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# Are Skills the Problem?

## Reforming the Education and Training System in the United States

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*Skill formation is a life cycle process. It begins in the womb and continues on in the workplace. Education policy is only one aspect of a successful skill formation policy, and not necessarily the most important one.*

—James Heckman and Dimitriy Masterov (2005)

*As the larger return to education and skill is likely the single greatest source of the long-term increase in inequality, policies that boost our national investment in education and training can help reduce inequality while expanding economic opportunity. . . . The economically relevant concept of education is much broader than the traditional course of schooling from kindergarten through high school and into college. Indeed, substantial economic benefits may result from any form of training that helps individuals acquire economically and socially useful skills, including not only K-12 education, college, and graduate work but also on-the-job training, course work at community colleges and vocational schools, extension courses, on-line education, and training in financial literacy.*

—Ben Bernanke, Chairman of the Board of Governors of the Federal Reserve (2007)

## STATING THE ARGUMENT

The stellar economic growth of the United States since the early 1990s surprised scholars and policy analysts who had decried the mediocre skills of the American workforce and the inadequate preparation of students for careers. Unlike other countries, which have comprehensive school and career development systems, the United States lacked a well-structured approach to education and training, especially for the “forgotten half” of young people not pursuing a college education.<sup>1</sup> The skill development models of Germany, Japan, and other developed countries were especially compelling examples to emulate.

Certainly, the argument seemed convincing. American students and workers were underperforming compared to their counterparts in other developed countries on tests of international reading, math, and writing skills. Young people not going on to college experienced difficult transitions from high school to career-oriented jobs. Productivity growth had slowed over the 1970s and 1980s. The wage gap between high school-educated and college-educated workers had widened sharply, and compensation had actually declined for high school dropouts. Economic analyses indicated that the rising wage inequality partly resulted from the increasingly important role of the skills required to complement rapid technological changes, such as those embodied in computers. Another reason for the rising demand for skill was that changes in the organization of work were giving nonsupervisory workers more responsibility for decisions and for achieving high quality (Murnane and Levy 1996).

From today’s perspective the skills problem looks overstated, since during the past 15 years the U.S. economy has far exceeded expectations. Between 1991 and 2005, national income rose in the United States by 45 percent, triple the 15 percent growth achieved in Japan and more than twice the 19 percent growth in Germany. U.S. gains in productivity also outpaced productivity growth in Japan, Germany, and most other advanced economies. The strong U.S. labor productivity performance is especially impressive in the context of a rapidly expanding job market that lowered unemployment rates and absorbed millions of poorly educated immigrants from less-developed countries, along with more than one million single parents who were former or potential welfare

recipients. Since 2000, unemployment rates have averaged 4.9 percent, down from 5.8 percent in the 1990s and from 7.3 percent in the 1980s. The decline in unemployment rates has extended to workers without a high school degree; their rates of joblessness fell from about 10.5 percent in the 1992–1994 period to under 7 percent in the late 1990s and in 2006–2007.<sup>2</sup>

Notwithstanding these indicators of the health of the U.S. economy, not all is going well for workers. Less-educated workers have seen their wages stagnate or decline, causing them to fall further behind college-educated workers. The share of workers covered by pensions and health insurance has declined in recent years. The intensification of global competition is posing a threat to workers at all levels. Concerns are growing about immigration, outsourcing, and the expanding labor force in India, China, and other less-developed countries whose workers are now a part of a world labor market (Freeman 2007). Trade and the dynamics of companies generate worker displacement, resulting in frequent earnings losses when workers move to other jobs. The share of U.S. workers with a high school diploma and the share with a college degree are no longer the highest in the developed world. According to the New Commission on the Skills of the American Workforce (NCSAW 2007), even well-paying jobs for college graduates are threatened by outsourcing to low-paid but well-educated workers in poor countries. Given automation, outsourcing, and the need for creative workers, the commission finds that “people who prefer conventional work environments are likely to see their jobs disappear.” At the same time, employers report difficulty in recruiting workers with adequate skills: over half of manufacturing firms have reported that the shortage of available skills is affecting their ability to serve customers, and 84 percent say the K-12 school system is not doing a good job of preparing students for the workplace (Deloitte Consulting 2005).

Perhaps the central concerns are shortfalls in skills and declining wages among a segment of American workers. Wages of men with less than a high school diploma have fallen. Men who graduated from high school but did not attend college have seen their wages stagnate. The worsening job market for African American men with no more than a high school degree has weakened their ability to start and maintain families. In contrast, well-educated workers, including African Americans with college degrees, enjoy low unemployment rates and earn good

salaries. Apparently the demand for skill is rising faster than the supply. In 1979, the median hourly wage of college-educated workers was 34 percent higher than that of high school-educated workers. By 2005, the advantage to the college-educated reached 56 percent.<sup>3</sup> Thus, while expanding the skills of the current and future U.S. workforce may not be sufficient, most experts see raising educational attainment as necessary for a future of good jobs.

Translating a skills strategy into policy is, however, not straightforward. The first problem is with the definition of skills. No one index can capture the multiplicity of skills required in a wide variety of work and occupational contexts. Reading, math, and writing capabilities are in high demand (Barton 2000) and are relevant to most jobs, including jobs held by workers with no college education (Holzer 1997). But so too are a range of other general skills (such as communication, responsibility, teamwork, allocating resources, problem-solving, and finding information) and occupation-specific skills.<sup>4</sup> Yet the nearly exclusive emphasis in public policy and in public funding is on academic skills. Today's goals, as espoused by leaders from politics, education, and the corporate sector, are twofold: 1) to raise educational attainment for K-12 students as high as possible, encouraging them to obtain at least a bachelor's degree, and 2) to insure that elementary and secondary students achieve at least basic academic competencies in a limited number of subjects. One measure of success is the share of students who pass academic tests of reading, math, and writing skills. A second is the share of students completing a bachelor's (or at least an associate's) degree. Implicitly, the United States has embarked on what James Rosenbaum (2001) has called a "college for all" policy.

To achieve these goals, governments have been doing four things: 1) increasing spending on elementary, secondary, and postsecondary schools; 2) mandating test-based performance measures that hold schools accountable for student performance; 3) expanding competition and school choice; and 4) offering subsidies to help students attend college. An increasing number of experts favor a skills strategy that begins at birth and uses high-quality, developmental child care before elementary school (Heckman and Masterov 2007). Although subsidized training through the public sector and through employers is a part of the nation's skill-building activities, spending on secondary and postsecondary education dwarfs the modest dollars spent training adults or

youth who have dropped out of the mainstream educational system. Some secondary and postsecondary institutions, such as vocational high schools, community colleges, and proprietary private vocational schools, offer school-based programs that involve occupational training. But the traditional ways workers learned an occupational skill—through informal on-the-job training and formal apprenticeships—have attracted very little attention.

The emphasis on schooling and academic test scores as skill enhancement strategies results partly from a failure to conceptualize and measure a broader array of skills that are critical to success in the workplace. Without institutions that specify and document a range of well-accepted generic and occupational skills, public statistical agencies regularly quantify only schooling and occasionally measure verbal and math skills based on test scores. These indicators are meaningful but incomplete and sometimes inaccurate or contested.<sup>5</sup> As a result, we lack comprehensive measures of the job skills of the nation's workforce. We know little about the share of workers who have attained, for example, communication skills or the ability to allocate resources and to work effectively in a team environment. We have only limited information on occupational skills.

Unfortunately, the weakness in the data is not merely an academic issue; it can lead to a distorted set of education and training policies. When the public, policymakers, and educators lack information on critical generic and occupational skills, they find it difficult to diagnose trends, to identify skill gaps, to learn about the skill limitations of different subgroups, to understand the skills that are most in demand, and to determine the best mechanisms for teaching skills. The incomplete measures are a problem for the private as well as the public sector. Business firms rarely measure the skills of their employees, perhaps in part because their accounting methods disregard the asset value of the skills of their employees.

The simplified, academic-based measures of skill cause policymakers to use schooling as virtually the sole method by which students learn skills. The result is a standardized set of school-based requirements, often accompanied by a uniform approach to teaching. Such methods may be appropriate for elementary school and perhaps through early high school, but the approach has two great flaws, especially beyond this level of schooling. One is the assumption that people learn the same

way—primarily through didactic teaching in a school setting. There is considerable evidence that learning styles differ markedly across students and that many learn best in a contextualized setting (Gardner 1999; Resnick 1987). The second flaw is the failure to appreciate the skill heterogeneity in the job market. Educational systems are usually large operations and typically require rules and conventions to make outcomes meaningful across students, school districts, states, and countries. Their emphasis on a few subjects, which are only marginally linked to student career interests, limits student incentives. Moreover, by their nature, school systems teach a homogeneous set of subjects and use a highly standardized approach to teaching. By comparison, the job market is strikingly heterogeneous, with hundreds of broad occupations and within each of those occupations different levels of work. The gap between the simple school-based definition of skill and the complex and varied skills required in the workplace is barely recognized in the United States. In contrast, many other countries recognize the heterogeneous and contextual nature of skills in three broad ways: 1) by using formal systems that qualify workers for most occupations, 2) by certifying workers for a variety of qualifications, and 3) by measuring the qualifications workers attain and the number of workers lacking valued qualifications.

Still, the U.S. system of skill-building has a critical asset: flexibility. The lack of formal pathways leaves space for workers to move in and out of schooling and training, which are often supplied by opportunistic community colleges, private occupational schools, on-line colleges, adult extension courses, apprenticeships, and often employers themselves. In distinguishing between the U.S. school system and the American *learning system*, Samuelson (2006) argues that these institutions offer workers a second chance, ways of combining school and work, and a close link between education and careers. Their flexibility and relevance, he says, overcome some but not all weaknesses of the mainstream system of high schools and colleges. Unfortunately, some students only use a community college to take a remedial course offering material that they should have learned in high school (Rosenbaum 2001). Others never attend, whether because their bad high school experiences make them unable or unwilling to return to school, because they get into trouble with crime or drugs, or because early parenthood creates barriers to long-term skill development.

What will it take for the training system to contribute in a greater way to helping American workers become more productive and have more rewarding careers? The central argument of this paper is that doing better requires that public policymakers and education and training practitioners recognize and address the multidimensional nature of skills, the variety of learning approaches (including the value of contextualized learning), and the desirability of close links with employers and the workplace. The next section considers conceptual and measurement issues related to the heterogeneous nature of skills demanded in the current and future U.S. economy. Section three examines the changing demand and supply of skills based on existing measures. In section four, I consider the strengths and weaknesses of the current system of U.S. skill development. Section five presents recommendations for improving and expanding skill development efforts in the United States.

## **DEFINING AND MEASURING SKILLS**

The modern economic approach to analyzing skills begins with human capital theory (Becker 1964). The analogy with capital arises because to increase workers' skills requires an investment of real resources in the present that yields a flow of returns in the form of enhanced productivity in the future. The enhanced skills may be specific (in that they raise a worker's productivity only within one firm), general (in that the worker's added capabilities can increase productivity to a range of firms), or some of both (learning one firm's computer system can help in another firm). This specific versus general distinction affects whom we expect to finance education and training and who benefits from these investments. The added productivity potential from general skills raises the willingness of all firms to pay high salaries to workers who enhance their general skills. Since workers gain the benefits from investments in general skills, firms are unlikely to fund the education and training that generates the skills. In contrast, some of the returns to firm-specific skills will be captured by the employer. Since other firms would not benefit from specific skills, they do not bid up wages, causing workers to remain with their existing firms at a higher level of productivity and

lowering the costs of turnover and recruitment. In this case, firms may finance and reap some of the benefits from training.

The language of human capital has entered the lexicon of policymakers and professionals throughout the world. Studies of the rates of return to education have been undertaken in scores of countries (Blöndal, Field, and Girouard 2002; Psacharopoulos and Patrinos 2004). The evidence from this vast literature documents positive returns to education and finds that the highest rates of return to primary school occur in less-developed countries. The average private and social returns to education remain around 10 percent even in wealthy countries and even at high levels of education. Although these returns are healthy, they represent the average return across all workers achieving the additional education, not the individuals at the margin of either obtaining the education or not. Moreover, besides ignoring the risk and uncertainty of the returns, they often ignore the costs paid on behalf of those who do not complete the added education.

One common misperception is that education conveys general skills useful in a range of fields while training provides only specialized skills that help in very specific contexts. A second is that employers will never pay for skills that might be used outside the firm. As Acemoglu and Pischke (1999) point out, employers often have an incentive to finance general training because of transaction costs in the labor market that, in reality, make it difficult for workers to quit and costly for employers to replace them. Also, firms providing the training know more than other firms about the content and value of training and how well individual workers have absorbed the knowledge. Firms realize that specific and general skills are often complementary—the ability to achieve high productivity gains from specific training increases as the worker's general skills rise. Still another issue is that the distinction between general and specific downplays the critical role of occupational skills, which are general in the sense of having value to more than one firm but which are specific to a set of firms. Task-specific skills in one occupation are often transferable to jobs in another occupation using similar skills.

Though useful and effective in predicting a range of outcomes, the human capital perspective ignores some motivational factors that affect the accumulation and effective use of skills. Not all learning is for instrumental purposes. People often learn in order to satisfy their curiosity or to gain a sense of accomplishment. The ability to learn a skill

conveys a sense of pride, and the effective use of skills in an occupation often brings workers a sense of identity. Skills rarely raise productivity in isolation; increases in productivity typically result when workers use their skills to complement the work of others in an appropriate setting within the organization (Brown 2001).

The framework provided by human capital offers little guidance as to which general, specific, or occupational skills are valuable in any given labor market. One approach is to estimate the gains in earnings associated with specific skills. While economists have developed such estimates showing that measures of math and verbal skills are correlated with earnings (Murnane, Willett, and Levy 1995), the fact that test scores do not account for much of the variation in earnings among workers suggests that other attributes or skills are relevant to job performance (Holzer 1997). To find out what these attributes might be, the U.S. Department of Labor (USDOL) created the Secretary's Commission on Achieving Necessary Skills (SCANS) in the early 1990s to study what skills effective workers require to succeed in specific settings. The commission's report highlights what have come to be called SCANS skills and characterizes them as incorporating many capabilities not directly taught in school. Some examples of SCANS skills are the abilities to allocate time and resources, to acquire and evaluate information, to participate effectively as a member of a team, to teach others, to negotiate differences, to listen and communicate with customers and supervisors, to understand the functioning of organizational systems, to select technology, and to apply technology to relevant tasks. The recent classification known as 21st Century Skills incorporates academic skills and knowledge but also emphasizes such other skills as interactive communication, teamwork, adaptability, planning, self-direction, and responsibility.<sup>6</sup> For all types of skills, there are many levels of competence. Context matters greatly. Responsibility and attention to detail may be necessary for both mowing lawns well and for nursing, but the required levels differ dramatically between the two occupations.

Employer hiring decisions are sensitive to an array of skills that go well beyond academic skills. In a survey of 3,200 employers in four large metropolitan areas, employers reported that such personal qualities as responsibility, integrity, and self-management are as important as or more important than basic skills (Holzer 1997). Further documenta-

tion on the importance of these job criteria comes from the National Employer Survey, which obtained responses from more than 3,300 businesses. These employers ranked attitude, communication skills, previous work experience, employer recommendations, and industry-based credentials above years of schooling, grades, and test scores administered as part of the interview (Zemsky 1997). Evidence for the relevance of occupation-specific and industry-specific skills comes from a paper by Sullivan (2006). He finds that some workers gain high wage returns to occupation-specific work experience while others gain high wage returns to industry-specific work experience.

The sociocultural approach to examining skills emphasizes the contextual nature of skills and the importance of nonacademic skills, which are often obtained in a work environment through joining experienced workers in “a community of practice” (Stasz 2001). Nelsen (1997) points out that workplaces not only require formal knowledge—facts, principles, theories, math, and writing skills—but also informal knowledge as embodied in heuristics, work styles, and contextualized understanding of tools and techniques. In a highly revealing case study of auto repair workers, she describes the importance of social skills for learning the informal knowledge, as captured in stories, advice, and guided practice. Nelsen further argues that the social skills learned at school are not necessarily useful at work and may even be counterproductive. (For example, in school, helping out one’s peers on exams and on some homework is considered cheating, whereas at work the exchange of information and knowledge is essential.) By implication, years of schooling are probably not a good proxy for informal knowledge or for the attributes helpful in attaining such knowledge.

Further evidence showing the importance of noncognitive skills comes from a complex analysis by Heckman, Stixrud, and Urzua (2006) of the schooling and job market experience of a national sample of young workers as they age from 14 through 30. Although the authors use a limited set of measures to capture cognitive and noncognitive skills, their results are striking. They find that, except for college graduates, noncognitive skills (as measured by indices of locus of control and self-esteem) exert at least as high and probably a higher impact on job market outcomes than do cognitive skills (word knowledge, paragraph comprehension, arithmetic reasoning, mathematical knowledge, and coding speed as measured by the Armed Forces Vocational Aptitude

Battery). Using another major data set, the National Education Longitudinal Study (NELS), Deke and Haimson (2006) develop evidence reinforcing the importance of nonacademic competencies, such as work habits, leadership skills, teamwork and other sports-related skills, and attitudes toward whether luck or effort determines success in life. They find that for two-thirds of all high school students, a nonacademic skill is most predictive of earnings. Operators of job training programs emphasize the need for disadvantaged men to gain self-esteem, communicate effectively, envision long-term goals, and demonstrate personal responsibility as well as to avoid inflexibility, dishonesty, defensiveness, and impatience (Carmona 2007).

The importance of noncognitive skills for performance on jobs should not be taken to mean that verbal, math, and writing skills are irrelevant or unnecessary for the vast majority of positions. When employers emphasize personal qualities, many may be assuming workers have at least some basic academic skills and that, once some threshold level is reached, noncognitive skills become a priority. On the other hand, few workers use many of the academic skills that educators view as vital to success. In a survey of a representative sample of workers, only 9 percent reported using the capabilities learned in Algebra I, and fewer than 13 percent of workers below the upper white-collar level ever write anything five pages or longer (Handel 2007).

Wage rates and wage differentials offer one way to assess the skills valued in the market, since they generally reflect productivity levels and differences across workers. Wage rates indirectly capture the return to the skills of the marginal worker. Since the employer is voluntarily paying to obtain the productive services of the worker, the wage may be indirectly capturing the full complement of skills. Still, understanding which skills are most important in determining wages would require data on the multidimensional pattern of skills. Moreover, wage differences might reflect factors other than skill, such as the danger of the job and the level of unionization.

The connection between wages and productivity, along with the variability of wage rates within groups that have ostensibly similar skills, offers further evidence for the multidimensional nature of skills. Although education is highly and positively correlated with wages, educational attainment explains only a small part of the variability in earnings. Indeed, the inequality of wage rates within major educational

categories is almost as high as wage inequality across the entire workforce. Work experience apparently raises wages, but the precise connections between actual skills and wages are rarely explicit. Higher test scores, especially on math tests, are associated with higher earnings, but they explain only a modest amount of wage variability.

The evidence provides some indicators for how best to measure skills, but, in practice, indicators of the skills of U.S. workers usually boil down to educational attainment and, in some cases, test scores and years of work experience. For example, in the 2006 *Economic Report of the President*, the chapter on “Skills for the U.S. Workforce” relies entirely on three considerations: 1) years of schooling and highest degree attained; 2) math and science test scores of 9-, 13-, and 17-year-olds relative to scores in other countries; and 3) the declining share of engineering and science degrees held by U.S. workers relative to immigrant workers (Council of Economic Advisers 2006). The concerns of the NCSAW about low skills also relate to how well the United States is doing relative to other countries. The commission focuses not only on the math and science test scores of current students and the literacy skills of the adult workforce, but also on an apparent shortfall in the training of U.S. engineers and scientists, especially when compared to the numbers being turned out by China and India. The commission highlights the importance of firms using creativity to retain high-wage jobs in the future but provides no measure of this elusive concept.

Educational attainment and test scores are commonly used as proxies for skills, but how well do they capture the level and trend of skills in the U.S. workforce? It turns out that accurate measures of even these basic indicators of skill are more elusive than is commonly recognized. More importantly, the education-based data provide no measure of additional dimensions of skill, an omission that can lead to faulty conclusions and policies.

Turning to data on the capabilities of U.S. workers, we start with the figures on educational attainment and ask about broad trends and about variations in school completion across subgroups by race, sex, Hispanic status, and metropolitan area. The standard data show steady progress toward the completion of high school and college and declining and modest racial gaps in the completion of high school. Table 2.1 shows the rise in high school completion and in college completion by race, sex, and Hispanic origin. The proportion of the over-25 population with

high school degrees jumped from 64 percent in 1976 to 86 percent in 2006. The share with a bachelor's degree nearly doubled, to 28 percent. In addition, the black-white gap in high-school completion narrowed from 20–24 percentage points in 1976 to less than 6 in 2006. The gains were much larger for the adult population than for successive cohorts of 25-to-29-year-olds. Still, as of 2006, 86 percent of all 25-to-29-year-olds had graduated from high school, including 83 percent of black men and 88 percent of black women. The rates of high school completion were much lower among Hispanic men and women. Growth in college graduates was especially high for all groups of women, but not nearly as strong for men.

Changes in the educational composition of the labor force are especially striking from the perspective of net additional workers. Between 1992 and early 2007, the adult labor force (ages 25 and over) expanded by about 24 million workers. Over the same period, workers with a bachelor's degree increased by 15.5 million and workers with at least some college rose by 7.9 million. Additional workers with no college amounted to only about 400,000, or 2 percent of the overall net changes. This number looks implausible given that over 40 percent of a recent cohort left school without any college.<sup>7</sup> Two phenomena explain the seemingly divergent pattern. First, the inflow of less-educated young people and immigrants into the labor force was offset by an outflow of less-educated older workers. Second, labor force participation rates are lower among less-educated than among more-educated workers. The demographic component will differ in the future because the segment of today's workforce nearing retirement is much more highly educated than past retirees. As a result, we are very likely to be adding many more less-educated workers than we lose to retirement.

The information for these conclusions comes from the Current Population Survey (CPS), the household survey used to measure the nation's unemployment rate since the late 1940s. These household surveys obtain information on the education, employment, and income of each member of the household from a responsible adult in the household.

Unfortunately, the CPS data do not tell the entire story and may be quite inaccurate, especially with respect to high school graduation. Data drawn from school reports (Common Core Data, or CCD) suggest much lower high school graduation rates, especially among black youth. Since schools report all ninth-graders registered and all high

**Table 2.1 High School and College Completion of Noninstitutional Population by Race, Hispanic Status, and Sex: Ages 25 and Over and 25–29 at Five-Year Intervals from 1976 to 2006 (%)**

Age and year	All		White		Black		Hispanic	
	Male	Female	Male	Female	Male	Female	Male	Female
Completed high school,								
25 and over								
2006	85.0	85.9	85.5	86.7	80.1	81.2	58.5	60.1
2001	84.1	84.2	84.4	85.1	79.2	78.5	55.5	58.0
1996	81.9	81.6	82.7	82.8	74.3	74.2	53.0	53.3
1991	78.5	78.3	79.8	79.9	66.7	66.7	51.4	51.2
1986	75.1	74.4	76.5	75.9	61.5	63.0	49.2	47.8
1981	70.3	69.1	72.1	71.2	53.2	52.6	45.5	43.6
1976	64.7	63.5	66.7	65.5	42.3	45.0	41.4	37.3
Completed college,								
25 and over								
2006	29.2	26.9	29.7	27.1	17.2	19.4	11.9	12.9
2001	28.2	24.3	28.7	24.6	15.3	16.1	10.8	11.4
1996	26.0	21.4	26.9	21.8	12.4	14.6	10.3	8.3
1991	24.3	18.8	25.4	19.3	11.4	11.6	10.0	9.4
1986	23.2	16.1	24.1	16.4	11.2	10.7	9.5	7.4
1981	21.1	13.4	22.2	13.8	8.2	8.2	9.7	5.9
1976	18.6	11.3	19.6	11.6	6.3	6.8	8.6	4.0

Completed high school, 25–29									
2006	84.4	88.5	84.1	88.3	83.1	87.8	60.6	66.7	
2001	85.3	88.3	84.6	88.3	85.4	87.0	58.3	67.3	
1996	86.5	88.1	86.3	88.8	87.2	84.2	59.7	62.9	
1991	84.9	85.8	85.1	86.6	83.5	80.1	56.4	57.1	
1986	85.9	86.4	85.6	87.4	86.5	80.6	58.2	60.0	
1981	86.5	86.1	87.6	87.6	78.4	76.4	59.1	60.4	
1976	86.0	83.5	87.3	84.6	72.5	74.9	57.6	58.4	
Completed college, 25–29									
2006	25.3	31.6	25.0	31.7	14.9	21.6	6.9	12.8	
2001	25.5	31.3	25.1	32.1	15.6	17.9	8.2	13.3	
1996	26.1	28.2	27.2	29.1	12.4	16.4	10.2	9.8	
1991	23.0	23.4	24.1	25.0	11.5	10.6	8.1	10.4	
1986	22.9	21.9	24.1	22.9	10.1	13.3	8.9	9.1	
1981	23.1	19.6	24.3	20.5	12.1	11.1	8.6	6.5	
1976	27.5	20.1	28.7	20.6	12.0	13.6	10.3	4.8	

NOTE: The four categories represent 1) the percentage of the noninstitutional population aged 25 and over that has completed four years of high school or more, 2) aged 25 and over that has completed four years of college or more, 3) aged 25–29 that has completed four years of high school or more, and 4) aged 25–29 that has completed four years of college or more.

SOURCE: U.S. Census Bureau (2007).

school diplomas awarded each year, some researchers have derived high school graduation rates by dividing the diplomas awarded by the ninth-grade enrollments four years earlier, while adjusting for the fact that ninth-grade enrollments can be swelled by high retention rates and also adjusting for internal and international migration. Unlike the case with conventional CPS-based measures, analysts using the CCD measures do not include private school students or count individuals earning GEDs as having graduated from high school.<sup>8</sup> Moreover, they do not capture the extent to which dropouts return to school. Still, the results are striking and troubling. Instead of only 8 percent of non-Hispanic whites in public schools not graduating from high school, the figure looks as high as 19 percent. Among African Americans, the share not completing high school jumps from 14 percent to 38 percent (Warren and Halpern-Manners 2007). The Hispanic graduation rate looks at least as high in the administrative data as in the household-based data. One broad and revealing measure is the number of public and private diplomas awarded divided by the number of 17-year-olds. It shows a decline from 77 percent in 1969 to 70 percent in 2000 (Chaplin 2002), but a recent increase back to 75 percent in 2004–2005. Overall, the trends in high school graduation look far less optimistic when using CCD-based measures than when relying on CPS-based data.

The low graduation rates based on administrative data raise serious questions about analyses of skills in the United States, as well as about public policies. Consider, for example, one of the stylized facts of labor economics, namely the rising earnings gap between high school graduates and college graduates. If many classified as high school graduates did not in fact complete high school and the misreporting is worsening, then current college–high school graduate comparisons and estimates of past trends may be highly inaccurate. Similarly, policy decisions could be influenced by this revised picture of high school completion. The nature of reforms to the nation's school system depends on whether the share of students not completing high school is small and declining or high and not declining at all, especially among African American students. If nearly everyone is graduating, administering high-stakes tests that require students to learn more in school may have a higher priority than reducing dropout rates.

From the perspective of measuring the nation's skills, one would like to know whether measurement problems extend to college comple-

tion as well. So far administrative tracking has not been undertaken to capture the accuracy of self-reported CPS data on the completion of an associate's, bachelor's, or professional degree. Although the college completion data may be entirely accurate, it is difficult to know for sure.

Test scores offer an independent indicator of skills that are rewarded in the workforce. There are a plethora of national tests, including the National Assessment of Educational Progress (NAEP), which measures reading, math, science, and writing skills over time and across states. International comparative data provide estimates of the adult literacy of U.S. workers and the academic skills of American students compared to their counterparts in other countries. Although U.S.-based policy researchers and political leaders often decry the poor performance of U.S. students in academic tests of comparative competencies, the data as a whole reveal a mixed picture (Boe and Shin 2005). In comparison to students in other industrial countries, U.S. students perform about average. U.S. students do considerably better than average in reading and civics, about the same in science, but worse than average in mathematics. Restricting the sample to the largest Western economies (the G7), Boe and Shin find that the U.S. disadvantage occurs only in math and only relative to Japan. They attribute some of the shortfall in U.S. test scores to the more heterogeneous U.S. population. When we restrict the sample to non-Hispanic white students, U.S. scores far exceed the scores of other G7 countries, except for Japan in math and science.

These data offer information only on the competency measures of current students. To learn about the literacy and basic math skills of the U.S. adult population, we turn to the 2003 National Assessment of Adult Literacy (NAAL). The NAAL tests cover prose literacy (skills in comprehending and using information from continuous text, such as news stories and instructional materials), document literacy (skills in using information from other texts, such as job applications, tables, and drug and food labels), and quantitative literacy (skills in identifying and performing computations of numbers embedded in a text, such as by filling out an order form, calculating interest on a loan, or figuring out a tip). The report (Kutner et al. 2007) defines levels of competency in terms of four categories: 1) below basic, 2) basic, 3) intermediate, and 4) proficient. "Below basic" does not necessarily mean illiterate; many in this category can, for example, find information in a short, simple

prose passage and identify on an instruction sheet what is permissible to drink before a medical test. Within the below basic range of quantitative literacy, individuals can add two numbers from a deposit slip and calculate change from a \$20 bill. But this group cannot calculate the weekly salary for a job based on hourly wages or locate two numbers on a bar graph and calculate the difference between them. At the high end, those individuals classified as “proficient” in terms of prose literacy can compare viewpoints in two editorials with contrasting interpretations of scientific and economic evidence. “Proficient” in quantitative literacy means individuals can calculate the yearly cost of a specified amount of life insurance using a table that gives monthly costs for each \$1,000 of coverage.

The tabulations provide considerable detail on levels of literacy by demographic, education, and occupational group, as well as information on changes between 1992 and 2003, the two years NAAL was conducted. For the entire population, about 14 percent scored in the lowest category (below basic) on prose literacy, 12 percent on document literacy, and 22 percent on quantitative literacy. About 13 percent of the population was “proficient” in all literacy measures. These figures understate the skills of the workforce because the age group least likely to participate in the workforce (ages 65 and over) performed worst in terms of literacy. Only about 11 to 12 percent of the 19–64 age group fell into the below basic category in prose and document literacy; 20 percent were below basic in quantitative literacy.

Apart from the over-65 population, the two groups with low literacy levels are Hispanic adults—especially those who spoke another language, at least before starting school—and African American adults. Depending on the measure, 36 to 50 percent of all Hispanic adults scored in the below basic literacy levels; fully 61 percent of adults who grew up speaking only Spanish tested below basic in prose literacy. African Americans also showed low rates of adult literacy, as 24 to 47 percent were classified as below basic for the three categories. In contrast, only 7 to 13 percent of whites were in this low literacy category. Some improvement took place over the 1992–2003 period for African Americans, but the trend worsened among Hispanics, perhaps because of the inflow of immigrants.

The NAAL confirms a close (but far from complete) connection between literacy scores and educational attainment. Consider, for ex-

ample, the prose literacy scores. While fully one-half of all adults without a high school degree or GED score in the below basic range, the proportion in this lowest category falls to 10 percent for those with GEDs. About 5 percent or fewer of those with at least some college fall into this bottom category. On the other end of the scale, the proportions reaching “proficient” rise from nearly zero among high school dropouts to 31 percent among those with a bachelor of arts and 41 percent among those with a graduate degree. Although college graduates achieve prose proficiency at levels well above less-educated adults, it is troubling that less than one-third meet this standard and that the proportion in the “proficient” group declined from 40 to 31 percent from 1992 to 2003. The overlap among categories is notable. In quantitative literacy, 63 percent of adults with associate’s degrees score higher than 26 percent of adults with bachelor’s degrees. For all three tests, the average performance of whites with an associate’s degree is higher than the average score of African American and Hispanic adults with a bachelor’s degree.

The combination of test score information and educational attainment provides considerable information on skills, but the precise connection with the job market is not clear. The evidence demonstrates that, while more education and higher literacy skills predict higher wage rates, much is left unexplained. A good example is the economic gains attached to a GED, which is sometimes considered an equivalent certification to a high school diploma. However, researchers have found that the GED by itself does little or nothing to raise the wages of workers without a high school diploma (Cameron and Heckman 1993), suggesting that the GED does not generate added skills. Yet the NAAL data show that those with a GED have test scores on prose, document, and quantitative literacy that are nearly identical to the test scores of adults with a high school diploma and that are far above the scores of high school dropouts. By implication, factors other than the academic skills measured in the NAAL must be important determinants of wages.<sup>9</sup>

More broadly, wage variability is high within education groups. Using data from the 2005 Current Population Survey (but excluding the upper half of the top 1 percent), I found that the Gini coefficient of wage rates is almost as high among male high school and college graduates (0.29 and 0.31) as among all adult male workers (0.33).

The rich nature of the NAAL data provides other indicators of the relevance of skills. One of special interest is the respondents’ own as-

assessments about whether their existing skills have limited their job opportunities. Not surprisingly, those at high literacy levels were much less likely to feel limited by their current skill levels. Of those in the “proficient” category of quantitative literacy, 89 percent said their current reading skills were not limiting their job options at all, and only 4 percent saw more than a very small limitation. Similarly, 80 percent of those in the “intermediate” category saw no job limitations. The unexpected result is that 66 percent at “basic” and even 40 percent at “below basic” levels believed their quantitative literacy did not limit their job opportunities. Some respondents are no doubt misinformed about their limited access to jobs, but others may actually qualify for the jobs of interest to them.

Educational attainment and test scores certainly offer important information about the nation’s skills. The general skills that result from schooling and academic competencies are valued in the job market. But they do not tell the full story about the *qualifications* of American workers to perform well at the workplace. As documented by the SCANS report and other research, having a range of noncognitive, interpersonal, occupational, and industry-specific skills matters at levels that vary given the contexts in which they are used. The term “qualifications” is perhaps better at capturing the specificity of requirements of jobs and careers than the word “skills.”

One common job qualification—often overlooked in discussions of skills and the workforce—is that applicants must be drug-free. Entry-level workers are frequently tested for marijuana and cocaine before obtaining employment. It is unclear to what extent illicit drug use influences the capabilities of American workers, but the evidence suggests that chronic drug use lowers employment (French, Roebuck, and Alexandre 2001).

Although job qualifications are diverse and go well beyond cognitive skills, we lack good measures of qualifications that incorporate noncognitive skills, occupational and industry skills, skills gained from general work experience, and work readiness. In part, the measurement problem arises because of the nation’s complex and often informal mechanisms for certifying and qualifying worker skills in occupations and industries. Becoming a manager at a hotel requires a set of skills that hotel firms judge as being necessary for the position. Yet most man-

agers do not receive a formal, recognized certification documenting this mix of skills. Instead, many jobs involve on-the-job training with little or no certification. In this context, it is not surprising that statistical agencies do little to measure and researchers do little to analyze occupational certification.

Contrast this pattern with the qualification systems of other advanced economies. As a National Research Council panel pointed out (Hansen 1994), several countries have national standards for work-related skills and certify those skills through training that qualifies workers for a particular occupation. Some of these countries make extensive use of apprenticeships that involve years of workplace and school-based training and formal testing to certify occupation and industry skills. The occupations are not limited to construction and craft positions but include computer work, technical sales, managerial positions, and service positions. Individuals earn one certification for completing an apprenticeship and another, much higher-level certification for becoming a master in the field.

One approach to national standards, emphasized by the United Kingdom and some other countries, is to develop a modular system of skill certification through the National Vocational Qualifications, or NVQs.<sup>10</sup> The NVQs set standards that define the competencies, knowledge, and understanding needed to perform well in a given occupation. The NVQs recognize workplace learning and competence based on evidence of performance at the workplace. The NVQ system takes account of skill gradations in each defined field and allows workers to gain documentation for each level, whether attained with one employer or many. The ultimate goal is that employers will place a value on their workers' attaining a qualification level, thus giving workers an incentive to learn on the job. Although this system has not worked as effectively as planned (Eraut 2001), the NVQ approach offers one example of how certifying the attainment of skills can provide the basis for measuring the heterogeneity of skills.<sup>11</sup>

Actually, skill standards embodied in state licensing laws and regulations and other standards adopted by industries or through apprenticeship programs have become common in the United States. About 20 percent of workers are required to have a state license to practice their occupation, up from less than 5 percent in the early 1950s (Kleiner

2006). Much of this increase has resulted from rapid growth in traditionally licensed occupations, such as medicine, dentistry, and law. However, the number of licensing laws has been increasing as well.

The distinction between certification of skills and licensing of occupations is important. Licensing requires everyone working in an occupation to meet a minimum qualification standard and excludes unlicensed workers from practicing the occupation. In the United States, licensing rules vary widely across states, and states regulate occupations as varied as alarm contractor, auctioneer, manicurist, and massage therapist. Economists have long stressed the anticompetitive nature of licensing, as incumbents in an occupation try to limit the supply of competitors (Kleiner 2006). Although licenses ostensibly offer some assurance to consumers that all providers will be of a consistent quality, Kleiner finds evidence that licensure plays more of a role in raising prices than in assuring quality. In contrast, certification provides information about a worker's skills but does not limit competition from those who lack certification. In the United States, certification is lacking in many fields, is too narrow and complex in other fields, and is not sufficiently portable and well recognized in still others (Wills 1992). In 1994, Congress established the National Skill Standards Board (NSSB) to develop a system of relevant, rigorous, portable, and well-recognized skill standards that would guide training and would provide reliable signals to worker and employers. Unfortunately, the NSSB was extremely slow to develop, rationalize, or recognize useful occupational standards.<sup>12</sup>

Given the uncoordinated and opaque approach to occupational certification in the United States, it is not surprising that policymakers rarely incorporate this dimension into deliberations about the skills of American workers. Measures of these skills are not readily available to capture changes over time, but occasionally statistical agencies collect data on occupational certificates. The Survey of Income and Program Participation (SIPP) provides some information on occupational certification, but only through schools. According to these data, almost 19 percent of workers reported earning "a diploma or certificate from a vocational, technical, trade, or business school." Included in this group are 7 percent of high school dropouts, 27 percent of high school graduates with no college, about 38 percent of those with some college but no associate's or bachelor's degree, 56 percent of those earning an associate's degree, and 10 percent of those with a bachelor's degree. This

information suggests the importance of vocational certification for a sizable share of workers, especially those with a high school degree but no bachelor's degree. Unfortunately, these data are rarely reported, and they probably miss various occupational certifications not granted through schools, such as is the case with many apprenticeships. I know of no nationally representative data source regularly reporting whether an individual holds a license or certification in his or her occupation.

Workers who complete apprenticeships are often very highly skilled, highly trained in a field relevant to the job market, and well paid. Yet the limited information on apprenticeships illustrates the weakness of measures of the skills of the U.S. workforce. The size of the current apprenticeship system is unclear. For the USDOL and its Office of Apprenticeship, the count of apprentices includes only those within the "registered" system governed by state or federal apprenticeship councils. A program becomes registered by submitting the plans for meeting the hours of on-the-job training and classroom training required by the relevant council. Although not recognized officially by the USDOL, some unregistered positions that involve coordinated work-based and school-based training may nonetheless be called apprenticeships by many workers and firms. Given the different definitions, estimates of the number of current apprentices range widely, from 426,000 active and registered apprentices (as reported by USDOL in 2006) to 1.5 million. The latter figure is based on the number of individuals in the National Household Education Survey who reported having participated in "a formal program in the 12 months prior to the interview that led to journeyman status in a craft or trade."

Still another measurement weakness arises because businesses do not keep track of the impact of their own investments on the human capital of their employees. No doubt employers believe they earn a return on their investments in training and educating their workers. Like investments in physical capital, the dollars spent this year on human capital investments yield a flow of added productivity over time. The benefits of investments in physical and human capital are not used up within the year. For this reason, the full expenditures on this year's physical investments are not counted as costs against current-year revenues. This year's costs (depreciation) are only the amount of the asset used up this year, and the remaining value is recorded as a firm asset. Because human capital is not recorded in a similar fashion, firms do not

keep records of human capital investment with the same care or include the asset of a highly trained workforce on their balance sheets.

### **So What?**

Clearly, measures of the skills of the U.S. workforce have important weaknesses. But does it matter? Would policy development or the interpretation of economic trends change in response to a more thorough definition and measure of skills?

Certainly, the emphasis on reading and math skills looks justified by the clear shortfalls in the literacy and basic quantitative abilities of the U.S. workforce as measured by the NAAL. Nonetheless, reliance almost exclusively on educational attainment, student test scores, and limited adult testing pushes policymakers toward an unbalanced approach, one that tries to improve on the skill indicators we measure while ignoring the skills we rarely measure. One gap of particular importance and potential relevance to policy is the lack of any good measure of occupational skills or qualifications. Contrast this approach with the broader measurements and policies of many other countries that measure occupational skill certifications and encourage rigorous work-based learning.<sup>13</sup> Although efforts to improve outcomes for students going through high school make sense, the pessimistic data on dropouts raise questions about what and how best to teach students. In particular, focusing solely on academic skills and school-based solutions may not work as well as a balanced approach that widens the definition of skill and offers substantial opportunity for skill development in workplaces and other institutions.

## **DEMANDS FOR SKILLS**

By nearly any indicator, the demand for skills has been increasing. To economists, the most convincing evidence is the increase in the wage premium paid to college-educated workers over high school-educated workers and the premium paid to more-experienced workers over less-experienced workers (Autor, Katz, and Kearney 2005). At the same time, the rising wage differences within educational and experi-

ence groups has been interpreted as reflecting an increasing demand for unobserved skills.

Discussions of rising skill demands often take place at a high level of abstraction and often ignore differences in occupational demands. To sense the importance of occupational demand factors in determining skill requirements, consider the job market for PhD physicists, people who have mastered science at the highest level. Raising the skills of the workforce by encouraging more people to learn enough to become physicists would increase the supply in a market with stagnant or declining demand. The 1990s saw substantially more doctorates granted than openings for physicists, and expectations are for continued slow growth in job openings in this field (BLS 2007). The example of physicists is not meant to dismiss the real increases in the demand for skills in the U.S. economy. Instead, it offers a cautionary note that raising skills does not always lead to improved jobs. Physicists certainly have the talent and capability to earn good wages in other professions, but their example and other evidence show that developing skills in fields not in demand can lead to frustration, job dissatisfaction, lower wages, and not necessarily to more good jobs (Allen and van der Velden 2001).

On the other hand, some occupations that require occupational skills but not significant formal education are in short supply. Even in manufacturing, an industry in which employment has declined by 3.4 million workers over the past 20 years, employers are having trouble finding welders and other technically competent workers.<sup>14</sup> Electrical occupations in the construction industry are fields in demand that require extensive occupation-specific skills but allow workers with no more than a high school diploma to enter training. Skill development for these fields takes place both in academic and in workplace settings. Moreover, demand for these workers is rising more rapidly than the workforce as a whole. In fact, the 2.8 million increase in construction jobs over the past two decades has gone largely unnoticed in comparison to the drop-off in manufacturing jobs.

On an aggregate level, the trends in occupations indicate an upgrading of skills, but one matched by the rise in educational attainment. Of the 23 million jobs added between 1992 and 2006, 22 percent were in management, business, or financial operations and 31 percent were in professional positions. These positions all require skill and considerable training, but many of these positions, such as lab technician or

manager of a fast food restaurant, do not require a bachelor's degree. Over the same 14 years, the 14.4 million increase in workers holding bachelor's degrees amounted to almost 60 percent of the net increase in the 25-and-older employed population.

For the future, the projections by the Bureau of Labor Statistics (BLS) provide a starting point. Using three factors—1) projections for demand for output by each industry, 2) the composition of occupations within industries, and 3) the educational requirements of occupations—the BLS has projected the educational requirements that would enable the economy to fill both the jobs newly created in each occupation and the job openings to replace workers expected to leave the occupation. The BLS demand projections suggest that of the 19 million new jobs that will be created between 2004 and 2014, a bachelor's degree or higher will be required for about 36 percent, some college for 28 percent, and a high school degree or less for 37 percent. Counting replacement demand indicates somewhat lower educational requirements: including replacement workers, a bachelor's degree will be needed for 26 percent of openings and some college for an additional 28 percent.

The projections cover more than 700 detailed occupations, and uncertainty is inherent in such an exercise. One critique argues that the projections have systematically understated the growth of skilled occupations (Bishop and Carter 1991). A second important issue is the extent to which skill requirements *within* occupations are expected to change. Another critical set of uncertainties has to do with flexibility and unmeasured skills not captured by the occupational or even the educational breakdown. Some education and training generate skills that can be applied to a variety of occupations. In addition, some positions may require a considerable amount of relevant work experience, yet existing data do not allow us to determine whether past work experience is well or poorly matched to demand. We may match workers to broad educational categories yet generate mismatches between skills and specific occupations in demand. These mismatches create shortages and missed opportunities, especially when the occupations require more than short-term training for the worker to perform productively.

One way to minimize mismatches is to develop close linkages between education and training systems and employers, so as to glean at least some information about employers' current and future demands.

Such linkages take place every day at the community college level, at workforce agencies, and occasionally at the undergraduate and graduate levels of universities, but often the educational realm operates quite independently of patterns of employer demand.

## **U.S. SKILL DEVELOPMENT SYSTEM**

People have long learned skills outside of formal education and training institutions (Resnick 1987). Although the vast expansion of accessible information has reinforced this tendency, formal institutions remain important in helping people gain the tools required to judge the quality of information and to use it effectively. Indeed, skills are likely complementary to the increased information flow of the Internet and other new technologies. People with sufficient skills become much more valuable because they can take the best advantage of today's computing and information revolution.

Although people become educated and learn skills for many reasons, this section focuses on skill development for productive careers. A useful way to begin is to classify these skill creation strategies as either initial preparation or continuing preparation for careers. It is true that some institutions—notably community colleges—provide each of these two kinds of skill development, but the distinction is nonetheless worth making.

### **Schools and Other Skill-Building Organizations**

Initial preparation starts in the school system. At least 10 years of schooling is the common experience of nearly every American growing up in the United States. Spending on the nation's educational system at all levels is nearly \$1 trillion, or about 7.5 percent of GDP. As of fall 2005, enrollment had reached more than 72 million students, of which 55 million were in elementary and secondary schools and 17 million were enrolled in postsecondary schools. Despite high and rising expenditures per student, national reports, public officials, and the general public have voiced dissatisfaction with the ability of the educational system to help students gain adequate skills. Going back at least to the

1983 report *A Nation at Risk: The Imperative for Educational Reform* and continuing through today, schools have been subject to withering critiques. The public has consistently rated public schools at about a C level, and its assessment has changed little since the mid-1980s.

Over the past couple of decades, we have witnessed a wide array of proposals designed to overcome the perceived weakness of the school system. Proposals for school vouchers, charter schools, school decentralization, school-based management, national standards, new math and reading curricula, and after-school programs are some of the ideas put forward for improving schooling outcomes. The No Child Left Behind (NCLB) Act, enacted in early 2002, is the most recent effort to insure that students acquire proficiency at reading, math, science, writing, and other skills. One focus of this law is on holding schools accountable for the performance of their students. To determine student progress, NCLB mandates an extensive system of annual tests for third- through eighth-graders. This level of testing is controversial because of various concerns: that state tests do not necessarily offer high standards; that excessive, high-stakes testing imposes constraints on the ability of teachers to broaden course content; and that schools get little credit for students who increase their scores if they are either well below the threshold for passing or well above the threshold. So far, the evidence for improvements in national reading, math, science, and writing skills in the wake of NCLB is mixed. Reading scores barely changed for fourth-, eighth-, and twelfth-graders; in fact, twelfth-graders scored worse in reading in 2005 than in 1992 (Perle, Grigg, and Dion 2005). In contrast, math scores have increased impressively for fourth- and eighth-graders (Perle, Grigg, and Donahue 2005). Other data comparing high school sophomores between 1980 and 2002 also revealed gains in math achievement but not in reading (Cahalan et al. 2006).

Making schools accountable for insuring that most if not all students attain basic reading and math skills is appropriate at early grades. However, in the higher grades, what is necessary for success in careers becomes less clear. More may not always be better, especially if the result is that many students fail, become discouraged, and have little chance to learn skills more relevant to their potential careers. What we know about workplace skills should play a significant role in setting benchmarks, but rarely are work-related skills considered worthy of teaching and testing. Murnane and Levy (1996) define the academic

skills required for a middle-class job as the “new basics.” They include the abilities to read and do math at the ninth-grade level or higher, to solve semistructured problems by forming a hypothesis and testing it, to work in groups with persons of diverse backgrounds, to communicate effectively, and to use a personal computer for tasks like word processing. For many individuals who reach these basic skill levels, the marginal gain in academic skills may yield no more benefit—and possibly less—than would a marginal improvement in other skills. Only a modest percentage of workers use many of the academic skills taught in late high school and college (Handel 2007). As noted above, Deke and Haimson (2006) report that, beyond a certain level, gains in earnings depend more on noncognitive than on cognitive skills for most students. Certainly, higher math and verbal SAT scores will help students enter more selective colleges. But this benefit only accrues to the small share of students competing for highly selective colleges.

For most jobs, the issue is not only the skill qualifications, but also the use of those skills. Although advanced math is a critical stepping stone for many engineering, scientific, and some social science endeavors, most other college students will probably not take a derivative anytime in their careers. But it is the continuing *use* of skills that leads to mastery. Students who learn—but make little use of—the tools of trigonometry or calculus are unlikely to retain them for long.

Indirectly and outside of formal courses, students often develop many of the problem-solving and common-sense skills emphasized in the SCANS report, as well as the physical, psychological, emotional, and social skills highlighted by Eccles and Gootman (2002) as necessary for healthy development of youth. Several of the assets said to promote youth development are closely linked to SCANS, including conflict resolution skills, the ability to plan and to allocate time, and working with others on a team. Other assets involve a sense of personal autonomy, efficacy, motivation, realism and optimism, and knowledge of vocations. Clubs, sports, internships, part-time jobs, and community service work are good places to develop these attributes. In 2002, about half of high school sophomores participated in athletics, 22 percent in a music activity, and 8 percent in an academic or vocational club. In addition, nearly 60 percent had worked for pay and 26 percent were working at the time of the survey. Sophomores from low-income families had somewhat lower activity levels. Although participation in these activi-

ties probably helps youth develop, no one measures the acquisition of added skill sets.

Despite the academic tests mandated by NCLB and a growing emphasis by states on a strictly academic curriculum, a sizable share of students still take vocational courses in high school. Students often take a vocational program alongside a strong academic program. Some students attend a regional vocational school part-time for vocational courses while continuing to take their academic courses at their home high schools (Silverberg et al. 2004). Some career and technical education (CTE) courses are not occupationally oriented but deal with family and consumer education as well as general workforce preparation skills, such as basic computer skills and learning about the job market (Levesque 2003). The occupational fields vary widely and include such diverse fields as business and marketing, health care, computers, food service and hospitality, construction, printing, and transportation. Students in vocational concentrations (three or more courses in a broad occupational field) are increasingly taking a solid set of academic courses as well.<sup>15</sup> But vocational concentrators have declined over time.<sup>16</sup>

Conventional high schools sometimes relate to the job market through work-based learning that counts for course credit under general programs or cooperative education. General work experience involves work for course credit that is not connected to a specific occupational program pursued in school. Cooperative education allows students to earn school credit for work related to an occupational program. Schools help place students in jobs that involve supervision by the teacher and employer, and employers evaluate students for their work-based learning and accomplishments. Work for class credit increased, from about 27 percent of students in 1982 to 32 percent in 1998.

While vocational education (now called career and technical education, or CTE) has declined in importance, alternative approaches, such as Career Academies and Tech Prep, have emerged to try to bridge the gap between career-focused learning and academic learning. Career Academies are high schools organized around an occupational or industry focus, such as finance (22 percent of Career Academies), information technology (14 percent), and hospitality and tourism (12 percent). The more than 1,588 academies involved in the program try to weave related occupational or industrial themes into a college preparatory curriculum. Students take two to four classes a year in the academy

taught by a common team of teachers, and at least one course is career- or occupation-focused. Academies attempt to use applied learning in academic courses as well as career-focused courses. They try to form partnerships with employers and local colleges. However, work-based learning in real jobs is not emphasized, and many students do not experience long-term internships or jobs. Tech Prep programs build integrated sequential courses of study involving high school and community college programs. Agreements between institutions allow some courses taken in high school to count toward a two-year associate's degree. As of 2003, about 1,000 consortia involving high schools and community colleges were operating, mostly coordinated by community and technical colleges and involving at least articulation agreements allowing the transfer of high school credits. Tech Prep participation has increased substantially, from about 173,000 students in 1993 to more than 1.2 million in 2001 (Silverberg et al. 2004). But these figures may overstate concentrators since some students report being in Tech Prep although they have taken only one vocational course that has transferability.

Skill development in postsecondary education takes place mostly through two-year and four-year colleges and universities. Even as undergraduates, about 60 percent of students are in programs with a career orientation, such as engineering, accounting or other business fields, teaching, and health care. Most of the more than 1 million degrees earned every year at schools that provide degrees in less than two years are in some occupational specialty. For the 2003–2004 academic year, almost 25 percent of these subbaccalaureate degree earners were in the health care field. Another 13 percent obtained a degree in a business-related field, and 15 percent graduated in a computer-related, engineering-related, or security field. Not all these subbaccalaureate vocational students are young. As of 2000, 56 percent were aged 24 or older and 34 percent were aged 30 or older. Still, younger people recently transitioning from high school made up more than half of those entering associate's degree or certificate programs. Enrollments in vocational associate's degree programs have increased substantially since the 1980s but have leveled off in recent years.

Some students use for-profit proprietary vocational schools, such as the Coastal Truck Driving School in New Orleans, for their career-focused education and training. Although national data on enrollments and numbers of schools are limited, there is considerable evidence that

millions of students enroll in proprietary vocational schools (Cellini 2006). The occupational and industry programs operating in proprietary schools are often similar to programs at community colleges.

Another route to obtaining skills is through job training, which is financed by several federal government agencies as well as state governments and private foundations. These training programs offer initial preparation for the workforce as well as retraining of adult workers. Usually, the goal is to help specific groups, including at-risk youth, displaced workers (especially those who have lost their jobs because of imports), workers with some kind of disability, senior citizens, migrants and farm workers, and workers who have been on welfare programs. Among the USDOL programs are dislocated worker, adult, and youth programs under the Workforce Investment Act (WIA), the Job Corps, Trade Adjustment Assistance, and veterans' programs. Other examples of job training programs with federal funding include YouthBuild, a program providing construction work experience and training to at-risk youth; and vocational rehabilitation grants to provide training to recipients of Food Stamps and of Temporary Assistance for Needy Families (TANF). The administration, oversight, and operation of these programs vary. WIA provides money to state and local entities which, in turn, set up One-Stop centers that provide employment placement services and contract for training with various providers, including community nonprofits or larger organizations, such as STRIVE and Goodwill Industries. In contrast, Jobs Corps is managed by the federal government, which awards competitive contracts to companies to operate Job Corps centers. Often, funds provided through federal job training programs pay for courses at community colleges or other established educational institutions.

Although the number of these programs is large, their scale is relatively small. According to estimates developed by Mikelson and Nightingale (2004), federal outlays for training provided by USDOL and other federal departments amounted to no more than about \$5 billion in 2003. Counting state job training programs adds only about \$500 million to the total. While these figures use a somewhat narrow definition of training and skill-building, the dollar allocation to training is very small—even under a more expansive concept of training—when compared to the hundreds of billions of dollars spent on education-oriented programs.

Often overlooked when surveying education and training institutions in the United States is the U.S. military. The Armed Forces is arguably the largest training organization in the United States (Hansen 1994; Laurence 1994). The military trains tens of thousands of military personnel in such fields as health care, electronics mechanic, auto repair, and trucking. Trainees learn skills that apply to their current employer (the military), but in many cases the occupational competencies learned have civilian applications too. However, some skilled workers exiting the military face certification and licensure problems in transferring their skills (Congressional Commission 1998). Although the military is an innovator in the job training field, the dissemination of military training approaches to the civilian economy remains limited. Of special interest but rarely studied are the training approaches used by the military in Project 100,000, launched in 1966, and in other initiatives to educate and train entrants allowed into the military despite their subpar qualifications (Sticht et al. 1987).

Some training takes place in prisons, but the quality and magnitude is uncertain and varies across states. Although many offenders are in great need of employment assistance, few prisoners receive employment-related training (Solomon et al. 2006). While one-quarter of prisoners released from Maryland and Virginia had taken part in vocational training, only 6 percent of New Jersey prisoners had, and only 1 percent of Georgia prisoners had. Many more participate in work-related activity, but only a modest effort goes into teaching work-related skills such as SCANS skills.

Outside the educational system, the largest amount of training takes place through employers in formal workplace programs and in informal, on-the-job training (OJT). In the late 1990s, over 70 percent of employers provided workers with some amount of formal training (Lerman, McKernan, and Riegg 2004). Although estimates vary, between 35 and 65 percent of workers received some formal training.

About 15 percent of workers participate in training for a full two weeks. Nearly all workers receive some informal training as well, including 95 percent of workers in firms with 50 or more employees. The training varies from a few days of instruction to several years of intensive apprenticeship training. In 1997, 82 percent of employers reported offering to reimburse workers for tuition for approved courses, including 69 percent who said they extended the offer to front-line workers.

Although only a minority of workers use tuition subsidies in a given year, 53 percent of adults enrolled in postsecondary degree programs received employer support from a tuition subsidy or paid leave. In 2001, employers apparently provided 30 hours of training for the average worker, mainly through for-credit courses or other courses. Outlays for employer-sponsored training are estimated to reach at least \$60 billion a year. The training is rarely intensive enough to prepare workers for specific occupational careers, but it usually upgrades the skills of existing workers.

## ASSESSING THE SKILL-BUILDING SYSTEM

To evaluate the system's effectiveness, one must answer three questions:

- 1) Does the system increase skills?
- 2) Do the added skills help workers increase productivity and earnings in the labor market?
- 3) Is the system cost-effective—does it generate high rates of return?

Even with excellent data and research, the questions are difficult to answer definitively. First, there is the counterfactual question—this system or system component compared to what set of alternatives? Second, benefits for individual workers and firms may not translate into gains for society as a whole. Third, the system may function well for some groups but not for others.

From the standpoint of overall productivity, the results of the U.S. training system look reasonable and, according to Lewis (2004), do not constrain U.S. productivity levels. Notwithstanding the conventional view of the ostensibly poor skills of the U.S. workforce, Lewis reviews comparative studies done by McKinsey Global Institute on many industries and finds that “the U.S. workforce achieved higher labor productivity than anyplace on earth” (p. 244).

Yet from the standpoint of high U.S. wage inequality and a weak job market for less-educated American workers, the U.S. system has much room for improvement. Many workers are in low-paying and low-

skilled positions, while businesses have trouble hiring U.S. workers for many well-paying jobs, whether as welders or computer scientists, because there are not enough of them. Other workers learn skills for jobs not in high demand. Still others lack basic academic, noncognitive, and occupational skills to qualify for good jobs.

### **Earnings Outcomes and Skill Development from Schools and School-Linked Programs**

So which parts of the skill-building system are sound, and which parts are in need of significant improvement? Although many in this country are dissatisfied with the academic outcomes of students in the K-12 education system, judging the effectiveness of the \$500-billion-plus outlays is difficult. Some observers base their assessment on comparisons of academic competencies and costs in the United States and other countries. Others point to the high share of minority and low-income students who perform poorly on tests of academic performance in reading, math, science, and writing. As noted above, U.S. students perform at about the OECD average; still, about one in four cannot reach basic levels of proficiency in math, reading, writing, and science, as defined by the NAEP. In 2003, about 1.1 million families were sufficiently dissatisfied with the public and private school options available to them that they turned to homeschooling.<sup>17</sup>

Education experts have developed measures of school performance and academic achievement, but the relationship between these indicators and job market outcomes is unclear. On one hand, more education is associated with higher earnings; moreover, there is strong evidence that added schooling is the cause of the earnings gains. The rate of return on completing high school is over 13 percent and the return on completing college averages about 10 percent. These returns suggest a real payoff from schooling, indicating that schools must be doing something right. On the other hand, impacts vary widely across students. As many as one in four students leave school before completing high school. Although the size of the high school dropout problem is uncertain, nearly half of the dropouts attribute their leaving school to boredom and lack of interest in classes. Moreover, employers report great dissatisfaction with the quality of high school graduates. Manufacturing firms report that 60 percent of applicants that have a high school

diploma or GED are poorly prepared for the typical entry job in the firm (Deloitte Consulting 2005). At the college level, the risks of wage volatility or of having a low return on one's education are high enough to reduce college completion (Chen 2003; Pereira and Martins 2002). Finally, observed rates of return to completing high school and college do not reveal whether alternative approaches might improve earnings and occupational outcomes.

One argument for career and technical education (CTE) is that some students may remain engaged in school and earn more in the job market from a career-focused approach to learning. It is well known that high school CTE in the United States varies in intensity, quality, and interaction with employers. But, in an extensive review of overall effectiveness, Silverberg et al. (2004) find that a higher share of vocational courses raises earnings, at least in the short run and the medium run. Another recent study, Bishop and Mane (2004), estimates that taking four advanced CTE courses instead of two academic courses and one personal interest course led to substantial gains in employment and earnings about eight years after normal high school graduation. The gains were higher than average for vocational students among at-risk and minority students and in groups taking the New Basics academic curriculum. Work-based learning through cooperative education added to the earnings effects. Bishop and Mane (2003) find that employer involvement, such as employer-school partnerships, raises earnings, reduces unemployment, and leads to higher rates of students holding jobs. Even students with low grades do better in the labor market as a result of these partnerships. In fact, employer-school partnerships appear to raise the share of students graduating on time and of those earning a high school diploma instead of a GED.<sup>18</sup>

Other indications of the effectiveness of career-focused education come from a major evaluation of Career Academies (Kemple and Scott-Clayton 2004). The evaluation involves a social experiment in eight cities, in which Career Academy applicants are randomly assigned either to the Career Academy or to the regular school. The impact analysis reveals that the academies generate an 18 percent earnings gain for young men (compared to those who applied to Career Academies but were not allowed into the program and were instead assigned to a regular school) but no change in earnings among young women. Moreover, the earnings gains are concentrated among students with a high or medium

risk of dropping out of high school. For this group, Career Academies generate as much growth in earnings as would accrue from two to three years of added education. The improved outcomes may be due to the small and closely linked learning community or to the occupation or industry that is the focus of the education. It is still too early to determine the sustainability of the career academy model, especially as regards its ability to develop and maintain close links with businesses and other employers.<sup>19</sup>

Turning to community colleges, we find that a recent review (Silverberg et al. 2004) reports that, for men, a year in a vocational program raises earnings by almost 8 percent over no education beyond high school. No gains in earnings accrue to men with a year of academic college work or even an academic associate's degree. However, earnings jump by 30 percent for men who have completed a vocational associate's degree. Women who have taken postsecondary academic courses do better in earnings even when not completing a certificate or degree than women with no postsecondary vocational courses: a year of community college education raises their earnings by 16 percent (over a high school degree only) when they take an academic curriculum but has no effect when they take a vocational curriculum. On the other hand, women who complete associate's degrees do better with a vocational than with an academic concentration (a 47-percent earnings gain versus 40 percent for those earning an academic associate's degree).

Estimates of the impacts of career-focused, proprietary schools are rare in the literature. According to one evaluation (Washington State Workforce Training 2004), most proprietary school students report that they learn a lot (66 percent), and 96 percent of employers are very or mostly satisfied with the training these students receive. On the other hand, attendees of private career schools did not achieve statistically significant gains in earnings over a comparison group with similar characteristics who registered with the state employment service. And while *completers* of these career school programs raised their employment by 8 percent and their earnings by \$373 a quarter, the gains were much smaller than among participants in community college programs. However, unobserved differences in the student populations might account for the weak performance of proprietary schools. Nearly 80 percent of proprietary school students receive a federal postsecondary grant or loan, which implies that low-income individuals often attend

these schools. Despite substantial government spending on proprietary schools, the evaluative evidence concerning their impact is meager.

Another way in which the education system interacts with the world of work is through internships, co-op programs, and apprenticeships. Few students participate in intensive, career-focused programs with substantial amounts of work-based learning (Haimson and Bellotti 2001).<sup>20</sup> One study of the early experience of minority high school students finds high participation in career majors: 30 to 40 percent of students who were in or just completing twelfth grade were taking these majors as of 1998 (Rivera-Batiz 2003). The study estimates that participation in a school-to-work activity increased course work in math and science in high schools, along with hours worked, and that it reduced the likelihood of dropping out of high school.

A recent study finds that job shadowing, mentoring, cooperative education, and internships boost participation in postsecondary education for women and (except for internships) for men as well (Neumark and Rothstein 2005). However, the gains in earnings from these activities are largely limited to men. For men unlikely to attend college, cooperative education, school enterprises, and internship or apprenticeship increase employment and lower the share of youth who are idle after high school. Women unlikely to attend college also achieve earnings gains from the internship or apprenticeship components.

Youth apprenticeships go beyond school internships by providing in-depth, work-based learning combined with related course work. Though youth apprenticeships constitute the most intensive form of career-focused education and training, youth apprenticeships and other (including certified) apprenticeships have been the least-studied major intervention. Despite the widespread, long-term use of apprenticeships in some countries and their resurgence in others (Leitch Commission 2006; Steedman 2005), few studies have examined how entering and completing apprenticeships in the United States affects educational and job market outcomes. One analysis followed high school students who participated in a Wisconsin youth apprenticeship in printing and found that participant earnings levels were substantially above expected earnings for similar youth (Orr 1995).

## Effects of Job Training

The most rigorous evaluations cover the least expensive parts of the skill development system—government-sponsored job training for low-income workers. Unlike education and training offered through the school system and employers, government-sponsored job training programs generally serve low-income, low-skilled workers who have limited skills and, often, other barriers to career success. Two large, highly cited studies are the evaluations of the Job Training Partnership Act (JTPA) and the Job Corps. Each used a social experiment in which applicants were randomly assigned either to have access to that particular job training program or to have no access. The administrative approach to the two programs differed markedly. JTPA was highly decentralized (as is its successor, WIA), whereas the federal government contracts directly with Job Corps providers, resulting in a more uniform program. The JTPA evaluation involved 16 independent, diverse sites drawn from hundreds of locally managed programs. JTPA participants typically obtain some classroom training in basic and occupation-specific skills, as well as on-the-job training and job search assistance. The Job Corps provides longer and more intensive educational and occupational-skills training, usually in a residential environment where participants have access to health care and other services.

The impacts of these programs are usually reported separately for youth and adults and for men and women. In the adult JTPA programs, the evidence shows that both adult men and adult women who are given access to JTPA earn more than the control group in the years after assignment to JTPA. Although the modest gains for both groups of adults (around 5 percent of earnings) were large enough to justify the program's modest costs, they were not sufficient to achieve a substantially improved job market outcome. Moreover, it is unclear how much additional skill the programs generated. The JPTA interventions did little or nothing to raise the earnings of youth participants (Carneiro and Heckman 2003, pp. 322–323; Orr et al. 1996).

Given the high cost per participant for those in Job Corps, the program must raise earnings substantially to achieve an adequate rate of return. Initially, the evaluation found sizable earnings increases which, when projected forward, indicated that the program's social benefits exceeded its costs. However, further analysis based on administrative

data through 2001 (almost three years beyond the earlier follow-up) documented a rapid erosion of Job Corps earnings gains after the four-year follow-up and a likely overstatement of earlier earnings gains because of differential attrition (Schochet, McConnell, and Burghardt 2003). For the full sample, earnings gains from Job Corps had eroded completely soon after the 48-month follow-up. The sharp reduction in medium-term and long-term earnings gains meant that projected social benefits per participant were more than \$10,000 (in 1995 prices) below social costs. Some groups of participants, such as young people entering their early 20s, sustained their earnings gains, but others (Hispanics and those with an arrest record containing serious offenses) did worse than their counterparts in the control group. The disappointing results are in some ways surprising, since Job Corps participants obtained sufficient education and training to increase their attainment of GEDs and vocational certificates.

Space does not permit a review of the evidence concerning many other government job training programs. Some have attained modest gains for participants, especially by increasing employment levels, but none are considered major successes. A meta-analysis of 31 evaluations of government-funded training programs for the disadvantaged found that annual earnings gains were about \$1,400 (1999 dollars) for adult women, \$300 for adult men, and zero or negative for youth (Greenberg, Michalopoulos, and Robins 2003).

Turning to employer-led training, we find wide variations in depth, purpose, and coverage of workers. Some training is brief and involves introducing workers to operations (such as a computer system or a telephone system), to safety aspects of the job, and to organizational goals. Other training aims at raising the basic skills of workers and their capability to implement new technologies or organizational methods. Some elaborate and intensive training takes place through apprenticeships, which combine three to four years of learning on the job with substantial course work. Nearly always, employer-led training occurs in the context of a work environment; indeed, that is one reason for its greater effectiveness in using contextualized learning (Resnick 1987)—for example, by teaching basic skills using materials that working students use on a daily basis.

Employer-led training is generally viewed as achieving high returns and skill development. Some estimates may overstate the true impacts

because those who take the training are drawn from a more capable group of workers than those who do not take training.<sup>21</sup> On the other hand, those who need more training to do a good job could be drawn from a less capable group. Although training affects employers as well as workers, the most straightforward way to measure its effects is to examine impacts on earnings of workers. We look first at apprenticeship training, where the evidence indicates significant gains for participants (Cook 1989). Researchers from the W.E. Upjohn Institute for Employment Research found that the gains associated with apprenticeship training in Washington were substantial two to three years after participants had left the program (Washington State Workforce Training 2004): those completing apprenticeships earned nearly \$4,300 more per quarter than the primary comparison group. These earnings gains are nearly three times the comparably estimated gains for those graduating with vocational degrees from community colleges, relative to the comparison group.

Broader studies indicate private-sector training yields modest gains in wage rates but very high rates of return on the typical training performed. One recent study (Frazis and Loewenstein 2005) finds that 60 hours of training increases wage rates by about 5 percent but has rates of return on an annualized basis of at least 40–50 percent. Employers finance 96 percent of formal company training, but they also fund 42 percent of training in the category involving business-school, apprenticeship, vocational or technical institute, and correspondence-course training (Loewenstein and Spletzer 1998). Firms certainly gain some of the benefit from training, but how much is not well understood.

A great deal of skill development takes place informally on the job as workers gain expertise in their occupations and industries (Sullivan 2006). For workers, the wage gains from occupation-specific experience are especially high in craft occupations, whereas for managers high returns occur for industry-specific experience. Professionals gain significantly from both types of experience. These wage gains provide confirming evidence of the importance of skill development through contextualized learning and communities of practice. Such situations offer workers in the same field the chance to share their understanding of how to be effective.

The significance of occupation-based and industry-based training and work experience is becoming increasingly recognized in founda-

tion-supported and publicly sponsored job training for low-income workers. Under “sectoral strategies,” programs target an industry (or a subset of an industry), become a strategic partner of the industry by learning about the factors shaping the industry’s workforce policies, reach out to low-income job seekers, and work with other labor market groups, such as community colleges, community nonprofits, employer groups, and policymakers. Nonexperimental evidence indicates that the six sectoral programs taking part in the Sectoral Employment Development Learning Project (SEDLP) have yielded impressive results but without a control group (Blair 2002). Earnings jumped by 73 percent in two years for the 95 percent of participants employed for those two years. Although most of the gains came from higher work levels, wage rates increased by 23 percent. Moreover, two years after training, 69 percent of participants were employed in occupations related to their training. The focused nature of the training, the linkages with employers, the development of pathways for entry level workers to advance, and the expertise gained by the training organizations probably all have contributed to the apparent success of the sectoral strategy approach.

### **Learning from What Works Best**

Although education and training yield mixed results when it comes to acquiring skills related to higher earnings, several lessons emerge from a review of the evidence. First, the education system, which spends nearly all of the money allocated to skill development, generates good but variable returns. Students typically learn basic academic skills that are critical for the vast majority of jobs and that yield high returns. At high levels of education, the system becomes more heterogeneous and the returns become more variable. The variations become pronounced throughout high school and postsecondary education. About 24 percent of all entering students and perhaps 40–50 percent of disadvantaged students (Warren and Halpern-Manners 2007) fail to complete high school despite free access to schooling. Thus, the cost of trying to educate these students is high but the returns are low. Other students gain more than the average student does from high school by completing vocationally oriented classes and by participating in school programs related to an industry or an occupation. Rates of return for college differ markedly between those not currently completing college and those

who are new college graduates. Thus, expanding access to higher education involves high added spending, but it may not increase earnings for students who learn little of relevance to their careers or who do not complete high school or college.

Second, education and training programs work well in having students learn and retain skills when the instruction uses hands-on or project-based learning, often in a work context. Integrating training with employers or employer organizations is typically beneficial as well. Third, the modest outlays on public job-training programs for the disadvantaged yield varying returns but rarely achieve significant earnings gains. Fourth, employer-sponsored training generates high rates of return, but the dollar amount of increased earnings is often low because employer training is usually short-term. Fifth, among the most successful programs are those that build occupation-specific skills in collaboration with employers, unions, or other organizations and that involve considerable learning at the workplace.

Despite the apparent benefits of emphasizing contextualized learning, close employer linkages, a broad array of skills, and a career focus, outlays for this approach to skill-building are minimal in comparison with spending on traditional K-12 schools and four-year colleges. While U.S. schools, government training programs, and firms spend about \$1 trillion a year on education and training, we are starving the programs that use highly effective strategies and meet the needs of most future workers.

## **DIRECTIONS FOR THE FUTURE**

Doing better in building skills for good jobs requires improvements on many fronts. This section proposes a few steps aimed at raising the skills and qualifications of current and future workers. Notwithstanding the importance of investing more in prekindergarten learning to achieve increased skills, I do not cover this area.<sup>22</sup> This section makes two suggestions for upgrading the skills of the workforce, beginning with skill preparation during the high-school and the immediate post-high school periods. These periods form a critical time for skill-building: students learning skills at an early age have low foregone earnings, can afford to

accept a lower training wage, can reap a long payoff, and can increase their ability to absorb future education and training. Providing students with a variety of skill-building options may reduce their likelihood of dropping out of high school and cause fewer to resort to job training programs for low-wage workers. Many of these programs have proven to have only modest success.

### **Reform the Way High Schools Prepare Future Workers**

Concerns about the weaknesses of American high schools and calls for major reforms are increasingly widespread (Gates 2005). Although few would quibble with Bill Gates' assertion that "all students can and should graduate from high school ready for college, work, and citizenship," tensions arise when it comes to making the means to that end more concrete. To many, the statement's implicit goal is to prepare all students for college. This is clear from the effort to require that all students take academic courses that meet college requirements. And while the prerequisites for college are well known and broadly similar, there is little discussion or analysis of what is meant by "ready for work." We can assume that work readiness means more than the ability to find a low-wage job. But even substituting the phrase "ready for a rewarding career" leaves open what should be the appropriate courses and other potential activities, such as workplace learning, undertaken by students. Education and political leaders seem to view "ready for work" as implying that students should complete a college-preparatory academic course, under the assumption that students will learn occupational and other workplace skills on the job or in community colleges (Achieve and National Governors Association 2005). Indeed, the agenda sponsored by the National Governors Association makes no distinction between the requirements for work and those for college. The report does little to document why these courses should be universal requirements for students in order for them to become ready for work. At the same time, the report ignores many skills that have been documented by SCANS and other projects as necessary for career success.

Another useful distinction is between the knowledge and skills all students should master and those that are particular to college preparation. While more learning is desirable, not every content standard in literature, math, science, and social science is necessary for students

to be well prepared for work or even a productive career. Consider, for example, the California English content standards for grades 11 and 12 that require students to be able to analyze “the ways poets use imagery, personification, figures of speech, and sounds to evoke readers’ emotions” and “the ways authors have used archetypes drawn from myth and tradition in literature, film, political speeches, and religious writings” (California State Board of Education 2007). Although such skills are desirable in themselves, there are tradeoffs in the use of student time. Forcing these content standards on all graduates may limit students from taking courses more helpful to their careers and, at worst, may worsen the dropout problem (Warren and Corl 2007). Nearly all careers involve some mastery of reading comprehension, writing, and math, but some state standards go far beyond actual career requirements. Whatever the standards, many students learn and retain information best through contextualized instruction and by applying the skills to school-based projects or to a work context (Resnick 1987; Packer 2006). Whereas schools emphasize individual instruction unaided by tools, cognitive social scientists point out the importance of learning in groups and of making use of tools; whereas schools stress symbol manipulation, cognitive scientists point to contextualized reasoning; and whereas schools focus on generalized learning, cognitive scientists favor situation-specific competencies.

What, then, are sensible high school reforms that can create a better-qualified workforce? Let’s first recognize the diversity of student interests and abilities, of skills required in the workplace, of career aspirations, and of career outlets. One way of making more students “ready for work” is to permit students to focus on attaining occupational qualifications at recognized standards that incorporate academic, occupational, and other workplace skills. High school students would have the chance to combine school-based instruction with well-structured work-based learning in a program that leads to an occupational certification and entry into postprogram training. Students would learn discipline with regard to work and would make practical use of their reading, writing, math, and science skills in the context of achieving a demanding occupational standard. Of the 47 percent of dropouts who leave school because they find classes uninteresting, many could be highly engaged in a program that provides learning at work, pay, and an occupational certification.

This approach of utilizing workplaces as learning locations can be linked to several strands of research and analysis. It builds on evidence of the importance of occupational skills and other noncognitive skills, as described in SCANS. It is consistent with evidence on the effectiveness of sectoral approaches and of employer-based training, including on-the-job training. It offers good options for meeting such youth development goals as personal autonomy and efficacy, motivation, realism and optimism, and knowledge of vocations. It helps link the supply mix of skills to the composition of demands by employers. Evidence from other countries shows that the model helps students develop an occupational identity, a professional ethic, and self-esteem based on accomplishment (Rauner 2007).

A common argument against a career-oriented approach is that the mix of jobs changes so frequently that occupational skills easily become outmoded. In contrast, academic skills are said to apply broadly and make future workers more adaptable. In fact, many of the occupational and SCANS skills are as likely to provide flexibility as academic skills are. Skills erode at least as much from disuse as from the dying out of occupations. Well-developed, career-focused programs that emphasize project-based learning and allow students to use what they learn in the workplace will do as much or more to help students retain skills as traditional academic classes.

One initiative that combines high standards, project-based learning, and an occupational focus is Project Lead the Way (PLTW). It offers engineering and biomedical science curricula to high school students in more than 1,500 schools, often through CTE programs. The PLTW program emphasizes project-based learning and the application of math and science to subjects like electronics, civil engineering, and architecture. PLTW is also noteworthy for incorporating noncognitive skills, such as working in and leading a team; public speaking; listening; and managing time, resources and projects. While the PLTW option is broadly available to schools, those that have adopted the program have largely been CTE programs. A charter school movement, High Tech Schools, is trying to place technology and preengineering throughout the curriculum. Started in San Diego but expanding to other areas, the program incorporates work-based learning through a 100-hour internship, project-based goals, and the building of student portfolios.

Career academy and Tech Prep programs also offer starting points for expanding occupational skills and noncognitive workplace skills. However, the occupational learning takes place almost entirely in school settings. Both programs would benefit if they included a larger work-based component that involved standards for achieving skills and close cooperation with employers and industry associations. Some students should be able to gain a recognized initial occupational qualification which they can build on as they acquire work experience in the occupation. Already, the two programs allow early entry into community college courses. Certainly, these and other programs should keep better track of their students' achievement of SCANS skills and of occupational qualifications.

These examples offer ways of expanding the learning approaches to enhance the skills of high school students. To diffuse the approaches across a wide variety of schools, state standards should incorporate SCANS skills and states should take steps to encourage instead of discourage the development of career-focused qualifications linked with real careers. One barrier to recognizing these skills is the disparate nature of occupational skill qualifications. As noted above, states typically have a plethora of standards for certification and licensing requirements, often influenced by current members of the occupation (Kleiner 2006). Although the National Skill Standards Board was unable to make these standards more coherent during its existence from 1994 to 2003, it is time for another try. The federal government should support states interested in developing models for judging outcomes based on SCANS and a streamlined set of occupational qualifications. Once sound standards are in place and schools see themselves and their students being judged on the basis of these broader competencies, they may be more receptive to approaches that build on these skills.

### **Expanding Valuable Skills of Adults**

Public and private activities to increase job-related skills are increasingly turning to employer-led or employer-linked training initiatives. Both foundations and the USDOL have sponsored sectoral strategies that focus planning, recruitment, and operations on the skill requirements of employers in specific industry sectors (Blair 2002). The USDOL is sponsoring the industry-focused High Growth Jobs Training

Initiative for projects that involve coalitions of employers and training organizations. Both initiatives select a sector or group of sectors, create coalitions, assess the skill requirements for existing positions, project the skills required to upgrade jobs, recruit and target potential trainees, develop training modules, and obtain a mix of public and private funding. Often, the workers who receive training come from groups targeted under USDOL-sponsored training programs, such as disadvantaged youth, dislocated workers, veterans, and individuals with basic skill deficiencies. Participating firms often include some of their current (incumbent) workers. The focus on industry needs and close linkages with employers are sound principles and have led to some effective programs that train workers to improve their jobs and earnings. So far, the programs are ad hoc arrangements and not a systemic part of the landscape. The training is usually short-term in nature and only occasionally leads to a recognized qualification. While the programs should be encouraged, the long-term goal should be to develop a large-scale, more intense, sustainable skill-building system using these principles.

In fact, we already have such a system—apprenticeship, which provides demand-driven, long-term training to potential workers. This system generates high skills for participants, involves extensive work-based learning, requires little or no foregone earnings on the part of participants, and fills positions that are in demand, and have job ladders and long-term options. It can promote productivity and can better the life chances of workers (Steedman, Gospel, and Ryan 1998). Apprenticeship programs teach both academic subjects in classrooms and applications in the workplace—the latter in the context of the tasks, problem solving, and social interactions of the occupation. The learner can draw on help from experienced adults and from peers trying to succeed in the same career. The entry requirements vary, but some require only a high school diploma. Though such apprenticeship programs are not well known to many public officials and policymakers, the number of apprentices at least matches the number of participants in public job-training programs and exceeds the number receiving intensive, long-term training. Yet the federal budget for the Office of Apprenticeship (OA) is only \$20 million, an amount that must cover the national office and all of the individuals in regions around the country who are monitoring such programs and helping to promote apprenticeship. The government provides no direct funds to help finance the training and

conducts virtually no research and little monitoring of many aspects of the apprenticeship programs. In recent years, OA has funded industry efforts to establish apprenticeships in nontraditional sectors, including nursing, information technology, geospatial technology, advanced manufacturing, and maritime occupations.

An expansion of apprenticeship training would certainly increase the nation's stock of usable skills and substantially raise the earnings of participants. Although the pool of apprenticeships depends mostly on employers, apprenticeship activity is likely to increase in response to an investment by the USDOL. Tripling the current budget, which would cost only \$40 million, could go a long way toward expanding outreach and technical assistance to stimulate more employers to offer apprenticeships, toward funding development and marketing of new apprenticeship occupations, toward coordinating skill requirements across programs in the same occupations, and toward conducting research and analysis. If the expanded funding generated a 2–3 percent increase in apprentices, it would more than pay for itself. Ideally, apprenticeship programs should work closely with high schools to provide immediate outlets for graduates. These steps could well encourage more students to complete high school and to gain sufficient academic competencies to qualify for the new opportunities.

Expanding apprenticeships is likely to be a highly cost-effective method for skill-building in high-demand occupations and for raising productivity and earnings at intermediate levels of the job distribution. Apprenticeships vary widely, but their social cost is very low in comparison to college. Foregone earnings (and foregone output) are low or zero, depending on the alternative job available to the apprentice. The classroom instruction costs about as much as 1–2 years in a community college program, or a total of about \$20,000. In comparison, the real costs of a four-year degree, some of which are borne by students and some by the government, are in the range of \$180,000 (about \$25,000 a year for tuition and expenses and \$20,000 a year in foregone earnings). Although no definitive analysis has estimated the returns to apprentices (over, say, high school graduates with no other certification), the evidence from the state of Washington indicates earnings gains in the range of \$15,000–17,000 a year. If this figure could be confirmed, the cost-effectiveness of adding apprentices would almost certainly exceed the social returns to adding college students, especially since two-thirds

of community college participants do not complete a degree within four years and about 45 percent of entrants to four-year programs fail to obtain a degree within six years.

Apprenticeships are expanding in many European countries, where they play a major role in developing skills for a wide variety of careers (Steedman 2005). The Leitch Review of Skills (2006) in the United Kingdom recently recommended expanding the number of apprenticeships to 500,000 for that country. In the United States, achieving the same proportion of apprentices in the population would require a four-fold increase in apprenticeships, to about 2.3 million.

### **Alter Accounting Practices to Count Some Skill Development as Investment**

Managers often proclaim that the skills and commitment of their employees are their companies' most precious assets. At the same time, they commonly admit that they can only manage what they can measure. These statements have consequences for human capital investment by private firms and, in turn, for the skills of the U.S. workforce. As noted above, productive investments in building the skills of a company's workforce count as current costs to firms and ultimately as consumption in national income accounts.<sup>23</sup> When companies invest in capital goods and plants, only a modest portion of the purchase counts as current-year costs in determining profits. The remaining value is counted as an asset on the company's balance sheet. In contrast, all of the spending on skill development counts as a cost in the current year, despite the reality that the company will gain benefits from these expenses over a period of years.

For tax purposes, it is advantageous to count training costs as expenses in the year they are incurred. However, this accounting treatment distorts the profitability of training investments relative to investments in capital, which firms depreciate over time. If investments in training were treated more in line with economic reality for measuring profits and assets (but not for tax purposes), the contributions of training investments might be measured more precisely and the benefits would become more apparent. Firms might then undertake considerably more training and increase the skills of their workforces. Employer training appears to yield high returns to workers as well as to firms. Thus, any

measure that increases the incentive for companies to increase spending on training could raise the useful skills of the U.S. workforce substantially. If businesses increased their training outlays by only 1 percent of wages and salaries, the added investments in human capital would amount to more than \$60 billion a year, or about double the entire education-related expenditures by all community colleges in the United States. Of course, the impact of accounting changes might be much smaller, but it is plausible to expect added training outlays in the billions of dollars.

One potential objection comes from the problem of how to measure the benefit to firms of two factors: 1) added worker capabilities and 2) the duration of these benefits. Another worry is that companies will overstate their training outlays relative to other labor costs. Such shifts would reduce accounting costs and overstate profits inappropriately, since only part of training outlays but all of salaries count against profits in a given year. Of course, similar judgments are required for allocating the costs of physical capital as well, especially concerning the length of the depreciation period. A major distinction between physical and human capital is that the firm has no property rights to the added human capital, as it has with added physical capital. If workers are not rewarded for the added human capital with wage increases, those workers may leave. Thus, training investments should count as assets to the company only to the extent that the company is able to benefit from the increased human capital. Certainly, the very fact that companies currently finance an extensive amount of training is indicative of their ability to capture some of the gains.

Valuation problems are real, but dealing in approximations is better than ignoring the reality that training does constitute an investment and should not be treated like goods or services that are used up in the current year. After all, the idea of counting the cost to the firm of providing financial options to employees was initially greeted with skepticism, both about the theory and about the feasibility of calculating an appropriate dollar amount. In fact, some measures of the costs of options depend on assumptions about longevity with the firm. Moreover, some firms already amortize some training expenses when workers are learning how to operate new equipment.

It will take some time to develop a consensus that accounting for the firm's human capital assets makes sense and to agree on a practi-

cal method for doing so. But the increase in the importance of human capital to the firm (not just to the worker) should stimulate action in the near term. The result will be additional training and ultimately better and more productive jobs.

## **SUMMARY AND CONCLUSION**

Generating skills is a critical task of modern economies. Not counting the value of the time students themselves spend on learning, the United States invests nearly \$1 trillion, or about 7 percent of its output, in education and training each year. A primary goal of this investment is to produce a well-qualified workforce that can find good jobs and rewarding careers. The stakes are high, not only for U.S. living standards but also for equality of opportunity and social cohesion.

So how well is the U.S. skill development system performing? With its schools, formal training programs, and on-the-job training activities, the U.S. system has helped develop a workforce skilled enough to achieve healthy productivity growth, especially over the past decade. The nation's universities attract hundreds of thousands of foreign students. At the same time, many workers have been left behind: they earn low wages that are stagnant from year to year, and they apparently are ill-equipped for well-paying jobs. Furthermore, employers are concerned about the lack of qualified workers in many occupations that require long-term education and training.

While the skills of the current and future U.S. workforce are a major topic for the public and for policymakers, we lack comprehensive measures of skills that are relevant to the distribution of jobs and to the achievement of high productivity. Information on school completion and on selected academic testing is widely used, and it properly forms part of the skills picture. However, these measures fall short because 1) they do not account for productivity-enhancing noncognitive skills of the type highlighted in SCANS, 2) they do not capture occupation-specific skills or broader skills learned through work experience, 3) the schooling and test score indicators are plagued by uncertainties, and 4) employers usually do not measure the increased capabilities attained by training their workforce.

Unfortunately, the weakness of existing measures affects public initiatives to improve skills. Policies are developed to raise schooling requirements and test scores, but they largely ignore other key indicators of productive skills. Investment decisions are directed at improving these imperfect indicators, leaving few resources and limited attention for other skills critical to workplace success. In the absence of well-accepted occupational qualifications for a broad range of careers, there are few measures of what share of workers have occupational qualifications and few policies to raise the share that have qualifications valued in the market. The result can be serious mismatches between the distribution of jobs in demand that pay good wages and the distribution of qualifications of the workforce. Some of these mismatches can be overcome with short-term training, but others require long-term training and work experience in the occupation.

How education and training providers conceive of skills affects curriculum content and teaching methods. When skill is viewed as knowledge in math, reading, writing and science, as measured by standardized tests, schools focus on theoretical concepts, emphasize individual learning instead of group learning and teamwork, use abstract tools instead of problem-solving in specific situations, and offer content that is weakly related to qualifications for careers. Nevertheless, classroom education works for many students. On average, more formal schooling yields solid financial returns through increased earnings, which presumably reflect increased productivity. But the gains from schooling vary widely, as do the ability and motivation of students to complete secondary and postsecondary degrees.

Only at the margins does the education system respond effectively to the diversity of learning styles, talents, and interests of students. The emphasis on college for all students leads to the adoption of curricula pushed by universities, which marginalizes career-oriented subjects and devalues experiential, work-based learning. The mismatches between the two types of curricula, approaches to teaching, student interests, and employer requirements contribute to high dropout rates (students often leaving out of boredom), low rates of qualification for many occupations, and poor earnings outcomes for a high share of young people.

As a result, many students leave the mainstream educational system without getting genuine qualifications for a good career. One reason for this is that the U.S. spends little on expanding skills that are well re-

warded in the workplace or on initiatives that involve close connections with employers, including but not limited to formal apprenticeship. Employer-led training is common, but only a small share of resources is devoted to collaborative school-based and work-based learning.

Much can be done to strengthen productive skills, but the first step is to recognize the differences in academic and career interests, learning approaches, and qualifications for careers. Reforms at the high school level should reflect this diversity. Many school-based programs offer learning in context and link education effectively with careers, but they are swimming against a strong tide of sentiment for requiring all students to meet college requirements. Students should be able to seek to achieve occupational qualifications by combining school-based instruction with well-structured work-based learning. The education and training system should be rewarded for raising standards not only for all broad-based, useful skills (including SCANS and 21st Century skills) but also for occupational skills. Career-focused programs, such as apprenticeships, provide a good way of achieving these outcomes.

Many adults respond effectively to career opportunities by using the nation's private and public vocational schooling. Though these schools are flexible and often provide excellent career preparations, many lack close linkages with employers, causing trainees to experience frustration upon graduating, having spent time and money in a program only to fail to land a job. One highly successful system to train adults for rewarding careers is apprenticeship. While apprenticeship provides a large component of training for careers in some countries and is growing in others, only a small and declining share of adults in the United States participate. One way to shore up and expand apprenticeship in the United States would be to increase its federal budget allocation, which at present is minimal. Expanding apprenticeship is likely to prove far more effective in raising long-term earnings at modest cost than is increasing the share of students entering college.

Altering accounting procedures to recognize the asset value of human capital is another low-cost intervention that could be used to encourage employer training. The change would recognize in income statements and balance sheets that training investments generate assets that yield future benefits. Although this modification in a company's practice would not be easy to construct, the result would be to make accounts better reflect current operations and company assets. Whether

managers were focusing on short-term or long-term profits, they would have more incentive to invest in training. Since employer-sponsored training yields a high return, additional employer-sponsored training is likely to prove productive and improve the skills, qualifications, and earnings of American workers.

Americans have long viewed the attainment of knowledge and skills as a primary mechanism for economic mobility. Unfortunately, in recent years the nation's laudable effort at promoting opportunity by enhancing skills has become too narrowly defined as raising educational attainment and academic test scores. In fact, limiting public initiatives to the goal of expanding and improving schools might actually increase inequality, since those who perform least effectively in academic settings will face continuing disadvantages. To fulfill our nation's goal of opportunity for all, we must do much more to measure and develop skills on the basis of a broader, more realistic perspective.

## Notes

1. National commissions and policy researchers forcefully argued these points. Examples include the Commission on the Skills of the American Workforce (1990) and the William T. Grant Foundation Commission on Work, Family, and Citizenship (1988). Also see Lerman and Pouncy (1990) and Hamilton (1987).
2. For an intriguing explanation of the U.S. productivity advantage and the determinants of sector and country differences in productivity, see Lewis (2004).
3. These are differences in log wages based on tabulations in Table 3.17 of Mishel, Bernstein, and Allegretto (2007) and accessible on the Economic Policy Institute Web site at [http://www.epi.org/content.cfm/datazone\\_dznational](http://www.epi.org/content.cfm/datazone_dznational).
4. See, for example, the report of the Secretary's Commission on Achieving Necessary Skills (SCANS 1992) for one ambitious effort to document and classify an extensive array of skills that goes well beyond traditional verbal and math competencies. A recent approach that highlights similar skills is known as 21st Century Skills (see, for example, Metiri Group 2007).
5. See, for example, the recent controversy over the alternative estimates of the share of a recent student cohort that graduated from high school.
6. For an overview of 21st Century Skills, see Metiri Group (2007).
7. These numbers were tabulated by the author, using figures from the Bureau of Labor Statistics Web site, [www.bls.gov](http://www.bls.gov).
8. In studying a youth cohort that went through high school in the late 1970s and early 1980s, Yates (2005) finds that about 40 percent of high school dropouts who left school for a year or more without a diploma ultimately completed at least a high school degree.

9. Heckman and Rubinstein (2001) make a similar point when they show that, holding constant for ability as measured by the Armed Forces Vocational Aptitude Battery, having a GED actually is associated with lower earnings than being a high school dropout.
10. For an overview on NVQ and other qualification systems in the United Kingdom, see material provided by the Qualifications and Curriculum Authority (2007).
11. The recent report by the Leitch Commission (2006) illustrates the use of qualification standards in assessing national skills and in developing policy initiatives to enhance skills.
12. Some industries issued standards through this process, but those standards have not come into common use by employers or by providers of education and training.
13. These broader measures and policies are embedded not only in systems that utilize apprenticeships extensively (including Germany, Switzerland, Austria, and Denmark), but also in the United Kingdom and other countries that use transparent approaches to occupational qualification.
14. See, for example, Brat (2006) and Deloitte Consulting (2005).
15. In 1990, only 19 percent of students with a vocational concentration completed the New Basics program of academic courses (four years of English and three years each of math, science, and social science). By 2000, 51 percent of vocational concentrators did so.
16. The share of students who were occupational (or vocational) concentrators dropped from nearly 34 to about 25 percent between 1982 and 1990 and remained at the lower rate through 2000. Seniors who were occupational concentrators and took at least one advanced course in the occupational field declined from 24 to 14.4 percent of all seniors from 1982 to 1998.
17. About two in three parents of homeschooled children report dissatisfaction with academic instruction in the schools, but their most important reasons for abandoning public (and private) schools are concerns about safety, drugs, and peer pressure and the desire to provide religious and moral instruction (U.S. Department of Education 2007).
18. The Lansing Area Manufacturing Partnership (LAMP) offers a good example of an effective employer-school partnership. Cosponsored by the United Auto Workers, General Motors, and the local school districts, LAMP exposes students to careers in the auto industry and improves their educational and career outcomes (MacAllum et al. 2002).
19. This last comment is based on correspondence with a former president of a school board in an inner-city community. He found that several Career Academies began well, but that their performance eroded over time. He attributes part of the problem to the weak links they had with employers.
20. No more than 3 percent were participating in a school-linked, structured, long-term (one to two years or longer) experience demanding the learning of new skills at the workplace and leading to any type of certification (Hershey 2003).
21. Although the estimates typically control for observed differences in capability, there may be quality differences not readily observed in the data.
22. However, see the set of working papers on pre-K learning sponsored by the

- Committee on Economic Development (CED), a business-sponsored public policy organization (CED 2007).
23. Counting education and training as investments would alter dramatically the current understatement of U.S. savings rates, in that properly accounting for human capital would increase measured investment and savings.

## References

- Acemoglu, Daron, and Jörn-Steffen Pischke. 1999. "Beyond Becker: Training in Imperfect Labor Markets." *Economic Journal* 109(453): F112–F142.
- Achieve. and National Governors Association. 2005. *An Action Agenda for Improving America's High Schools*. 2005 National Education Summit on High Schools. Washington, DC: National Governors Association.
- Allen, Jim, and Rolf van der Velden. 2001. "Educational Mismatches versus Skill Mismatches: Effects on Wages, Job Satisfaction, and On-the-Job Search." *Oxford Economic Papers* 53(3): 434–452.
- Autor, David H., Lawrence F. Katz, and Melissa S. Kearney. 2005. "Rising Wage Inequality: The Role of Composition and Prices." NBER Working Paper No. 11628. Cambridge, MA: National Bureau of Economic Research.
- Barton, Paul E. 2000. *What Jobs Require: Literacy, Education, and Training, 1940–2006*. Princeton, NJ: Education Testing Service.
- Becker, Gary S. 1964. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. New York: Columbia University Press.
- Bernanke, Ben S. 2007. "The Level and Distribution of Economic Well-Being." Remarks before the Greater Omaha Chamber of Commerce, Omaha, Nebraska, February 6.
- Bishop, John H., and Shani Carter. 1991. "How Accurate Are Recent BLS Occupational Projections?" *Monthly Labor Review* 114(10): 37–43.
- Bishop, John, and Ferran Mane. 2003. "The Impacts of School-Business Partnerships on the Early Labor-Market Success of Students." In *The School-to-Work Movement: Origins and Destinations*, William J. Stull and Nicholas M. Sanders, eds. Westport, CT: Praeger, pp. 189–202.
- . 2004. "The Impacts of Career-Technical Education on High School Labor Market Success." *Economics of Education Review* 23(4): 381–402.
- Blair, Amy J. 2002. "Measuring Up and Weighing In: Industry-Based Workforce Development Training Results in Strong Employment Outcomes." Sector Policy Project Series Report No. 3. Washington, DC: The Aspen Institute.
- Blöndal, Sveinbjörn, Simon Field, and Nathalie Girouard. 2002. "Investment in Human Capital Through Upper-Secondary and Tertiary Education." *OECD Economic Studies* 34(1): 52–111.

- Boe, Erling E., and Sujie Shin. 2005. "Is the United States Really Losing the International Horse Race in Academic Achievement?" *Phi Delta Kappan* 86(9): 688–695.
- Brat, Ilan. 2006. "Where Have All the Welders Gone, As Manufacturing and Repair Boom?" *Wall Street Journal*, August 15, B:1.
- Brown, Phillip. 2001. "Skill Formation in the Twenty-First Century." In *High Skills: Globalization, Competitiveness, and Skill Formation*, Philip Brown, Andy Green, and Hugh Lauder, eds. New York: Oxford University Press, pp. 1–55.
- Cahalan, Margaret W., Steven J. Ingels, Laura J. Burns, Michael Planty, and Bruce Daniel. 2006. *United States High School Sophomores: A Twenty-Two Year Comparison, 1980–2002*. NCES Statistical Analysis Report 2006-327. Washington, DC: U.S. Department of Education, Institute of Education Sciences, Analysis Report. National Center for Education Statistics.
- California State Board of Education. 2007. *Grades Eleven and Twelve: English-Language Arts Content Standards*. Sacramento, CA: California Department of Education. <http://www.cde.ca.gov/be/st/ss/enggrades11-12.asp> (accessed October 23, 2007).
- Cameron, Stephen V., and James J. Heckman. 1993. "The Nonequivalence of High School Equivalents." *Journal of Labor Economics*. 11(1, Part 1): 1–47.
- Carmona, Rob. 2007. "Testimony of Rob Carmona." U.S. Congress. Joint Economic Committee. 110th Cong., 1st sess., pp. 1–12. <http://jec.senate.gov/Documents/Hearings/03.08.07%20African-American%20Male%20Unemployment/Testimony%20-%20Carmona.pdf> (accessed August 2, 2007).
- Carneiro, Pedro, and James J. Heckman. 2003. "Human Capital Policy" and "Responses." In *Inequality in America: What Role for Human Capital Policies?* James J. Heckman and Alan B. Krueger, eds. Cambridge, MA: MIT Press, pp. 77–240 and pp. 293–326.
- Cellini, Stephanie Riegg. 2006. "Smoothing the Transition to College? The Effect of Tech-Prep Programs on Educational Attainment." *Economics of Education Review* 25(4): 394–411.
- Chaplin, Duncan. 2002. "Tassles on the Cheap." *Education Next* 2002(3): 24–29. <http://www.hoover.org/publications/ednext/3365101.html> (accessed August 2, 2007).
- Chen, Stacy. 2003. "Risk Attitude and College Attendance." Department of Economics Discussion Paper. University of Albany. SUNY.
- Commission on the Skills of the American Workforce. 1990. *America's Choice: High Skills or Low Wages!* Washington, DC: National Center on Education and the Economy.
- Committee for Economic Development (CED). 2007. *Invest in Kids Working*

- Group and Partnership for America's Economic Success*. Washington, DC: CED. <http://www.ced.org/projects/kids.php#working> (accessed October 23, 2007).
- Cook, Robert. 1989. *Analysis of Apprenticeship Training from the National Longitudinal Study of the Class of 1972*. Rockville, MD: Westat.
- Council of Economic Advisers. 2006. "Skills for the U.S. Workforce." In *Economic Report of the President, 2006*. Washington, DC: Executive Office of the President, pp. 49–64.
- Deke, John, and Joshua Haimson. 2006. *Valuing Student Competencies: Which Ones Predict Postsecondary Educational Attainment and Earnings, and for Whom?* Princeton, NJ: Mathematica Policy Research. <http://www.mathematica-mpr.com/publications/PDFs/valuestudent.pdf> (accessed August 2, 2007).
- Deloitte Consulting. 2005. *2005 Skills Gap Report—A Survey of the American Manufacturing Workforce*. Washington, DC: Manufacturing Institute.
- Eccles, Jacquelynne, and Jennifer Appleton Gootman, eds. 2002. *Community Programs to Promote Youth Development*. Washington, DC: National Academies Press.
- Eraut, Michael. 2001. "The Role and Use of Vocational Qualifications." *National Institute Economic Review* 178(1): 88–98.
- Frazis, Harley and Loewenstein, Mark. 2005. "Reexamining the returns to training: Functional form, magnitude, and interpretation." *Journal of Human Resources*, 40(2), 453-476.
- Freeman, Richard B. 2007. "Is a Great Labor Shortage Coming? Replacement Demand in the Global Economy." In *Reshaping the American Workforce in a Changing Economy*, Harry J. Holzer and Demetra Smith Nightingale, eds. Washington, DC: Urban Institute, pp. 3–24.
- French, Michael T., M. Christopher Roebuck, and Pierre Kébreau Alexandre. 2001. "Illicit Drug Use, Employment, and Labor Force Participation." *Southern Economic Journal* 68(2): 349–368.
- Gardner, Howard. 1999. *Intelligence Reframed: Multiple Intelligences for the 21st Century*. New York: Basic Books.
- Gates, Bill. 2005. Speech to the National Education Summit on High Schools, held in Washington, DC, February 26. <http://www.gatesfoundation.org/MediaCenter/Speeches/Co-ChairSpeeches/BillgSpeeches/BGSpeechNGA-050226.htm> (accessed August 3, 2007).
- Greenberg, David H., Charles Michalopoulos, and Philip K. Robins. 2003. "A Meta-Analysis of Government-Sponsored Training Programs." *Industrial and Labor Relations Review* 57(1): 31–53.
- Haimson, Joshua, and Jeanne Bellotti. 2001. *Schooling in the Workplace: Increasing the Scale and Quality of Work-Based Learning. Final Report*.

- Princeton, NJ: Mathematica Policy Research, Inc.
- Hamilton, Stephen F. 1987. "Apprenticeship as a Transition to Adulthood in West Germany." *American Journal of Education* 95(2): 314–345.
- Handel, Michael J. 2007. "A New Survey of Workplace Skills, Technology, and Management Practices (STAMP): Background and Descriptive Statistics." Presented at the National Research Council Workshop on Future Skills, held in Washington, DC, May 23.
- Hansen, Janet S., ed. 1994. *Preparing for the Workplace: Charting a Course for Federal Postsecondary Training Policy*. Washington, DC: National Academies Press.
- Hansen, J. S., National Research Council (U.S.). Committee on Postsecondary Education and Training for the Workplace., et al. 1994. *Preparing for the workplace : charting a course for federal postsecondary training policy*. Washington, D.C., National Academy Press.
- Heckman, James J., and Dimitriy V. Masterov. 2005. "Skill Policies for Scotland." In *New Wealth for Old Nations: Scotland's Economic Prospects*, Diane Coyle, Wendy Alexander, and Brian Ashcroft, eds. Princeton, NJ: Princeton University Press, pp. 119–165.
- . 2007. "The Productivity Argument for Investing in Young Children." NBER Working Paper No. 13016. Cambridge, MA: National Bureau of Economic Research.
- Heckman, James J., and Yona Rubinstein. 2001. "The Importance of Noncognitive Skills: Lessons from the GED Testing Program." *The American Economic Review* 91(2): 145–149.
- Heckman, James J., Jora Stixrud, and Sergio Urzua. 2006. "The Effect of Cognitive and Non-Cognitive Abilities on Labor Market Outcomes and Social Behavior." *Journal of Labor Economics* 24(3): 411–482.
- Hershey, Alan. 2003. "Has School-to-Work Worked?" In *The School-to-Work Movement: Origins and Destinations*, edited by William Stull and Nicholas Sanders (79-100). Westport, CT: Praeger Press.
- Holzer, Harry. 1997. "Is There a Gap Between Employer Skill Needs and the Skills of the Work Force?" In *Transitions in Work and Learning: Implications for Assessment*, Alan Lesgold, Michael J. Feuer, and Allison M. Black, eds. Washington, DC: National Academies Press, pp. 6–33.
- Kemple, James J., and Judith Scott-Clayton. 2004. *Career Academies: Impacts on Labor Market Outcomes and Educational Attainment*. New York: MDRC.
- Kutner, Mark, Elizabeth Greenberg, Jin Ling, Bridget Boyle, Yung-Chen Hsu, and Eric Dunleavy. 2007. *Literacy in Everyday Life: Results from the 2003 National Assessment of Adult Literacy*. (NCES 2007-480). U.S. Department of Education. Washington, D.C.: National Center for Education Statistics.

- Kleiner, Morris M. 2006. *Licensing Occupations: Ensuring Quality or Restricting Competition?* Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.
- Laurence, Janice H. 1994. "The Military: Purveyor of Fine Skills and Compartment for a Few Good Men." EQW Working Paper No. 25. Philadelphia: National Center on the Educational Quality of the Workforce.
- Leitch Commission. 2006. *Leitch Review of Skills: Prosperity for All in the Global Economy—World Class Skills*. Final Report. London: Stationery Office. [http://www.hm-treasury.gov.uk/media/6/4/leitch\\_finalreport051206.pdf](http://www.hm-treasury.gov.uk/media/6/4/leitch_finalreport051206.pdf) (accessed August 3, 2007).
- Lerman, Robert I., and Hillard Pouncy. 1990. "The Compelling Case for Youth Apprenticeship." *Public Interest* 101(Fall): 62–77.
- Lerman, Robert, Signe-Mary McKernan and Stephanie Riegg. "The Scope of Private Sector Training: Who, What, Where, and How Much?" *Job Training in the United States*. Edited by Christopher O'Leary and Stephen Wandner. Upjohn Press. 2004.
- Levesque, Karen. 2003. *Trends in High School Vocational/Technical Course-taking: 1982-1998*. NCES 2003-025. Washington, DC: US Department of Education. National Center for Education Statistics.
- Lewis, William W. 2004. *The Power of Productivity: Wealth, Poverty, and the Threat to Global Stability*. Chicago: University of Chicago Press.
- Loewenstein, Mark and James Spletzer. 1998. "Dividing the Costs and Returns to General Training." *Journal of Labor Economics*, vol. 16, no. 1, January 1998, pp. 142-71
- MacAllum, Keith, Karla Yoder, Scott Kim, and Robert Bozick. 2002. *Moving Forward: College and Career Transitions of LAMP Graduates*. Washington, DC: Academy for Educational Development.
- Metiri Group. 2007. *enGauge 21st Century Skills for 21st Century Learners*. Culver City, CA: Metiri Group. <http://www.metiri.com/21/Metiri-NCREL21stSkills.pdf> (accessed September 4, 2007).
- Mikelson, Kelly S., and Demetra Smith Nightingale. 2004. *Estimating Public and Private Expenditures on Occupational Training in the United States*. Washington, DC: U.S. Department of Labor, Employment and Training Administration. [http://wdr.doleta.gov/research/FullText\\_Documents/training\\_expenditures\\_paper\\_6\\_30\\_06.pdf](http://wdr.doleta.gov/research/FullText_Documents/training_expenditures_paper_6_30_06.pdf) (accessed August 3, 2007).
- Mishel, Lawrence, Jared Bernstein, and Sylvia Allegretto. 2007. *The State of Working America 2006/2007*. 10th edition. An Economic Policy Institute Book. Ithaca, NY: ILR Press.
- Murnane, Richard J., and Frank Levy. 1996. *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy*. New York: Free Press.

- Murnane, Richard J., John B. Willett, and Frank Levy. 1995. "The Growing Importance of Cognitive Skills in Wage Determination." *Review of Economics and Statistics* 77(2): 251–266.
- Nelsen, Bonalyn. 1997. "Should Social Skills Be in the Vocational Curriculum? Evidence from the Automotive Repair Field." In *Transitions in Work and Learning: Implications for Assessment*, Alan Lesgold, Michael J. Feuer, and Allison M. Black, eds. Washington, DC: National Academies Press, pp. 62–88.
- Neumark, David, and Donna Rothstein. 2005. "Do School-to-Work Programs Help the 'Forgotten Half?'" Working Paper 11,636. Cambridge, MA: National Bureau of Economic Research.
- New Commission on the Skills of the American Workforce (NCSAW). 2007. *Tough Choices or Tough Times*. Executive Summary. Washington, DC: National Center on Education and the Economy.
- Orr, Larry, Howard S. Bloom, Stephen H. Bell, Fred Doolittle, and Winston Lin. 1996. *Does Training for the Disadvantaged Work? Evidence from the National JTPA Study*. Washington, DC: Urban Institute Press.
- Orr, Margaret Terry. 1995. *Wisconsin Youth Apprenticeship Program in Printing: Evaluation 1993–1995*. Boston: Jobs for the Future.
- Packer, Arnold. 2006. "The SCANS Philosophy." Unpublished manuscript. Institute for the Economy and the Future, Western Carolina University, Cullowhee, NC.
- Pereira, Pedro and Pedro Martins. 2002. "Is There a Return-Risk Link in Education?" *Economics Letters*, vol. 75, no. 1, pp. 31–37
- Perle, M. W. Grigg, and G. Dion. 2005. *The Nation's Report Card: Mathematics 2005*. (NCES 2005-453). U.S. Department of Education. Washington, D.C.: National Center for Education Statistics.
- Perle, M. W. Grigg, and P. Donahue. 2005. *The Nation's Report Card: Reading 2005*. (NCES 2005-451). U.S. Department of Education. Washington, D.C.: National Center for Education Statistics.
- Psacharopoulos, George, and Harry Anthony Patrinos. 2004. "Returns to Investment in Education: A Further Update." *Education Economics* 12(2): 111–134.
- Qualifications and Curriculum Authority (QCA). 2007. *National Vocational Qualifications (NVQ): Purpose of Framework*. Belfast, Northern Ireland, UK: QCA. [http://www.qca.org.uk/qca\\_7134.aspx](http://www.qca.org.uk/qca_7134.aspx) (accessed October 25, 2007).
- Rauner, Felix. 2007. "Vocational Education and Training—A European Perspective." In *Identities at Work*, Alan Brown, Simone Kirpal, and Felix Rauner, eds. Series: Technical and Vocational Education and Training: Issues, Concerns and Prospects, Vol. 5. Dordrecht, The Netherlands: Springer,

- pp. 115–144.
- Resnick, Lauren B. 1987. “The 1987 Presidential Address: Learning In School and Out.” *Educational Researcher* 16(9): 13–20.
- Rivera-Batiz, Frances. 2003. “The Impact of School-to-Work Programs on Minority Youth.” In *The School-to-Work Movement: Origins and Destinations*, edited by William Stull and Nicholas Sanders (169-188). Westport, CT: Praeger Press.
- Rosenbaum, James. 2001. *Beyond College for All: Career Paths for the Forgotten Half*. New York: Russell Sage Foundation.
- Samuelson, Robert J. 2006. “How We Dummies Succeed.” *Washington Post*, September 6, A:15.
- Secretary’s Commission on Achieving Necessary Skills. 1992. *Learning a Living: A Blueprint for High Performance. A SCANS Report for America 2000*. Washington, DC: U.S. Department of Labor.
- Schochet, Peter Z., Sheena McConnell, and John Burghardt. 2003. *National Job Corps Study: Findings Using Administrative Earnings Records Data*. Final Report. Princeton, NJ: Mathematica Policy Research.
- Silverberg, Marcia, Elizabeth Warner, Michael Fong, and David Goodwin. 2004. *National Assessment of Vocational Education: Final Report to Congress*. Jessup, MD: U.S. Department of Education.
- Solomon, Amy L., Christy Visher, Nancy G. La Vigne, and Jenny Osborne. 2006. *Understanding the Challenges of Prisoner Reentry: Research Findings from the Urban Institute’s Prisoner Reentry Portfolio*. Washington, DC: Urban Institute, Justice Policy Center. <http://www.urban.org/publications/411289.html> (Accessed August 3, 2007).
- Stasz, Cathleen. 2001. “Assessing Skills for Work: Two Perspectives.” *Oxford Economic Papers* 53(3): 385–405.
- Steedman, Hilary. 2005. “Apprenticeship in Europe: ‘Fading’ or Flourishing?” CEP Discussion Paper No. 710. London: Centre for Economic Performance, London School of Economics and Political Science.
- Steedman, Hilary, Howard Gospel, and Paul Ryan. 1998. *Apprenticeship: A Strategy for Growth*. London: Centre for Economic Performance, London School of Economics and Political Science.
- Sticht, Thomas G., William B. Armstrong, Daniel T. Hickey, and John S. Caylor. 1987. *Cast-off Youth: Policy and Training Methods from the Military Experience*. New York: Praeger.
- Sullivan, Paul. 2006. “Empirical Evidence on Occupation and Industry Specific Human Capital.” Unpublished manuscript. U.S. Bureau of Labor Statistics.
- U.S. Bureau of Labor Statistics. 2007. *Occupational Outlook Handbook*. “Physicists and Astronomers.” <http://www.bls.gov/oco/ocos052.htm>. U.S.

- Census Bureau. 2007. *Table A-2. Percent of People 25 Years and Over Who Have Completed High School or College, by Race, Hispanic Origin and Sex: Selected Years 1940 to 2006*. Washington, DC: U.S. Census Bureau. <http://www.census.gov/population/socdemo/education/cps2006/tabA-2.xls> (accessed August 28, 2007).
- Warren, John Robert, and Amelia Corl. 2007. "State High School Exit Examinations, Retention in Grade 9, and High School Completion." Presented at the Population Association of America 2007 Annual Meeting, held in New York, March 29–31.
- Warren, John Robert, and Andrew Halpern-Manners. 2007. "Measuring High School Graduation Rates at the State Level: What Difference Does Methodology Make?" Presented at the Population Association of America 2007 Annual Meeting, held in New York, March 29–31.
- Washington State Workforce Training and Education Coordinating Board. 2004. *Workforce Training Results 2004*. Executive Summary. Olympia, WA: Washington State Workforce Training and Education Coordinating Board.
- William T. Grant Foundation Commission on Work, Family, and Citizenship. 1988. *The Forgotten Half: Pathways to Success for America's Youth and Young Families*. Final Report. Washington, DC: William T. Grant Foundation.
- Wills, Joan L. 1992. *An Overview of Skill Standards Systems in Education and Industry: Systems in the U.S. and Abroad*. Vol. 1. Washington, DC: Institute for Educational Leadership.
- Yates, Julie A. 2005. "The Transition from School to Work: Education and Work Experience." *Monthly Labor Review* 128(2): 21–32.
- Zemsky, Robert. 1997. "Skills and the Economy: An Employer Context for Understanding the School-to-Work Transition." In *Transitions in Work and Learning: Implications for Assessment*, Alan Lesgold, Michael J. Feuer, and Allison M. Black, eds. Washington, DC: National Academies Press, pp. 34–61.