How Education Changes: Considerations of History, Science, and Values

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The transmission of knowledge and skills to the next generation, the process of education in formal and informal settings, is inextricably bound with the emergence of Homo sapiens over the last several hundred thousand years (Brunet 1960; Donald 1991; Tomasello 2000). Formal schools, however, are just a few thousand years old; and the notion of universal education, in which all young persons in a society receive several years of competent schooling, is still a distant dream in many corners of the globe (Bloom and Cohen, 2001; Bloom, 2003).

For the most part, institutions change slowly. Such gradual change may be a positive element. The practices associated with an institution tend to be worked out by trial and error over long periods of time. While such experimentation does not guarantee a stronger and more effective institution, at least the most problematic structures and procedures are eliminated. When it comes to educational institutions—which have come to bear a primary responsibility for the intellectual and moral health of the next generation—such conservatism is especially to be recommended. We do not—or at least we should not want to—sacrifice our children to the latest fad, On occasion, shock treatments are administrated to an educational system—for example, consider the dramatic changes that took place in Japan after the Second World War or in China following the Communist Revolution in I949. Such changes may achieve their initial goal. But less welcome consequences can also occur; for example, hiding large parts of history in the case of Japan, alienating children from their parents in the case of the Cultural Revolution in China.

Education stands out in one crucial way from most other societal institutions. Put directly, education is fundamentally and primarily a "values undertaking," and educational values are perennially in disputed. Members of a society can reach agreement with relative ease about the purpose of medicine—to deliver high-quality health care to all citizens; nor need the purposes of the military or the monetary

system be perennially disputed. However, except for certain fundamentals, the purposes of education, and the notion of what it means to be an educated person, are subjects about which individuals—both professional and lay—hold distinctive and often conflicting views. Clearly, the values that undergirded the educational system in imperial Japan or China differed radically from those that came to motivate the system in a fledgling democratic society like Japan in 195o or an experimental socialistic society in China at the same time. As I once put it whimsically, "in the United States in the early 21st century, how could we possibly create an educational system that would please the three Jesses—conservative North Carolina senator Jesse Helms, charismatic African American leader Jesse Jackson, and flamboyant Minnesota wrestler-turned-governor Jesse Ventura?"

While the gradual change of educational institutions can readily be justified, we must also ask what can, and should, happen to educational institutions when dramatic alterations take place in the ambient society. Such changes can take place as a result of a shift in values: that is what prompted changes in East Asia a half century ago. However, changes can also take place as a result of scientific findings that alter our understanding of the human mind or because of broader historical forces, like globalization, that affect regions all over the world. At such times, the tension between the pace of institutional change, on one hand, and the pace of scientific discoveries and historical forces, on the other, can become acute.

For much of its relatively short history, formal schooling has been characterized by a religious orientation. Teachers were typically members of a religious order; the texts to be read and mastered were the holy books; and the lessons of school were ethical and moral in character. (The madrasas of the Islamic world, the cheders that have accompanied the Jewish diaspora in recent decades, and the rise of fun&/mentalist schools in the United States would have seemed much less anomalous a few centuries ago.) Religious instruction, or a state religion, is still common in many European countries, while the "state religion" of communism is only gradually waning as an educational staple on the Chinese mainland. (It remains alive and well in Cuba.)

Yet, despite the persistence of such religious or quasi-religious strains, most of the developed world, and much of the developing world, has converged on a form of precollegiate education that is largely secular in thrust. The major burden of the first years of school—the primary grades—is threefold: (1) to introduce children to the basic literacy systems of the ambient culture—the "three R's," to use the English parlance; (2) to acclimate youngsters to the milieu of decontextualized learning, where—in contradistinction to the learning that is most readily accomplished by human beings—one learns about events and concepts outside .of their naturally occurring contexts (Brunet, Olver, and Greenfield 1966; Resnick 1987); (3) to give children the opportunity to play and work together civilly with those individuals with whom they can expect to grow and eventually spend their adult years. While such processes used to begin around the age of six or seven, it is notable that many countries now attempt to inculcate these skills in the preschool years, sometimes as early as the fourth or fifth year of life.

A century ago, only a small percentage of the population received eyen this much education before those with "basic education" returned to the farm or proceeded to the factory. Bloom and Cohen note that in "recent decades; progress towards universal education has been unprecedented. Illiteracy in the developing world has fallen from 75% of people a century ago to less than 25% today" (2002, p. I). Still the amount of education in the developing world is modest: the "average number of years spent in school more than doubled between 1965 and 1990, from 2.1 to 4.4, among those age 25 and over in developing countries" (Bloom and Cohen 2002, p. I). In contrast, in the developed world, nearly all youngsters receive education at least through some secondary school, and in some lands, a third to a half or even more receive some form of postsecondary education.

Following the years of primary school, the burden of education shifts. Complementing the missions stated above, most formal educational institutions also strive to help students obtain fluency in the basic literacies, so that they can deal readily with all manner of texts; assist them in mastering the fundamentals of several key disciplines, particularly mathematics and the sciences; and provide tools so that students can understand and participate in the formal and informal social, economic, and political

systems of their country. This latter goal is achieved both through direct instruction in history, literature, and civics and through a demonstration of these processes in the manner in which the school operates. Specifically, in authoritarian cultures, almost all of the processes of education are dictated by a central authority, such as the Ministry of Education or the dominant religious order. In more democratic cultures, students and teachers have considerable say in the governance and activities of the school, and sometimes even curricular choices are left to the local educational establishment.

It would be an exaggeration to claim that education across the developed world is centrally orchestrated. Vast and gritty differences exist across and even within nations. Yet there is surprising convergence in what is considered a reasonable precollegiate education in Tokyo or Tel Aviv, in Budapest or Boston. Following ten to thirteen years of school, students are expected to have studied several sciences, mastered mathematics through beginning calculus, know a good deal about the history and governance of their own country, be able to read and write fluently in their native language. Most nations have or are moving toward standardized curricula and assessments in these areas—another indication of globalization's momentum. Countries differ notably in the extent to which they require mastery, of languages other than the native tongue(s), knowledge of the history and culture of other parts of the world, and acquaintance with "softer" subjects like the arts or literature. International comparisons, such as the International Mathematics and Science Survey (TIMMS) or the PISA tests, exert increasingly strong pressures in the planning chambers of educational ministries. And programs like the International Baccalaureate are spreading rapidly to many countries—developing as well as developed—throughout the world (Walker, 2002a).

From this description, it may seem that large parts of the world have managed to strip education not only of its religious moorings but also of a clash among competing values. To some extent, this characterization has validity. There is little dispute across the globe that future citizens need to be literate, numerate, capable of scientific thought, and knowledgeable about the history, traditions, and governmental system of the nation in which they are being educated. Yet the specter of values still

looms large in two respects. First, competence in science, mathematics, engineering, and technical subjects has come increasingly to be valued, perhaps overvalued, in comparison, say, to the arts, literature, moral education, or philosophy. In this sense, a technical education is equally important to fundamentalist Muslims, Hindus, Christians, and Jews; piano or calligraphy lessons take place .after school or on weekends for those who can afford it. Second, especially within democratic societies, there are large and unresolved disputes about what competence means. Thus, within the sciences, competence can mean mastery of large bodies of factual information, familiarity with laboratory procedures, in-depth understanding of selected key concepts, and/or the ability to make new discoveries or raise new questions. And educational policy, makers disagree about whether future citizens should know political or social history, embrace triumphalist or critical accounts of their own history, learn to support or to critique the status quo. The sphere of values remains alive and well in education.

Until thirty years ago, even students who received the highest-quality education typically left school during adolescence. Nowadays, however, some form of tertiary education is becoming common, even expected, especially in developed countries. The American option of some years of "liberal arts" is exceptional and may be an endangered species even in the United States; it is (perhaps reasonably in some countries) assumed that sufficient liberal arts were conveyed in the .precollegiate years and that the tertiary years should focus on professional or at least preprofessional training, again with an emphasis on technical professions. Whether or not tertiary education occurs at the end of adolescence, it is widely recognized that some forms of adult or "lifelong" learning will be necessary across the occupational spectrum. Which institutions should handle such an education and what value systems will be embodied are questions that will need to be addressed in the coming years,

For centuries, significant changes in the educational system have been due largely to historical .events. The emergence of urban centers in Europe gave rise to the universities of the late Middle Ages. The invention of the printing press made possible wide-scale literacy and allowed individuals

increasingly to take charge of their own education ("Just give me a library card, please"). The changing status of women both allowed more young girls into the educational system and ultimately conferred career options beyond teaching on large numbers of capable adult women.

Since the rise of psychology and other social sciences in the latter part of the nineteenth century, educational policy makers have sought to base their recommendations on emerging knowledge about human beings. Note that this is itself a values statement: the claim that scientific discoveries about human nature ought to be a basis for educational changes might seem bizarre in an educational milieu where, sacred considerations are dominant.

With little question, in recent years the largest impact on educational policy making has come as a result of psychometrics. Testing has a long history, but its rationale took a sharp turn in the early twentieth century. The impetus for this turn came from the growing belief that individuals differed from one another in intellectual potential and that psychologists could measure these differences reliably through an IQ (intelligence quotient) test.

Interestingly, the test makers initially embraced a range of political and social positions. Alfred Binet, the French psychologist who created the first intelligence tests, sought to identify individuals with potential learning difficulties so that these persons could achieve special help and support. American progressives who embraced intelligence tests saw them as ways of improving education generally by placing it on a more scientific basis: as Lord Kelvin famously pointed out, measurement is the key component of any scientific practice. However, testing has also been embraced by those with a contrasting political and social agenda. For many scientists and policy makers in the early twentieth century, testing was a scientifically validated way of selecting those with talent and consigning those who scored poorly to the backwaters of school and society (Gould 1981).

Contributing strongly to educational policy and practice have been the models of human learning that have emerged in psychology. Each of the principal models has antecedents that date back to earlier philosophical positions, but each has been reinforced by researchers who draw on data and scientific

ways of thinking. For example, B. E Skinner (1938), the behaviorist, drew on studies with animals and human beings to argue that learning is best effected by a careful schedule of rewards and punishments (more technically, schedules of reinforcement). This epistemological position—which dates back to the empiricist philosophers of the seventeenth and eighteenth centuries—called for carefully calibrated curricula that guided learners smoothly from one concept or practice to the next, slightly more complex one—-in a way as error free as possible. ,

Consider two contrasting pictures of human nature that derived from the psychology of cognitive development. Drawing on the famed Swiss psychologist Jean Piaget (1983) many educators have called for a system in which young individuals discover for themselves the laws that govern the physical, biological, and social worlds. According to this position, which reverberates with Rousseauian sentiments, attempts to inculcate facts and concepts directly are ill-advised: only superficial learning can result. Students are better off if—like Rousseau's Émile—they can explore for themselves the operations of, say, a lever, an abacus, or the rules that govern a billiard ball and figure out the operating principles. While not rejecting the Piagetian perspective in toto, the influential Russian psychologist Lev Vygotsky (1978) added two important components. First, he noted that there is a great deal of knowledge about such concepts already circulating within the society and that the challenge of education is to help students internalize what has already been established by previous generations. Second, he showed that proper support, or scaffolding, for the learning child is always advisable and sometimes necessary if the child is to achieve more sophisticated understandings and skills. It is illusory to believe that children can on their own figure out the major ideas that have slowly emerged in the scholarly disciplines, even though they may be able to master certain universal understandings without explicit tutelage.

Even though most educators have not read Binet or Skinner, Piaget or Vygotsky in the original (and most parents have not heard of these authorities), the legacies of these intellectual giants have exerted an impact on education around the world. For at least a century, belief in formal tests as means of selecting and comparing has proved an incredibly powerful twentieth-century virus. Behaviorist methods are

widely used, particularly with populations that exhibit cognitive or emotional problems. But discovery methods are also prominent in many scientific and mathematics classes, while' concern with the proper forms of support or scaffolding permeate discussions about education, ranging from Head Start programs to apprenticeships in. scientific laboratories or medical schools.

Just as generals often fight the last war, many educators base their well-intentioned practices on outmoded ideas about human cognition. In the past quarter century, I have had the opportunity to observe two major changes in how scientists think about human learning and to anticipate the emergence of a third. In each case, these paradigm shifts could have major educational implications, ones that remake how teachers work with students. In tracing the course and fate of these understandings, we can gain important insights into what happens when scientific discoveries meet educational practices.

From Intelligence to Intelligences: Let me begin with the example of intelligence. For nearly a century, a consensus has obtained among those who are charged with thinking about intelligence. Put succinctly, the consensus stipulates that there is a single thing called human intelligence; individuals differ from birth in how smart they are; one's intellectual potential is largely determined by one's biological parents; and psychologists assess a person's intellect by administering a test of intelligence. These views date back to the claims of Charles Spearman (1904) and Lewis Terman (1916) at the turn of the century, and they have been espoused in recent years by such experts as the British psychologist Hans Eysenck (1987) and the American social scientists Richard Herrnstein and Charles Murray (1994).

While this consensus was challenged from early on by both scholars (Thurstone 1938) and, commentators (Lippmann 1922-1993/1976), only recently has there been a more concerted critique by scientists of various stripes. Among scholars of artificial intelligence, there is a growing recognition that notions such as "general problem solving" are not well-founded and that successful computer programs

contain specific knowledge about specific forms of expertise. Among neuroscientists, there is agreement that the brain is not a general, equipotential organ: rather, specific capacities (e.g., language, spatial orientation, understanding of other people) are associated with specific regions of the brain and have evolved over the millennia to entail specific kinds of information processing (for relevant references, see Gardner 1983/1993a, 1985). Among anthropologists and psychologists, an increasingly vocal minority has proposed the existence of several relatively independent forms of intelligence (Battro, 2003; Goleman 1995; Mithen 1996; Rosnow, Skedler, Jaeger, and Rin 1994; Salovey and Mayer 1990; Sternberg 1985; Tooby and Cosmides 1991).

In a formulation developed over two decades ago, I argued that human beings are better thought of as possessing half a dozen or more separate sets of capacities that I termed multiple intelligences (Gardner 1983/1993a) **(See Essay 10)**. "MI theory," as it has come to be called, has two fascinating and complementary facets, and both of these can play out in the educational sphere. The first implication is that all of us possess these several intelligences: they make us human, cognitively speaking. Thus any teacher faced with youngsters who are not totally impaired can assume that the students possess all of these intelligences. If one chooses, it is possible to teach to the specific intelligences, to develop them, to draw on them in conveying consequential educational materials,

The second facet is that each individual possesses a distinctive profile of intelligences. Even identical twins—literally clones of one another with the same genetic profile—may each exhibit a characteristic "scatter" of intellectual strengths and weaknesses. These differences are due, presumably, to several factors: for example, even when two individuals have identical genetic information, they don't undergo the identical experiences in the world (or even in the womb); and two individuals who appear indistinguishable on a physical basis may be strongly motivated to distinguish themselves from one another.

The assertion that we possess a range of intelligences, with each person's profile as idiosyncratic, immediately poses a fascinating educational dilemma. One horn of that dilemma proclaims that we

should ignore these differences or even try to erase them. The opposing horn holds that we should recognize these differences and try, insofar as possible, to .turn them to our educational advantage.

It is important to note that, throughout most of human history, differences among individuals have been considered a nuisance factor in educational circles. We have favored uniform schools in which each person is treated the same as every other one. Moreover, this "equal treatment" appears on the surface to be fair, since no favoritism has apparently been shown. However, one can also argue—as I have—that such "uniform" schools are actually unfair (Gardner 1993b, 1999a). They privilege one profile of intelligences—almost always the blend of language and logic that is probed in intelligence tests—and ignore or minimize the other ones. It would be possible to take entirely the opposite tack—one that I have labeled "individually centered education." In this alternative philosophy, one finds out as much as possible about each student and then crafts an education that helps each student learn as much as possible, in ways that are congenial to that student. I believe that such individualized education will come to fruition very soon. This outcome will occur not because of my theory or my preaching but because technology will make it possible to individualize education as much as we want to. And once it becomes clear that algebra or French or economics or music theory can be presented in many ways, then it will constitute malpractice to perseverate in using the methods of uniform education (see Turkle 1997).

The case of MI theory makes it clear that scientific findings can readily yield educational implications. Indeed, once MI theory had been enunciated, educators in many parts of the world began to claim that they were refashioning their classes or schools in the light of the theory. I was pleased that these ideas—psychological ones—had stimulated their thinking. But it soon became clear that MI theory was like an inkblot test—an ambiguous stimulus that could be interpreted in highly idiosyncratic ways. Some educators saw MI theory as a rationale for arts education or special education; others saw it as a pretext for creating tracks, in terms of the various intelligences; still others considered MI theory as a suggestion to teach seven to eight topics and/or to do so in seven to eight different ways. Even the

psychometricians got into the act: I was approached by several publishing companies and asked if I wanted to develop a battery of tests, one for each intelligence!

The decisions one makes in such instances clearly reflect one's own value system. One can never proceed directly and unambiguously from a scientific finding to an educational practice. Indeed, this stricture pertains even to the traditional view of intelligence. I had a chance to discuss the findings of *The Bell Curve* (1994) with its senior author, Richard Herrnstein, before his untimely death. Herrnstein and I agreed that if one premise of the book was correct—that it is difficult to change IQ—one may draw two diametrically opposite inferences. The Herrnstein-Murray inference is that it is not worth trying to raise IQ and that one should simply accept these differences and make the best of them. But an opposite, more optimistic inference is that one should devote all one's energies in an attempt to raise IQ and one might well hit upon a method that is successful.

The embracing of MI theory, at least at a nominal level, is an example of how a scientific finding can be readily validated by the educational community. However, such a friendly reception is not always the case.

The Challenges of Disciplinary Understanding: Once one has acquired the basic literacies, the next educational milestone entails mastery of various subjects or disciplines. While the list of valued disciplines differs across societies, in general it features a number of sciences (biology, physics, chemistry), several branches of mathematics (algebra, geometry, precalculus), as well as a smattering of more humanistic pursuits (history, geography, one or more art forms). If the literacies represent the consensual curricula for the elementary grades, disciplinary mastery and understanding is the curriculum of choice for secondary schools and perhaps college as well.

Let me say a word about each of these terms. When I speak of disciplines, I intend a distinction between subject matter (learning the names, facts, and concepts of a particular subject) and discipline (mastering the distinctive ways of thinking that characterize a scientist, historian, humanist, or artist).

Both scientists and historians offer explanations of events, but the nature of the data that they examine and the kinds of explanations that they offer are distinctively and instructively different. When I speak of understanding, I venture #well beyond the simple capacity to recall what one has read or heard about. An individual who understands a disciplinary topic can apply that understanding to new situations, ones that she has never encountered before. In the absence of such performances of understanding, acquired knowledge remains inert—incapable of being mobilized for useful purposes.

In the past, both traditionalists and progressives woefully underestimated the difficulties entailed in disciplinary understanding. Traditionalists saw disciplinary study chiefly as the mastery of factual and definitional information drawn from various subject matters; and. such mastery entailed chiefly repetition, drill, and preconfigured problem sets (Bereiter and Engelmann 1966; Hirsch 1987, 1996). Progressives believed that disciplinary understanding flowed naturally from the opportunity to explore topics in depth, in natural settings, at one's own pace (Brunet 1960; Dewey I964; Jervis and Tobier 1988). Just as literacy should arise as a matter of course following opportunities to practice in a literate environment, so disciplinary mastery should arise naturally from deep immersion in the relevant subject matter.

Alas, both of these educational perspectives have proved wrong. A large body of research from the cognitive sciences over the last few decades has documented an alarming state of affairs. It turns out that the understanding of the principal ideas in the various disciplines has proved much more challenging than most educators have believed. The smoking gun can be found in the study of the sciences. Even students who get high grades in the sciences at leading secondary schools and universities turn out to have very tenuous understanding of the principal ideas in various subject areas. This result has been ascertained by examining such students outside of their classroom environment. Not only are most students inadequate in applying properly what they have learned in class, but in many cases, they give the same answers to problems and questions as are given by students who have not even taken the course in the first place! (For a summary of the relevant literature, see **Gardner 1991, 1999b,** and

Essays #.) Thus, for example, even our high-scoring high school and college students fail to evince understanding of evolution, or the laws of motion, or the principles of economics when they are questioned outside a text-test context.

Again, the recognition of new data about the human mind should prove provocative to educators, but in this case it does not immediately dictate commensurate educational practices. One could, for example, simply dodge the challenge of disciplinary mastery and remain at the level of Gradgrindian (or Hirschian) factual mastery. One could decide to challenge directly the misconceptions of the young and see whether the proper conceptions can readily arise in their place. One could let the misconceptions play out, see where they are inadequate, and let youngsters themselves contrive better understandings. One could develop targeted curricula that provide support for specific forms of disciplinary understanding. It hardly needs to be remarked that the kind of local and national assessment instruments in play will exert a powerful impact on the educational strategy that is followed. If the instrument calls for a great deal of coverage, then any chance of eradicating misconceptions will be undercut. And in my view, the latter scenario is what has happened so far. Few educators are willing to face the serious implication of the finding that genuine disciplinary understanding is rarely found, even among our most successful students.

In the fall of 2002, both the Rhodes Scholarship and the Marshall Scholarships were announced at Harvard University. Seven students won these coveted awards, which provide support for study at a British university. What caught my eye was the fact that all seven of these students had undertaken interdisciplinary study while undergraduates. One student was enrolled in history and literature, a second was in physics and biochemistry, a third was in philosophy and international relations. All three of these individuals were also seriously involved in the arts.

While it has rarely been written about in the popular media, a major sea change has occurred in the academy over the last fifty years. A large number of interdisciplinary centers, programs, projects, and

departments have sprung up all over the educational landscape, from middle school, through college and university curricula, all the way to advanced think tanks in the sciences, the humanities, and policy studies. This trend has reflected a variety of forces, ranging from the sober (so many contemporary problems demand input from a number of disciplines) to the mundane (it is attractive for a faculty member to have her own center, in which she can explore issues of interest to her in the ways she finds congenial with colleagues of her own choosing). And the actual work carried out under the rubric of interdisciplinarity has ranged from pathbreaking to self-absorbed to trivial.

For the last few years, my colleagues and I, complementing our studies of disciplinary understanding, have been exploring the nature of interdisciplinary work (Boix-Mansilla and Gardner 1997; Gardner and Boix-Mansilla 1994). There is no question that interdisciplinarity is in the air and that much work is being carried out under its banner. What has struck us is the astonishing lack of standards for what counts as adequate or appropriate interdisciplinary work. While standards are in place for judging the quality of work in the traditional disciplines, there has not been time—and perhaps there has not been motivation—to set up analogous kinds of indices for quality work in various interdisciplinary amalgams. Thus one is thrown into an uncomfortable situation: either accept all the work uncritically ("if it is interdisciplinary, it must be meritorious"); apply indices from the disciplinary world that may not be appropriate; or try to assess the impact of the work—which may not necessarily reflect its quality.

The rise of interdisciplinary studies is not a scientific phenomenon; rather it is a historical fact of our time. Trends in our increasingly globalized society have brought interdisciplinary concerns to the fore. Issues like poverty reduction, anti-terrorism, privacy, prevention of disease, energy conservation, ecological balance—the list could be expanded at will—all require input from and syntheses of various forms of disciplinary knowledge and methods. Educational institutions seek, in their ways, to respond to the demand for this kind of skill; and the more adventurous students are attracted to studies that call for a blend of disciplinary expertises, Yet in a world that still believes in one kind of intelligence and that

has not appreciated the difficulty of understanding even a single discipline, we are hardly in a position to mount interdisciplinary programs and feel confident about evaluating their success. Perhaps it will be necessary to institute psychological studies of the synthesizing or interdisciplinary mind.

Nearly everyone recognizes that the youth of today are being prepared for a world that is different in fundamental ways from the world of-1900, 1950, perhaps even 1975. In addition to the obvious differences in political alignments and technological sophistication, youth today partake of a powerful hegemonic cultural message emanating from the United States, as well as strong and divergent cultural countercurrents streaming in from major societies. Any student growing up in such a world needs to be able to navigate among these diverse and powerful messages (see Friedman 2000; Giddens 2000; also see Jenkins, Maira, and Watson, 2003). Yet there is not even the beginning of a synthesis of how this altered world should impact education, particularly education at the primary and secondary levels (see Suarez-Orozco and Qin-Hilliard, 2003), Here, I put forth some suggestions for a curriculum suitable to the era of globalization. I do so with the explicit awareness that all educational recommendations presuppose a certain set of values. Mine are based on an education that is suitable for a democratic society, in which individuals have a fair degree of say in where they live and how they live; in which the use of one's mind to the fullest is a prominent value; and in which all able-bodied individuals are expected to contribute not only to the security and well-being of their families but also to the health of the broader communities in which they live.

Beginning on a conservative note, I believe that we should not turn our backs on those methods and procedures that have been worked out over long periods of time. Though there is always room for improvement, we know a great deal about how to develop the literacies in young persons, both those who can learn in normal ways and those who have specific learning problems—for example, in the decoding of written alphabetic text.

Once we come to the mastery of disciplines, however, we can no longer afford business as usual. Now that we know the difficulties of disciplinary mastery, we need to recognize that this concern must occupy a large proportion of our pedagogical energies. My recommendation in this area is to cut down radically on the number of subjects to master in precollegiate education: I would favor all students learning at least one science, one area of history, one art form, expression and appreciation in their own language, and especially in countries where the principal language is not widely spoken beyond its borders, expression and appreciation of English.

Once a sharper focus has been adapted, it is indeed possible to teach for disciplinary understanding. Such teaching is best done by focusing on the principal deep ideas in the discipline and approaching them from many different angles (Blythe 1998; Cohen, McLaughlin, and Talbert 1993; Wiske 1998). A depth-over-breadth engagement with a limited number of topics and disciplines is most likely to undermine the misconceptions and to establish deep and robust forms of understanding. Interestingly, the idea of multiple intelligences can be used here. For if one focuses sharply on a limited number of concepts, it is possible to approach these concepts in several ways, exploiting our various human intelligences. Such a multi-perspective approach yields two dividends: it reaches more students and it exemplifies what it means to have expertise (Gardner 1999b). After all, the expert is the individual who can think of a topic in lots of different ways.

My focus on a few key disciplines reveals that I believe in the idea of a core curriculum. In that sense I am a traditionalist. But I am completely open to the presentation of the curriculum along any number of pathways and to the assessment of mastery in several different ways, In matters of pedagogy and assessment, I am a pluralist. These ideas clash with those who want to revert to the ideal of uniform schools; they are congenial to those who see themselves as helping each student to realize his or her full potential in ways that are congenial.

Because of my fealty to the disciplines, I have been a strong believer that interdisciplinary work should await the mastery of a number of individual disciplines. We would not take seriously a claim of

bilingual-ism unless a person had mastered more than one language; and so I reason that one should not evoke the term interdisciplinary until one has exhibited mastery of more than one discipline. Pursuing this line, disciplinary education becomes the challenge of secondary education, interdisciplinary education the superstructure associated with tertiary and postgraduate education.

Recently, however, I have softened this line. Because interdisciplinary work has become so important in our world, it may not be practical to withhold its practice until complete mastery of specific disciplines has coalesced. Perhaps it will be possible for an individual to achieve sufficient mastery of one discipline so that he can become part of a multi-discipline team. The challenge for this new team member is to bring a particular disciplinary perspective to bear on a problem and to gain .enough expertise so that he can appreciate the contributions of the other disciplines, pose insightful questions, and integrate the answers into his understanding. I see no reason why novices should not be allowed to observe these interdisciplinary exchanges and benefit from them. However, it is vital that such novices understand that ultimately one will not be able to participate in a legitimate way in an interdisciplinary team unless .one has paid one's disciplinary dues.

Membership in such teams points up another vital desideratum for participation in a global society. Simply being the smartest person in one's discipline will no longer suffice. Individuals need to be able to work effectively and in a civil manner with individuals who have different expertises and who come from different cultural backgrounds (Murnane and Levy 1996; Resnick 1987; Suarez-Orozco and Qin-Hilliard, 2003). We might say that such individuals need to develop interpersonal intelligence and multicultural understanding. While there is a place for direct instruction in these realms, there is little question that youngsters are most powerfully affected by the examples that they see around them each day. To the extent that parents, teachers, and their respective communities exhibit strong forms of personal relations and cultural sensitivity, we can expect that youngsters will be equipped to participate effectively in working and playing teams. If, however, ' such forms of sensitivity have not been exhibited regularly by those who are closest to the young, then educational or work institutions face a

daunting challenge.

Many have proposed that in our highly competitive global society, creativity, originality, thinking "outside the box" are at a premium. Silicon Valley represents eloquent testimony to the importance—as well as the risks—of a highly creative ambience. Yet it is questionable whether the enhancing of creativity should be a task of the schools. Much depends on whether the lessons of creativity are manifest "on the street" and in commercial enterprise—as they are in Silicon Valley or Hong Kong—or whether the conformism and tradition encountered daily on the streets and in the home need to be countered boldly in the educational system.

I propose that precollegiate education in the future encompass the following relatively new skills and understandings (see Suarez-Orozco and Qin-Hilliard, 2003). These need not be transmitted by schools or by schools alone, but unless they are passed down via other sectors of the society, their transmission will become the challenge par excellence for the precollegiate educational system.

1. Understanding of the global system. The trends of globalization—the unprecedented and unpredictable movement of human beings, capital, information, and cultural life forms—need to be understood by the young persons who are and will always inhabit a global community. Some of the system will become manifest through the media; but many other facets—for example, the operation of worldwide markets—will need to be taught in a more formal manner.

2. Capacity to think analytically and creatively within disciplines. Simple mastery of information, concepts, and definitions will no longer suffice. Students will have to master disciplinary moves sufficiently so that they can apply them flexibly and generatively to deal with issues that could not be anticipated by the authors of textbooks.

3. Ability to tackle problems and issues that do not respect disciplinary boundaries. Many—perhaps most—of the most vexing issues facing the world today (including the issue of globalization!) do not respect disciplinary boundaries. AIDS, large-scale immigration, and global warming are examples of problems in need of interdisciplinary thinking. One could take the position that it is first necessary to master individual disciplines; moving among or beyond disciplines then becomes the task of tertiary or professional education (Gardner 1999b). However, there is much to be said for beginning the process of interdisciplinary work at an earlier point in education—as is done, for example, in the "theory of knowledge" course required of students in the International Baccalaureate or the courses in "problem-based learning" taught at the Illinois Mathematics and Science Academy. How best to begin to introduce rigorous multi-perspective thinking into our classrooms is a challenge that we have only begun to confront; and as noted, our psychological understanding of the mind of the synthesizer has yet to coalesce.

4. Knowledge of and ability to interact civilly and productively with individuals from quite different cultural backgrounds—both within one's own society and across the planet. Globalization is selecting for interpersonal competencies, including the ability to think and work with others coming from very different racial, linguistic, religious, and cultural backgrounds (see Malta, 2003; C. Suarez-Orozco, 2003). Mastery and cultivation of these competencies will be the cornerstone of educational systems in the most successful democracies of the twenty-first century (see Suarez-Orozco and Qin-Hilliard, 2003).

5. Knowledge of and respect for one's own cultural tradition(s). The terrorists who crashed into the Twin Towers in September 2001 of the World Trade Center privileged the scientific and technical knowledge and cognitive skills that globalization has to offer. At the same time, they despised the Western (and especially the American), values, ethos, and worldview that in many regions of the

world—including much of Western Europe—pass as globalization's underside. Societies that nurture the emergence of the instrumental skills needed to thrive while not subverting or undermining the expressive domains of culture—values, worldviews, and especially, the domain of the sacred—will endure and may even have the edge in globalization's new regime. Managing the dual process of convergence (in the instrumental domains of culture) and divergence (in the expressive domains of culture) may well be among the most critical tasks of education for globalization. Societies that can manage this psychic jujitsu will thrive.

6. Fostering of hybrid or blended identities. Education for globalization will select for the crafting and performing of hybrid identities needed to work, think, and play across cultural boundaries (see C. Suarez-Orozco, 2003). These will be increasingly indexed by multilingual competencies and transcultural sensibilities that will enable children to traverse discontinuous cultural meaning systems; to metabolize, decode, and make meaning in distinct, sometimes incommensurable cultural spaces, and social fields. Societies that privilege transculturation and hybridity will be in a better position to thrive, while societies that enforce a regime of compulsive monoculturism and compulsive monolinguism are likely to lose out under globalization's emerging regime.

7. Fostering of tolerance. Education for globalization will give those societies that tend to (1) tolerate or, better yet, privilege dissent, (2) foster doubt (in Francis Bacon's sense), and (3) provide equality of opportunity will have a powerful edge over societies that tend to privilege reflex-like consent and inequality of access to opportunity due to various ascribed qualities. More ominously, our world is unlikely to survive unless we become far more successful at fostering tolerant attitudes within and across nations.'

Though many may wish that they would go away, the main lines of globalization are here to stay. It is difficult to envision a world in which the economic trends, communication technologies, movements

of population, and cultural messages of the past few decades will somehow be reversed. Even events as epochal as those of September 11, 2001, are likely to modulate the forces of globalization rather than derail them in a fundamental way.

Yet local or national institutions, mores, and values will not necessarily disappear. Indeed the very power of the forces of globalization will in many cases prompt strong reactions, sometimes violent, sometimes effective. Those newly emerging institutions that can respond to the forces of globalization while at the same time respecting the diversities of cultures and belief systems are most likely to have a long half-life.

Chief among those institutions will be educational systems, with those charged with precollegiate education assuming enormous importance for the foreseeable future. Educational systems are inherently conservative institutions, and that conservatism is in many ways justified. Still, just as educational systems eventually adapted to the agricultural and industrial revolutions, just as they eventually responded to the decline of religion and the invention of print and audiovisual technologies, they will have to adapt as well to the facts of the globalized, knowledge-centered economy and society. In doing so, they will have to somehow integrate the new scientific findings, their multiple (and sometimes seemingly contradictory) educational implications, with past and present historical trends, and to do so in light of their most cherished values. This task may take one hundred years or more; but as a French military leader once famously remarked when facing an especially daunting task, “In that case, we had better begin today.”