
United States	35%
Ireland	35%
Poland	34%
Australia	31%
France	31%
Hungary	31%
Spain	30%
New Zealand	29%
Netherlands	27%
Norway	25%
Portugal	25%
Sweden	24%
Czech Republic	24%
Germany	23%
Austria	23%
Denmark	20%
Slovak Republic	20%
Iceland	19%
Switzerland	18%
Mexico	13%
Turkey	11%

Percent of Young Adults (Ages 18 to 24) Currently Enrolled in College.

CollegeCompletion

Country	Number
Japan	26
Portugal	25
United Kingdom	24
Australia	23
Switzerland	23
Denmark	23
Ireland	21
New Zealand	21
France	20
Iceland	19
Korea	18
Belgium	18
Sweden	18
Slovak Republic	18
Poland	17
United States	17
Spain	17
Netherlands	16
Hungary	16
Czech Republic	15
Mexico	14
Norway	14
Finland	13
Turkey	13
Austria	13
Germany	13
Italy	12

Total Number of Degrees/Certificates Completed per 100 Students Enrolled.

**Figure 2: The U.S. remains among the leaders in college participation ...
but it ranks in the bottom half in college completion.**

Source: Organisation of Economic Co-operation and Development (OECD). Data represent the percentage of adults with an associate's degree or higher in 2003.

India

India's economy—the world's fourth largest—has grown rapidly over the past decade, reaching nearly 8% annual growth in recent years. This economic performance has been built, in part, on growth in technology-driven sectors, including software development, outsourced services, and, more recently, cross-border-contracted research and development (R & D). These sectors rely on a critical mass of educated and skilled workers, a large share of whom have facility in English. Disparities in income and living conditions are substantial, however, so that per capita annual income for the population as a whole is about $600.

Education and Research and Development have been identified as key policy targets, if the country is to build on rapid growth in knowledge-economy sectors. In the words of the prime minister, India is best positioned to "leapfrog in the race for social and economic development" by establishing a knowledge-oriented paradigm of development. A National Knowledge Commission was established in 2005 to recommend appropriate policies to boost research, technology transfer, and skill and knowledge development to strengthen India's competitive position in the global knowledge economy.

Higher education currently enrolls more than nine million students (about 10% of the relevant age group), with almost 20% of students in engineering and medicine. More than 300,000 students graduate each year with qualifications in science and engineering; of these graduates, according to one study, only about 100,000 are comparable to U.S. bachelor's degrees and another 100,000 are comparable to U.S. sub-bachelor's awards, such as associate's degrees. In both cases, the annual volume of graduates is similar to U.S. degree production in these fields. Further, India's elite science and technology institutes rank among the world's best, producing graduates who track into leading posts in national and multinational firms. Overall, however, graduate unemployment is high, at a time when the supply of graduates in some dynamic fields is judged insufficient to meet demand. Generally, the quality—and particularly the relevance—of study programs pursued by many students are judged to be weak. Targeted initiatives have been advanced to strengthen research and training in science and engineering, with funding and enrollment increases for leading institutes, and to broaden student learning, partly through new options for students to combine conventional studies with skills-oriented coursework, and new job-oriented diploma or certificate programs.

China

China's rapidly growing economy, increasing at about 9% per year since the late 1990s, ranks among the largest in the world. The private sector, which is fueled in part by substantial growth in foreign direct investment that benefits from relatively low costs and a favorable business environment, accounts for about one-half of overall gross domestic product. While incomes are rising rapidly in the coastal areas, wide regional disparities are evident. A stated policy aim is to strive for economic growth that is more knowledge- and innovation-driven, and that is more equally shared among the population. Education figures prominently in this effort.

Educational attainment continues to improve, including higher education. Expansion of educational opportunity has been rapid and substantial, increasing from about 10% of the college-age population enrolled in 1999 to just under 20% in 2006. With 16 million enrolled in higher education, China now stands among the world leaders in this area. Growing graduate unemployment—partly attributed to uneven quality in teaching and learning—has led authorities to call for a more modest 5% annual growth in student numbers, which is still an increase of about 700,000 to 900,000 students annually. China already produces a substantial share of the world's science and engineering graduates each year. Expansion is being accommodated partly through the growth of private institutions and cross-border provision, as well as growth in public national and provincial institutions, the latter drawing more on tuition fees as a revenue stream. Public funding has targeted research and key disciplines in leading universities. For all programs, new quality-assurance processes are being implemented gradually.

The United States: 1992 to *Measuring Up 2006*

It is not surprising that nations that have historically performed far behind the United States in college opportunity, participation, and attainment would initially achieve faster rates of growth. What was not predictable is the "wall" that the United States hit in the early 1990s and the national failure to make significant progress on key higher education indicators in the last decade and a half, while the rest of the world improved. Two additional points, however, become clear from *Measuring Up 2006*:

- Pre-collegiate preparation for college in the United States continues to improve incrementally. For example, high school graduates today are more likely to have taken upper-level math and science courses to prepare for college than high school graduates a decade ago, though many still leave high

school unprepared for college-level work. However, approximately 3 in 10 high school students do not graduate on time, which limits their personal prospects and diminishes the nation's pool of college-educated workers and citizens.

- National trends and averages conceal important variations among states. The state-by-state *Measuring Up* report cards and the summaries that follow highlight significant improvements, declines, and disparities in individual states.

In addition, national college participation rates are flat. High school graduation rates have declined, although those who do graduate are more likely to attend college. The chance of a U.S. 9th grader being enrolled in college four years later is less than 40%. Large gaps in college attendance that correlate with either income or race and ethnicity have not narrowed. About 4% of working-age adults attend college part-time, a smaller proportion now compared with the early 1990s.

The proportion of students who complete college programs has improved modestly, with most of the improvement in certificates rather than degrees. Even in best-performing states, only about two-thirds of students in four-year colleges and universities complete a bachelor's degree within six years.

College affordability has declined dramatically. The primary affordability measures used in *Measuring Up 2006* are family income and the proportion of that income required to finance a year at a two-year public, four-year public, or four-year private college or university after all student financial aid is taken into account. The results show that paying for college has become significantly more difficult for most American families, particularly those with modest and low incomes. An important indicator of declining affordability is an increase in student debt. Each year more students borrow and the amount they borrow increases.

Finally, the nation lacks direct comparable measurements of student learning. This nearly complete lack of information about a crucial aspect of higher education in America accounts for the "Incomplete" grade received by most states. However, *Measuring Up 2006* for the first time includes 50 states' scores on a limited number of indicators of student learning. Nine states that made progress in their information receive a "Plus" grade.

The Demographic Context

The areas of challenge that *Measuring Up 2006* reveals for the nation and for each of the 50 states become even more important in relation to two major demographic realities that will heavily influence education and the economy in the United States for the next quarter century. First, 78 million post-World War II baby boomers are moving toward retirement years. The sheer size of the baby boom generation, combined with the entry of women into the workforce on an unprecedented scale, accounts in large part for the explosive growth of college-educated residents available to the workforce in the United States over the past decades. Between 1980 and 2000, for example, the prime-age workforce (ages 25 to 54) grew by 35 million workers, an increase of almost 50%. Both proportionately and in absolute numbers, more baby boomers completed high school and enrolled in and completed college programs than any previous generation of Americans. These increased rates resulted in the doubling of the college-educated workforce between 1980 and 2000.[4]

The second demographic reality concerns the difficulty of replacing these well-educated workers. The American workforce is projected to grow much more slowly during the first decades of the 21 st century than it has since World War II, with a predicted increase of only about three million prime-age workers through 2020—in contrast to the 35 million added between 1980 and 2000.[5] Moreover, the composition of the next generation reflects the demographic shifts that have occurred within our nation's youth. That is, a larger proportion of America's future workforce will come from ethnic minority and low-income groups. Many workers in these groups will be first-generation college students who are served least effectively by education at all levels, whether elementary, secondary, or postsecondary. Such students graduate from high school, enroll in college, and complete college programs at significantly lower rates than the baby boomers that preceded them.[6]

In short, America's educational strengths are heavily concentrated in the nation's older population. Their successors in the workforce will be drawn from a smaller pool comprised primarily of young adults who, if current educational trends persist, are less likely to have college-level education and training. Because of this educational disparity, individuals with college-level skills may be in short supply, which may in turn severely limit individual opportunity and erode economic growth.[7] The implications of these two demographic realities have received much less attention than have other more immediate concerns regarding the baby boomers, such as retirement and health care costs. Yet they are of equal or greater importance to the economic strength of the nation.

The expansion of a knowledge-based global economy has raised the bar for higher education in the United States—particularly in light of the rapid growth of college opportunities in many other nations. These nations have made their greatest gains in college access and attainment more recently than the United States has. One consequence is that the comparative educational advantage of these countries rests with their younger adults and workers. As the baby boomers in this country reach retirement age, a key challenge for the United States—and each of the 50 states—will lie in our collective ability to improve rapidly the educational opportunities and achievement of our younger Americans.

Profile: American Higher Education
Colleges and Universities
- Over 4,000 colleges and universities offer degree-granting programs
    - 15% are public 4-year institutions
    - 25% are public 2-year institutions
    - 45% are private 4-year institutions
    - 15% are private 2-year institutions

Students
- About 15 million students are enrolled at the undergraduate level
    - 42% attend public 2-year colleges and universities
    - 37% attend public 4-year colleges and universities
    - 21% attend private 2- and 4-year colleges and universities
- Thirty-eight percent of undergraduates are enrolled part-time
- One-third of all undergraduates are older than 24 years of age; two-thirds of this group are enrolled part-time
- About a third of all undergraduates are non-white.

Appropriations for Higher Education
- State and local governments currently provide $72 billion for higher education, an increase of 20% since 1991 (in 2005 dollars).

1. In the *Measuring Up* series, "higher education," "college education," "postsecondary education," and "education and training beyond high school" are used interchangeably to refer to academic and occupational education and training after high school offered by two- and four-year, public and private, nonprofit and for-profit institutions.
2. Comparisons are made with the member countries of the Organisation of Economic Co-operation and Development (OECD). Currently, 30 countries are affiliated with the Organisation, including Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.
3. Anthony Carnevale and Donna Desrochers, *Standards for What?* (Princeton, N.J.: Educational Testing Service, 2003), p. 69.
4. David T. Ellwood, "The Sputtering Labor Force of the Twenty-First Century: Can Social Policy Help?" in Alan B. Krueger and Robert M. Solow, eds., *The Roaring Nineties: Can Full Employment Be Sustained?* (New York, NY: The Russell Sage Foundation, 2001), p. 433; Committee for Economic Development, *Cracks in the Education Pipeline* (Washington, D.C.: 2005), p. 22.
5. Ibid.
6. The National Center for Public Policy and Higher Education, "The Educational Pipeline," *Policy Alert*, April 2004.
7. Thomas J. Tierney, "How Is American Higher Education Measuring Up? An Outsider's Perspective," in James B. Hunt Jr. and Thomas J.Tierney, *American Higher Education: How Does it Measure Up for the 21 st Century?* (San Jose, CA: The National Center for Public Policy and Higher Education, 2006).

National IQ Scores - Country Rankings

http://www.photius.com/rankings/national_iq_scores_country_ranks.html
SOURCE: Richard Lynn, Tatu Vanhanen, Jelte Wicherts

The intelligence scores came from work carried out earlier this decade by Richard Lynn, a British psychologist, and Tatu Vanhanen, a Finnish political scientist, who analysed IQ studies from 113 countries, and from subsequent work by Jelte Wicherts, a Dutch psychologist.

Countries are ranked highest to lowest national IQ score.

Rank	Country	%
1	Singapore	108
2	South Korea	106
3	Japan	105
4	Italy	102
5	Iceland	101
5	Mongolia	101
6	Switzerland	101
7	Austria	100
7	China	100
7	Luxembourg	100
7	Netherlands	100
7	Norway	100
7	United Kingdom	100
9	Belgium	99
9	Canada	99
9	Estonia	99
9	Finland	99
9	Germany	99
9	New Zealand	99
9	Poland	99
9	Sweden	99
10	Andorra	98
10	Australia	98
10	Czech Republic	98
10	Denmark	98
10	France	98
10	Hungary	98
10	Latvia	98
10	Spain	98
10	United States	98
11	Belarus	97
11	Malta	97
11	Russia	97
11	Ukraine	97
12	Moldova	96
12	Slovakia	96
12	Slovenia	96
12	Uruguay	96
13	Israel	95
13	Portugal	95
14	Armenia	94
14	Georgia	94
14	Kazakhstan	94
14	Romania	94
14	Vietnam	94
15	Argentina	93
15	Bulgaria	93
16	Greece	92
16	Ireland	92
16	Malaysia	92
17	Brunei	91
17	Cambodia	91
17	Cyprus	91
17	FYROM	91
17	Lithuania	91
17	Sierra Leone	91
17	Thailand	91
18	Albania	90

18	Bosnia and Herzegovina	90	24	Belize	84
18	Chile	90	24	Colombia	84
18	Croatia	90	24	Iran	84
18	Kyrgyzstan	90	24	Jordan	84
18	Turkey	90	24	Marshall Islands	84
19	Cook Islands	89	24	Micronesia, Federated States of	84
19	Costa Rica	89	24	Morocco	84
19	Laos	89	24	Nigeria	84
19	Mauritius	89	24	Pakistan	84
19	Serbia	89	24	Panama	84
19	Suriname	89	24	Paraguay	84
20	Ecuador	88	24	Saudi Arabia	84
20	Mexico	88	24	Solomon Islands	84
20	Samoa	88	24	Uganda	84
21	Azerbaijan	87	24	United Arab Emirates	84
21	Bolivia	87	24	Vanuatu	84
21	Brazil	87	24	Venezuela	84
21	Guyana	87	25	Algeria	83
21	Indonesia	87	25	Bahrain	83
21	Iraq	87	25	Libya	83
21	Myanmar (Burma)	87	25	Oman	83
21	Tajikistan	87	25	Papua New Guinea	83
21	Turkmenistan	87	25	Syria	83
21	Uzbekistan	87	25	Tunisia	83
22	Kuwait	86	26	Bangladesh	82
22	Philippines	86	26	Dominican Republic	82
22	Seychelles	86	26	India	82
22	Tonga	86	26	Lebanon	82
23	Cuba	85	26	Madagascar	82
23	Eritrea	85	26	Zimbabwe	82
23	Fiji	85	27	Egypt	81
23	Kiribati	85	27	Honduras	81
23	Peru	85	27	Maldives	81
23	Trinidad and Tobago	85	27	Nicaragua	81
23	Yemen	85	28	Barbados	80
24	Afghanistan	84	28	Bhutan	80
24	Bahamas, The	84			

28	El Salvador	80	39	Chad	68
28	Kenya	80	39	Djibouti	68
29	Guatemala	79	39	Somalia	68
29	Sri Lanka	79	39	Swaziland	68
29	Zambia	79	40	Dominica	67
30	Congo, Democratic Republic of the	78	40	Guinea	67
			40	Guinea-Bissau	67
30	Nepal	78	40	Haiti	67
30	Qatar	78	40	Lesotho	67
31	Comoros	77	40	Liberia	67
31	South Africa	77	40	Saint Kitts and Nevis	67
32	Cape Verde	76	40	Sao Tome and Principe	67
32	Congo, Republic of the	76	41	Gambia, The	66
32	Mauritania	76	42	Cameroon	64
32	Senegal	76	42	Gabon	64
33	Mali	74	42	Mozambique	64
33	Namibia	74	43	Saint Lucia	62
34	Ghana	73	44	Equatorial Guinea	59
35	Tanzania	72		North Korea	N/A
36	Central African Republic	71			
36	Grenada	71			
36	Jamaica	71			
36	Saint Vincent and the Grenadines	71			
36	Sudan	71			
37	Antigua and Barbuda	70			
37	Benin	70			
37	Botswana	70			
37	Rwanda	70			
37	Togo	70			
38	Burundi	69			
38	Cote d'Ivoire	69			
38	Ethiopia	69			
38	Malawi	69			
38	Niger	69			
39	Angola	68			
39	Burkina Faso	68			