

A View toward the 21st Century: The Grounding of High School Career and Technical Education

High schools must make it part of their mission to help young people understand that life without the intellectual tools for fully participating in the marketplace constitutes a sentence to likely destitution. (National Association of Secondary School Principals 1996, p. 3)

The "new" vocational education, described hereafter as *career and technical education*, is grounded in the writings, research, and agendas of many authors and scholars, reform groups, parents' and the general public's expectations for schools, and coalitions established for the purposes of high school or whole school reform. Many business coalitions and economists continue to address the realities and challenges of the changing 21st-century global economy and the related need for education and skills considerably different from those needed for the 20th-century economy. Parents and communities, too, are being increasingly vocal about their expectations for their children and their schools. Nearly all parents want their children to attend college, and they expect their public schools to prepare them to do so. But they also want the schools to provide their children with career education and prepare them with the knowledge and technical skills to be successful in contemporary workplaces.

We've learned much just in the past 20 years from research on student learning, motivation, and achievement that confirms the importance of contextualizing curriculum for most students most of the time. A defining condition of being human is that we have to understand the meaning of our experience and thus the meaning of our education.

There is an increasingly growing body of knowledge from the effective schools literature that calls for contemporary changes in public school systems, curriculum, instruction, and outcomes that also is helping to inform changes in career and technical education. These several forces are commingling, in some fashion, to form a new philosophy and purposes for career and technical education.

The New Economy

The factory of the 21st century will be between our employees' ears. (Vance D. Coffman, Chairman and CEO, Lockheed Martin Corporation for the National Alliance of Business)

From Businesses' Perspective

Among the major influences on the entire educational system, and certainly career and technical education, are the economic developments that continue to have a significant impact on the professions, jobs, and ways of living and working of most people in most places in most parts of the world. Advances in technology, growing international economic competition, widespread use of the Internet, and the systems, operations, and style of management changes in most American businesses and industries have increased the demand for highly skilled and educated workers in this nation.

It is no longer a postagricultural or postindustrial world. Rather, it is a *new* world of fast communications, rapid decision making, and intelligent social skills that are needed to deal with economic, technical, ecological, and ethical issues facing virtually every economic, social, or political system (Nijhof 1998). This new economic world is vastly different from the agricultural/factory environment that ushered in public school vocational education at the turn of the 20th century. It is characterized today by international activity, cyberspace, ever-changing market demands and standards, shorter product life cycles, increasingly sophisticated computers, and the need for a more thorough knowledge of the whole business environment rather than just specific skills or narrow job tasks (Carnevale 1991; O'Hara-Devereaux and Johansen 1994; Wirth 1992).

Workplaces during the past decade have also ushered in new challenges. Today's workplaces are often in multiple locations characterized by cultural diversity, fragmented or "different" organizations and infrastructures, economic restructuring, and constantly changing worker roles and duties. Increasingly, economists and scholars talk about the ascendancy of knowledge as a primary product and competitive edge for many businesses; increased reliance on team problem solving—often from remote locations; an urgent (and sometimes difficult) need to manage information and technology; ability to analyze, synthesize, and evaluate information and use it to solve problems; new versions and forms of prerequisite technical skills; flexible jobs; and new iterations of related education and skill requirements, that is, a constant need to continue to learn and upgrade (Bernhardt, Morris, Handcock, and Scott 1998; Brown 1999; Carnevale 1991; Marshall and Tucker 1992; Wirth 1992).

In addition, the specific skills needed to enter and succeed in these workplaces have also changed significantly in the past 2 decades. Technical and technological skills remain important, but they must be modified and grounded in employees' ability to think of them in the context of the big picture (i.e., technical skills' role in knowledge and understanding of all aspects of the industry). But employers increasingly discuss the importance of new categories of skills crucial to employees' ability to work "smarter, not harder." These skills go by any number of labels: soft skills, generic skills, employability skills, new basic skills, essential skills, or applied general education skills. Any number of studies have identified them and the listing should be familiar to career and technical educators: knowing how to learn, interpersonal skills, competence in applying general education (reading, writing, calculating, computing) to workplaces, ability to work in teams or groups, effective listening and oral communications skills, adaptability and

flexibility, personal management skills with good self-esteem and personal and work ethics, leadership or initiative, and—seemingly, above all—the ability to think and to solve problems in workplaces. Many of these skills were once reserved for those in management; today, they are considered necessary for individuals at all levels of employment (Alpern 1997; Clagett 1997; Evers, Rush, and Berdrow 1998; Secretary's Commission on Achieving Necessary Skills [SCANS] 1991; Stasz, Ramsey, and Eden 1995).

In the United States today, fewer than 20 percent of the work force are in jobs classified as unskilled. This is almost an exact reversal of the nature of the American work force just 40 years ago. In 1959, 60 percent of the work force was unskilled, with 20 percent classified as professional and 20 percent as skilled. Today, 60 percent of the workforce is in skilled occupations and 20 percent in professions (Murnane and Levy 1996; **21st Century Skills for 21st Century Jobs** 1999); nearly all of these workers are required to have postsecondary education.

The jobs today are also different. The assembly-line, single-skill jobs of the factory or construction site and the office clerk-typist or bookkeeper are largely defunct. Rather, there is a tremendous demand for educated people with general employability and specialized technical skills in areas related to computer science and computer technology, high-tech manufacturing, software development, biotechnology, biomedical applications, sales and services, database management, and health care. The 10 fastest-growing jobs include database administrators and computer support, computer engineers, systems analysts, personal care aides, physical therapy assistants, home health aides, medical assistants, desktop publishing specialists, physical therapists, and occupational therapy assistants. Eight of these 10 jobs require postsecondary or extensive continuing education; the three fastest-growing positions generally demand college degrees (**21st Century Skills for 21st Century Jobs** 1999, p. 5). Other rapidly growing or “hot” jobs, all of which require technical skills and (probably) postsecondary education include physician assistants, drafters, paralegals, emergency medical technicians, construction managers, dental hygienists, computer programmers, licensed practical nurses, machinists and tool programmers, and dieticians and nutritionists (“10 Hot Jobs” 1999, pp. 26-27).

These high-skill, high-tech jobs in the new economy virtually mandate that schools (and, incidentally, colleges) make significant changes in what and how teachers teach and to whom they teach it. In many prestigious reports and in interviews conducted for this report, businesses and business coalitions bemoaned the growing gap between the technical and social requirements of the workplace and the skills and education of people looking for employment.

Those in human resources especially described the limited skills brought to the hiring arena by applicants in today's labor pools. In citing a new survey by the American Management Association (AMA), Grimsley (1999) of the **Washington Post** reported that more than one-third of job applicants nationwide lack the basic math and reading skills for jobs they are seeking. This is an increase from 19 percent just 3 years ago. The biggest literacy gap was reported by executives in wholesale and retail industries who said that 56 percent of the applicants failed to meet basic math and reading standards; 43 percent of applicants for manufacturing positions had skill deficiencies.

There are several reasons postulated by employment officials interviewed for this report and by AMA's survey of personnel executives from 1,054 companies that employ more than one-fourth of the U.S. work force and had tested 165,684 applicants in 1998: a tightening labor market, narrowing applicant pools among high school graduates, "older" workers who are less apt to have higher levels of literacy skills, and some language barriers among immigrants. But the *major* reason seems to be a disconnection between applicants' education and the higher skills needed in today's workplaces where the new technologies and systems have raised the bar for job applicants in terms of literacy, math, and communication skills.

Many executives blame what they describe as weak school systems. Their criticism seems especially targeted to current students and recent high school graduates. In a 1997 press release, the presidents of the National Academy of Sciences, National Academy of Engineering, and the Institute on Medicine commented, "Many corporations report that only about one-tenth of American high school graduates seeking employment have the skills necessary to qualify for entry-level jobs" ("Preparing Workers for the 21st Century" 1997). Workers, too, give the nation's high schools poor marks in preparing high school students for work. In a study conducted in May 1999 at Rutgers University, more than 50 percent of America's workers gave high schools a C or lower on their effectiveness at preparing the next generation of workers (Joyner 2000, p. E3). So whether it is described as a one-third, a 25 percent, a 50 percent, a 56 percent, or a 90 percent failure rate of high school graduates to "pass" entry-level employment screening, a very serious problem exists for public education when significant numbers of business persons and groups perceive that schools are *not* teaching and students are *not* receiving the education they need to be successful in workplaces. Every economy has education baselines that must be met by all participants, and the perception seems to be that far too many U.S. high school graduates are below this baseline.

Groups representing business interests continue to ask the schools to provide a *better* education with more rigor and relevance to students and then instill the need for lifelong learning in both youth and adults. This increased education and achievement are thought to benefit businesses and industries in reduced training costs, reduced recruiting and hiring costs, positive employee responsiveness to innovation and changes, improved productivity, and in workers' ability to learn new skills, work multiple tasks and operations, and communicate with customers. In various reports and interviews, it was increasingly pointed out that small and medium-sized businesses especially need beginning employees with solid education and technical skills. Many smaller businesses are simply unable financially to invest in remedial general education and extensive employee training.

Growing out of the *new* economy and the related need for higher levels of education by businesses, efforts have increased considerably to strengthen the links between school and work for high school youth. Recently, 12 national business organizations—including the National Alliance of Business and the National Association of Manufacturers—joined forces to form the Business Coalition for Education Reform (BCER), a unique collaborative dedicated to strengthening the nation's schools < <http://www.bcer.org/>> . The BCER has pledged to support and expand business involvement in education at

national, state, and local levels. The primary goal for the BCER is to increase academic achievement for all students. The collective voice emphasizes strongly more time and focus by all students on the core curriculum and admonishes schools to stop tracking students out of the core curriculum. The BCER coalition also pledges to ensure that academic standards reflect the skills needed for personal and career success in a changing economy and to help the public understand the critical need for world-class academic standards and the changes school systems must make to achieve them. The BCER leverages resources, expertise, and partnerships to help states and communities learn from each other's experiences in advancing education reform.

The American Business and Education Partnership < <http://www.acteonline.org/abepmenu.html> > consists of more than 100 business and education leaders who are dedicated to transforming the nation's educational system to ensure that its graduates possess both academic and technical skills required for today's and tomorrow's job market. Sponsored by the Association for Career and Technical Education, this business partnership aligns with its tagline, "Rethinking the Way America Does Business with Education."

A third principal player trying to influence educators to be more responsive to workplaces is the National Research Council (NRC), which has synthesized, summarized, and highlighted reports to inform education discussions in a number of key policy matters. NRC and its major affiliates (the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine) have focused especially on developing national standards for math, science, and technology, as well as influencing instructional practices, assessment, and achievement for *all* students (National Research Council 1997).

From Students' Perspective

It is also important to recognize in any redirection of high school career and technical education the role the new economy is playing in determining the need for all students today to have increasingly higher levels of academics and to know more and to be able to learn even more. It is simply in the best interests of all high school students to plan for and prepare to attend postsecondary education whether they want to or not. This crucial information should be included in career development and guidance sessions for all students in all schools.

In his summit on 21st Century Skills for 21st Century Jobs < <http://www.wpskillsummit.org> >, Vice President Gore highlighted an administration report showing that increased education and training are linked to higher employee wages and employer productivity, with college graduates earning an average 77 percent more than individuals with only a high school degree (up from previous reports showing comparable figures of about 58 percent). Other reports and studies have also highlighted the salary differential among various levels of education.

In all studies, higher levels of learning result in increased wages. For individuals *not* earning a high school diploma, the long-term financial outlook is not good. Expressed in

constant 1997 dollars, the average high school dropout earned 42 percent less annually than the average person did with a high school education—\$16,124 compared to \$22,895. An associate's degree adds \$3,340 (\$26,235) and a baccalaureate degree adds \$17,583 (\$40,478) to the average high school graduate's annual salary. An advanced degree adds \$40,334 (\$63,229). Stated differently, for full-time workers aged 25 or older, less than a high school diploma means \$342 per week on average, a high school diploma (no college) means \$481 per week, and college graduation means \$842 per week. Some college also increases the median annual earnings of full-time, year-round wage and salary workers for all adult population segments. For example, just 1 year of nondegree education at a college increases hourly wages above those for high school graduates by 8 percent for males and 5 percent for females under 21 years of age (Bureau of Labor Statistics 1998; Choy 1998; Decker 1996; Medrich 1996; Phillippe and Patton 2000; Toth 1999; *21st Century Skills* 1999).

In addition to higher salaries and wages, various government data also show that increased levels of educational attainment and academic achievement enhance students' future abilities to earn a good living and sustain a career in other ways. They correlate strongly with improved worker productivity, less unemployment, greater benefits, ability to learn new skills and workplace operations more rapidly, exposure to and engagement with computers, and generally, better ability to negotiate the rigors of the labor market. Even dislocated workers with an associate's degree or higher find new jobs at higher average pay than the jobs they lost (*21st Century Skills* 1999). Conversely, the Bureau of Labor Statistics (1998) reported that the unemployment rate for out-of-school youth (16-24 years of age) who have not graduated from high school is 19.8 percent, compared with 11.1 percent for those with a high school diploma (no college) and 2.1 percent for those with a baccalaureate degree.

The conclusion is indeed obvious. Drawing on economic analyses of wage and salary and other employment-related data and information, individuals' investment in education and further training pays big dividends—the more education, the better.

Public Expectations

An examination of public surveys leads to two conclusions about public expectations related to career and technical education: (1) the public does indeed want career education and work skills included as critical components of the public school K-12 curriculum, and (2) parents expect their children to attend college.

In a recent nationwide survey conducted by the Gallup Organization with funding from the Office of Educational Research and Improvement, Marzano, Kendall, and Cicchinelli (1998) concluded that five subject areas have the requisite level of support (i.e., majority acceptance by the American adult public) as *definitely necessary* in school curriculum: health, **work skills**, language arts, technology, and mathematics. The survey asked the respondents to evaluate each of 248 standards as one that students should *definitely*, *probably*, *probably not*, or *definitely not* know or be able to do by the time they graduate from high school. The standards were later classified into 15 subjects for purposes of analysis.

Within each of the 15 subject areas, the specific standards may have been ranked differently; that is, there was considerable variability within subject areas relative to the perceived importance of specific standards. But in the Work Skills subject, the majority of respondents rated all standards as *definitely* necessary. The standards for Work Skills, written by “experts,” seem heavily drawn from the “soft” or “employability” skills discussed earlier as well as general life skills. They include, for example, standards about working with others, working with tools and technology, self-regulation, work ethic, and managing money.

Another objective of this Gallup survey (Marzano et al. 1998) related to the overall goals of education. Question 1 stated: “A main goal of education should be to provide knowledge that helps individual students obtain meaningful employment.” About 79 percent responded *definitely*, more than 18 percent said *probably*, and fewer than 3 percent said *probably not* or *definitely not*. This current survey data of public opinion adds additional support to many studies conducted by Gallup and others during the past century that have supported the public school’s role in preparing youth for employment and careers.

Americans increasingly recognize the value of education and expect their youth to attend college. When surveyed, nearly all graduates of the class of 1992 said they planned to attend postsecondary education either right after high school (77 percent) or at some later point (an additional 20 percent); 71 percent of them say they planned to earn a bachelor’s degree. Even among completers whose families had low incomes or whose parents’ formal education stopped at high school, the vast majority (94 percent in each case) planned to continue their education at some time (Choy 1998). In a recent study by ACT, 77 percent of 1999’s 10th graders indicated that they planned to attend a 4-year institution after graduation. Of the 634,700 students surveyed, only 6 percent planned to attend a community or technical college and another 3 percent saw vocational or proprietary school, job training through the military, or career apprenticeship in their future (*Vocational Training News*, June 29, 2000).

In reality, however, actual college attendance compared with “wannabe” college attendance is far from a perfect correlation. About 67 percent of 1997 high school completers enrolled in college in October of that year; nearly two-thirds of them enrolled at a 4-year college and about one-third enrolled at a 2-year institution. Women attended in larger numbers and proportion than men; 70.3 percent compared with 63.5 percent. About 20 percent of those new college attendees were enrolled part time (Bureau of Labor Statistics 1998). More comprehensive, segmented data appear with the graduating class of 1992. The following is a summary from various government data sets about the postsecondary attendance of this class:

1. 73 percent of 1992 graduates were enrolled in a postsecondary institution within 2 years of graduation (Levesque et al. 2000, p. 110).
2. Of the 1992 graduates enrolled in college 2 years later, 93.2 percent were from the college preparatory curriculum, 48.8 percent were from a vocational education concentration, 90.6 percent completed both a vocational concentration and the college preparatory curriculum, and 69.1 percent were from “other or general” (ibid., p. 111).

3. The previous figures are a marked increase in college enrollment rates from a decade earlier, when 57.3 percent of 1982 public high school graduates enrolled in a postsecondary institution within 2 years of graduation, about 41.5 percent had been vocational concentrators, 86 percent had completed both a vocational concentration and the college preparatory curriculum (very small number), and 61.2 percent had graduated with an other/general classification (ibid., p. 110).
4. Among 1992 public high school graduates who enrolled in postsecondary education within 2 years of graduation, vocational concentrators (58.4 percent) were much more likely to enroll in public community colleges than were college preparatory graduates (18.7 percent). An additional 13.5 percent of vocational concentrators went to private 2-year or nondegree technical schools; only about 2 percent from the college prep curriculum did likewise (ibid., p. 111)
5. Nearly 80 percent of the graduates of the 1992 college preparatory curriculum attended a 4-year college (52.3 percent public and 26.4 percent private not for profit); conversely, 39 percent of vocational concentrators did so (30.5 percent at a public 4-year and 8.5 percent at a private not-for-profit college) (ibid., p. 111).
6. Nearly three-fourths (74.5 percent) of the graduates from both the college preparatory and vocational concentration curriculum attended either public (58.8 percent) or private not-for-profit (15.7 percent) 4-year colleges (ibid., p. 113).
7. The public 4-year enrollment rates of high school graduates who completed both a vocational concentration and a college preparatory curriculum were similar to high school graduates who complete a college preparatory curriculum only. They are much higher than students who completed a vocational concentration only (Hudson and Hurst 1999; Levesque et al. 2000).

It is interesting to note that most students work while attending college. In an October 1997 survey (Bureau of Labor Statistics 1998), 57.3 percent of college students were employed. Nearly 70 percent of 2-year college enrollees worked and nearly 53 percent of those enrolled in 4-year colleges were employed; 88 percent of part-time students and 51.6 percent of full-time students were working. Even freshmen worked; 37.1 percent of them attending 4-year colleges and 63.2 percent of those attending 2-year colleges were working in October. It is assumed that many of the working students benefited from some high school career and technical education to provide them with appropriate work skills that qualified them for employment. Related surveys show that parents generally want their children to attend college, expect them to work to pay for some of the expense, and expect the public schools to provide them with the work skills to do so.

Despite the positive enrollment of high school graduates in higher education, studies indicate that the United States has a dismal record for college program completion or graduation. There is clear evidence from the government's *Condition of Education* report (Wirt et al. 1998) that at least 28.3 percent of U.S. college students drop out before completing a bachelor's or associate degree or certification program and that another 17.5 percent indicate they are still enrolled 6 years after initially entering college. According to recent studies by ACT, nearly 26 percent of all 1999 freshmen in 4-year colleges and 44.9 percent of freshmen at 2-year colleges did not return for a second year. Further, ACT claims that only about 51 percent of all college students will

complete a baccalaureate degree (*Vocational Training News*, June 29, 2000). The Organization for Economic Cooperation and Development claimed the United States ranked 23rd of 31 countries worldwide on high school and college graduation rates, with 37 percent of U.S. undergraduates dropping out before competing a baccalaureate degree (“United States Ranks 23rd” 1999). Studies and statistics do vary on the exact percentages. Some report only data from public, state-supported institutions; others include private schools as well. But the 50 percent figure is probably reasonably accurate; that is, only about 50 percent of students who start college or university—and certainly those who attend state-supported systems—will eventually receive a baccalaureate degree (Kirst 1998).

In reviewing extensive data and conducting interviews with scholars and data analysts for this report, three conclusions seem obvious: (1) the public expects high school youth to attend college and indeed more continue to do so each year; (2) huge numbers of high school graduates are not prepared to be successful at 4-year colleges, and large percentages (50 percent probably on a nationwide average) will drop out before completing a liberal arts baccalaureate degree or a professional program within 6 years; and (3) almost all high school students could and should benefit from career and technical education.

Perhaps less obvious, a conclusion that seems to make sense is that economic and public expectations are that virtually *all* American youth should complete a solid, high-quality education that includes career and technical education through the equivalent of 2 years of postsecondary education.

Student Learning, Motivation, and Achievement

We’ve probably learned more about the mind and how it works in the last, say, 25 years than has been learned in all previous systematic study. But to translate that kind of knowledge into different kinds of classroom practices and different kinds of attitudes about the mind is not an easy process. (“Interview: Howard W. Gardner” 1995)

A third factor that contributes to thinking about new directions for career and technical education as we advance into the 21st century is recent research and increased wisdom about how students learn and can be taught to learn even more in schools and other environments. This is important knowledge as we continue to figure out how to motivate more students to stay in school longer, to draw from their interests and personal experiences to advance their learning, and to show them connections between that which must be learned and how it is used in the world.

It is a fundamental assumption at the outset of this section that nearly all students can be motivated—and thus taught—to learn and to learn at increasingly higher levels in all subjects including career and technical education. And it is the school’s responsibility—working in tandem with parents and relevant community groups—to figure out how to motivate and teach them effectively.

In addition, career and technical educators cannot abdicate their responsibility to help their students learn deeper, critical, and theoretical knowledge that has to underpin job skills and tasks they are teaching to students. They must help students learn and plan for the long term and not just be content with relatively short-term job training. Some vocational educators may still be hiding behind the historical rhetoric, using only a competency-based, job task framework in designing curriculum and instruction. Learning or acquiring x number of job skills in a high school vocational education program is simply no longer sufficient to develop the long-term employment opportunities for youth.

Relatively recent theories and research on cognition and learning do clearly support some of the instructional approaches historically used by vocational educators—learning by doing, head and hands, theory and practice—and will continue to be used by career and technical educators in the 21st century. Many of the applied, practical, hands-on instructional approaches used by vocational education teachers historically have much to offer to colleagues who teach academic subjects in high schools. Much of this instruction has helped to shape new theories and research from the cognitive sciences. Workplaces especially can provide real-world contexts for cognitive development.

We simply know today so much more than we knew 25 years ago about how individuals learn, think, remember, perceive, form associations, transfer knowledge, construct knowledge and meaning from new information, and apply knowledge to solve problems including those that are poorly structured and unfamiliar. We also know more today about how to structure curriculum and learning experiences for young people that build on our new knowledge of cognition. Further, we know more about how to motivate more students to continue to learn more. Our challenge, of course, is to figure out how to use this new knowledge to advance student achievement in schools and other learning environments (e.g., workplaces).

Business persons and educators involved with this report say we must help *all* students to reach new levels of higher-order thinking. This, then, is much of the impetus that undergirds the initiatives to integrate vocational and academic education: Higher-order thinking skills—grounded in recent research about cognition—are essential and must be taught. It is important to teach youth how to think, not just what to think. Any definition of higher-order critical thinking skills includes the ability to think creatively, make decisions, solve problems, visualize a solution, reason, analyze, interpret, and continue to learn. Critical thinkers draw on a variety of resources and disciplines to solve problems, they use standards of performance as a benchmark, and they are intermittently independent and group reliant for assistance.

We are also beginning to learn more about adolescent and adult learning, retention, and application processes in nonschool environments. There are implications to be drawn from how learning occurs and knowledge is developed in organizations such as businesses, nonprofit agencies, and government that offer apprenticeship and other forms of work-based learning programs. A major finding, for example, from the learning organization literature is that the essence of real learning—that which leads to individual and

organizational changes—is social (i.e., undertaken with peers) and tackles real problems (Spence 1998).

At all levels of society—national, state, local—our desire to increase achievement for all students may hinge on our willingness to implement meaningful changes in our school systems and in instruction based on knowledge and research about how students learn and acquire knowledge. This is tough work. The research and its implications are not consistent with most people’s historical experiences of schooling nor with their perceptions of how they think students learn and should be taught. Like it or not, many people do perceive intelligence and ability to learn as defined by the intelligence quotient (IQ), which assumes that a person’s intellectual potential is fixed, genetically determined, can be measured early in life, and largely determines an individual’s potential to learn.

Thus, much of the public’s fundamental philosophy or beliefs about schooling, how students learn, how schools should operate, and the entire assessment process is probably at odds with much of the research related to learning. This perception of learning grounded in IQ scores (a one-time “dipstick” measurement) along with the disconnection between knowledge about learning and much of current practice in school seems especially prominent among those who control the power and the purse strings in education.

Throughout most of the educational history of the United States, education has essentially operated under the assumption that cognition is mostly enhanced through memorization of facts and formulas and acquisition of pieces of knowledge and bits of skill by reading chapters, outlining the content or answering factual questions at the end of a chapter, and taking notes from the teacher’s lectures about the content. Drill, drill, and more drill was—and still is—the prevailing teaching method in many classes at all levels of education throughout the United States. Most of education is passive or, at best, responding to that which the authoritative teachers or textbooks say. Much of education—certainly at the high school and collegiate levels—still functions that way today. As wryly noted by Howey (1998), “Sadly, the primary learning tool for too many students is a yellow highlighter” (p. 295).

In more traditional or classically structured classrooms, student assessment is typically based on objective tests of content prepared from the textbook and the teacher’s lectures. The classroom environment is competitive (who can get the highest score on the test), independent (i.e., one student listening or reading or working quietly at a self-contained desk with minimal interruption by classmates), and controlled (teacher talks, students listen).

Summarizing a decade of research on cognition, Berryman and Bailey (1992) emphasized two major points. First, school “routinely and profoundly violates” all that we know about how students learn and the proper conditions under which they should apply knowledge appropriately to new situations. Second, these practices permeate all levels of American education. The authors exploded five myths about learning that they say are prevalent in American education practices:

1. The educational establishment assumes that people predictably transfer learning to new situations. (They don't.)
2. Learners are best seen as passive vessels into which knowledge is poured. (They aren't; students learn best through active processes.)
3. Learning is the strengthening of bonds between stimuli and correct responses (behaviorist theory of learning), which means breaking learning down into single subjects, simpler subtasks, routines, and items (based on Taylor's scientific management of workplaces, which is no longer practiced in most businesses).
4. What matters is getting the right answer. (Wrong; accepting only correct answers tends to negate development of skills associated with problem solving, discovery, and deeper understanding of concepts.)
5. To ensure their transfer to new situations, skills and knowledge should be acquired independently of their contexts or use. (Dead wrong.)

This is critical information for career and technical educators, as well, and it is important to debate as we reform programs, curriculum, and teaching methods in the next decade. Our historical grounding (aka philosophy) in teaching and learning has been most closely identified with Charles Prosser's essentialist philosophy of education. Prosser, the original director of the Federal Board for Vocational Education after the passage of the Smith-Hughes Act in 1917, believed that a practical education must be provided to prepare large numbers of students in a trade or vocation. He espoused specific training in schools for jobs needed in production and manufacturing industries.

The premise behind Prosser's essentialism is that education should train for specific jobs rather than train for culture: "Vocational education only functions in proportion as it will enable an individual actually to do a job... Vocational education must establish habits: habits of correct thinking and of correct doing. Hence its fundamental theory must be that of habit psychology" (Prosser and Quigley 1950, pp. 215-216). Prosser then prepared and justified 16 theories (better called theorems) around this essentialist philosophy to guide vocational education. Many of the theorems were carefully written to distinguish and separate vocational education from general or academic education and to teach until "right habits of doing and thinking are repeated to the point that the habits developed are those of the finished skills necessary for gainful employment" (p. 222). Again, it is important to understand this founding philosophy of vocational education and the related theorems. They are still very prevalent in many segments of the profession and are often used as the rationale for continuing specialized job training at the high school level.

The essentialist philosophy helped to shape behaviorism, which believes that stimuli (e.g., reward and punishment) help develop desirable responses and behavior—and thus learning—in the learner. Thus, for vocational education purposes, it was believed that we learn from business and industry the competencies that are needed (knowledge, skills, behavior) and, using prospective employment as a stimulus, teach these competencies to our students. It was further thought that there was the right way—the "correct" way—to learn these skills and at a level of acceptable performance. Behaviorism was and is the foundational theory for today's competency-based vocational education programs.

As discussed in this section and elsewhere, the new economy clearly calls for more inclusion of *thinking* and *culture* into career and technical education. The learner needs to be able to make sense of the workplace and its context within that person's life. It isn't just "training" for specific jobs, but "education" to make decisions, solve problems, find answers, and draw on a variety of disciplines and cultural contexts to make sense out of changes, challenges, and day-to-day operations at the workplace. Thus, the learner (i.e., the worker) needs both the theory or the broad framework of that which underlies the mission and all aspects of that industry as well as the company's and his or her role, responsibilities, and duties within the larger society. This leads to the integration of vocational and academic education, which may be among the most important recommendations emanating from Congress in the past three Perkins Acts.

Much of educational psychology and research in the last 20 years tends to support instructional approaches associated with active, contextual learning. That is, students are apt to understand more, retain more, and apply more if the knowledge is taught in active, engaging environments, in context, and students are allowed to put the knowledge to practice by demonstrating its application in some way. The various research studies have been grounded in several theories:

- The situated nature of cognition, which sees knowledge as inseparable from the contexts and activities within which it develops
- Constructivism, which views the learner as one who constructs meaning from that which is learned through active, individual, and personal processes based on previously constructed knowledge
- Social and cultural factors, which determine what, how, and how much we know and learn
- Cognition that is distributed over the individual, other persons, and various artifacts such as physical and symbolic tools
- Achievement and motivation, which are directly related to students' ability to make sense out of that which they are to learn

New theories of multiple intelligence embrace the knowledge that different students do learn differently and draw on research on the way the brain processes information. Howard Gardner (1983), Professor of Education at Harvard University, is the nation's most renowned scholar on the theory of multiple intelligences. Gardner has identified eight distinct forms of intelligence: verbal-linguistic, logical-mathematical, visual-spatial, kinesthetic, musical-rhythmic, interpersonal, intrapersonal, and naturalistic. Gardner believes that people do possess all eight intelligences, but in varying degrees of strength and skill. One key to effective teaching and thus enhanced student achievement, according to Gardner, is for teachers to structure lessons and experiences that draw on each student's primary learning style(s).

Flannery (1993), drawing on the adult and continuing education literature, categorizes learning styles as analytical (field independent-FI) or global (field dependent-FD). Analytic or FI learners (“left brain”) process information sequentially, use logical inductive processes, and perceive information in an abstract, objective manner. Global (“right-brain”) learning processes are deductive, intuitive, concrete, and subjective. Global or FD individuals use their entire surroundings—including other people—to process information. These are two very different ways of learning and it is difficult, for example, for “right brainers” to process complex material—especially in math and science—that is taught through very traditional, deductive learning processes.

Others categorize learning styles in other ways. James and Gardner (1995) describe three categories: perceptual, cognitive, and affective. Griggs (1991) uses personality models, information processing models, social interaction models, and instructional preference models. These theorists draw heavily on the personality and social styles of learners as important clues as to how best to teach them. Regardless of the specific categories, the point is that individual and cultural group learning styles differ. Finding ways to address these differences is a challenge and responsibility for all involved with education.

Contemporary researchers are synthesizing much of the research from the last 20 years on student cognition and learning into a relatively new theory of contextual teaching and learning. These researchers have concluded that cognition involves much more complex activities than once thought. Cognition today is said to be (Borko and Putnam 1998)—

- *Situated* in particular physical and social contexts; how a person learns a particular set of knowledge and skills and the situation in which he or she learns them is a fundamental part of what is learned and closely connected to a person’s ability to transfer the knowledge.
- *Social* in that interactions with people in one’s environment are major determinants of both what is learned and how learning takes place; an important part of what it means to become competent in one’s domain (math, science, workplaces, music) is to learn the forms of discourse and argument and other accepted ways of reasoning, acting, valuing, and performing within that discipline and with one’s colleagues and teachers.
- *Distributed* or “stretched over” the individual, other persons, and symbolic and physical environments.

This work on contextual teaching and learning gives additional credence to the policy-influencing initiatives to integrate academic and vocational education and, indeed, to bring more of the pedagogy historically identified with career and technical education to academic subjects. A few groups developing national standards for specific subject areas, such as the National Council of Teachers of Mathematics and the American Association for the Advancement of Science, have included workplace problem solving in the standards themselves. Concomitantly, it is incumbent upon career and technical

educators to include more of the theory underlying knowledge and skills they teach relative to particular industries and careers.

A recent initiative of the U.S. Department of Education's Office of Vocational and Adult Education (OVAE) has sought to provide further analysis of contextual teaching and learning and its implications for the preservice and continuing education of teachers. In summarizing the compendium of papers commissioned by OVAE, Howey (1998) operationally defined contextual teaching and learning (CT&L) as follows:

Contextual teaching...enables learning in which students employ their academic understandings and abilities in a variety of in- and out-of-school contexts to solve simulated or real-world problems, both alone and with others. Activities in which teachers use contextual teaching strategies help students make connections with their roles and responsibilities as family members, citizens, students, and workers. Learning through and in these kinds of activities is commonly characterized as problem based, self-regulated, occurring in a variety of contexts including the community and work sites, involving teams or learning groups, and responsive to a host of diverse learners needs and interests. Further contextual teaching and learning emphasize higher-level thinking, knowledge transfer, and the collection, analysis, and synthesis of information from multiple sources and viewpoints. CT&L includes authentic assessment, which is derived from multiple sources, ongoing, and blended with instruction. (pp. 19-20)

Howey's view of CT&L embraces other theories and terms used by learning theorists—experiential learning, real-world learning, active learning, learner-centered instruction, and action learning. Thus, it is important to state that this extensive definition is indeed meant to embrace much of existing practices by many teachers. In some respects, CT&L supports and amplifies what many effective teachers have always done. But it is just as important to state that far too many teachers continue to use very traditional, talk-and-chalk methods.

In summary, the exploding knowledge about brain development, cognition, and learning theory and their relationship to student motivation and achievement continues to seriously challenge the way in which the vast majority of students have been and continue to be taught in public schools today. The majority of students simply do not learn as well or retain as much knowledge and information through such primary teaching methods as lecturing, lecturing with overhead or chalkboard (or even an LCD panel), and quiet time working or reading at one's desk. This, of course, works for some youngsters and may prepare some of them to be successful with the typical state and local standardized tests of recall, facts, formulas, terms, definitions, sequences, dates, and short answers to objective questions—all of which have an absolute "correct" answer.

For most high school students, not only are these traditional methods boring (and therefore school is boring), but they don't learn well and are unable to recall or apply much of the material months or even days later. Conversely, studies consistently show that students who are actively engaged in their learning, apply the content in context, draw on

prior knowledge to construct and synthesize new knowledge, and are allowed to demonstrate knowledge acquisition in a variety of ways do, indeed, retain the knowledge and its practices far into the future. Unfortunately, most active learning processes do not make for quiet, well-ordered classrooms; easily constructed and graded “standard” examinations; and one clear winner (i.e., head of the class or valedictorian).

Yes, it will be tough to change the learning culture in schools to more active, student-engaged environments, with some of the knowledge acquisition being delivered in places other than school classrooms. Career and technical teachers have much to offer in this arena of teaching and learning. They have long engaged in active, action-oriented learning environments (e.g., typing, auto tech, agricultural education with its supervised farm projects, and cooperative education programs). Conversely, career and technical educators must pay increased attention to the theory and the essence of the why (not just the how) in planning programs, curriculum, and instruction. It is the blending of the academic with the vocational that is probably the most responsive to the knowledge of how high school students learn and remember best.

School Reform

Schools and school systems in the United States have done a noteworthy job of preparing students for the industrial age; fewer have systematically decided how they will prepare students for the 21st century. Therefore, if we continue on our present path, we’ll be preparing students for a world that will no longer exist. (American Association of School Administrators 1999, p. 6)

In addition to the new economy, increased public expectations that more high school graduates will attend college, and research on student learning, a fourth late 20th-century development that affects important reforms in career and technical education is the rather loud call for school reform. Nearly every individual or group interviewed for this report—whether from business, professional or trade association, government, or education—commented that it is insufficient to reform only vocational education into a new career and technical education without major changes in public schools, especially high schools.

Poll after poll, thousands of pieces of education legislation from the 50 states, and cumulative analysis of writings of scores of educational journalists from the nation’s top newsmagazines and newspapers all show that education today is the number 1 concern of the American public. The National Conference of State Legislators expected school quality to top state legislative agendas in 1999 (Toth 1999).

The quality of high school education seems to be the principal target for the reform efforts. There is no single statistic, survey, or anecdote that best depicts the public’s discomfort with the quality of the high school experience. It probably began with the 1983 release of the report, *A Nation at Risk*, with its eloquent prose denigrating the “rising tide of mediocrity” of American education and its call for significant reforms in education, especially in high schools (National Commission on Excellence in Education 1983). Thousands of pieces of state-level legislation were passed in the 1980s and

1990s, probably as a direct result of **A Nation at Risk**. Most state legislation raised requirements for students that could be quantified, such as more high school credits, more credits in selected subjects (i.e., math and science) required of all students in order to graduate, and tougher standards in most subject areas. Today, for example, 48 states require students to be tested in academic subject areas and 36 states require state-determined passing scores before students can receive a high school diploma. Some of these exams or exit standards are considered fairly mediocre by curriculum content experts; others—especially some of those most recently developed—are considered quite tough, and there is genuine concern that huge numbers of students are not being adequately prepared to pass them.

A recent wake-up call that stirred up legislators and many educators came from the results of U.S. students' scores on international tests of math and science. The Third International Mathematics and Science Study (TIMSS) is the largest ever undertaken and includes data from one-half million students in 41 nations. U.S. schoolchildren are the only students internationally with above-average scores in 4th grade to lose ground in the 8th grade, and then do worse again in the 12th grade. In the fourth grade, U.S. students' achievement is near the top in both math and science. By the eighth grade, U.S. students are still above the international average in science, but below the international average in math. However, by the 12th grade, U.S. science and math performances are below the international average and among the lowest of the 21 TIMSS countries whose 12th graders completed both math and science examinations. In an analysis of the results, researchers concluded that U.S. math and science curricula lack the "coherence, focus, and rigor of the curricula taught in other countries that participated in TIMSS" (National Institute on Educational Governance, Finance, Policymaking, and Management 1999, p. 1). Other reasons cited for the low U.S. scores were the emphasis on acquisition of skills rather than problem solving and thinking, failure to include deductive reasoning, repetitive and unchallenging curriculum and textbooks in grade after grade—"a mile wide and an inch deep" (Hettinger 1999, p. 31), and, in general, lower-quality lessons by U.S. teachers.

But it isn't just low test scores on international examinations or even failure to meet state-determined standards that have the public buzzing about American high schools. Other reports and anecdotes cite the increased violence in schools and alienation among increasingly large numbers of high school youth, especially their estrangement from parents, other adult mentors and guides, and institutions—including schools themselves—that were once thought to provide structure and support for youth. The schools simply may be too isolated from communities. Many cite the lack of career direction and planning by so many students as problematic in high schools. Huge percentages of students, probably as many as 42 percent, "wander around the curriculum" by selecting courses at random without regard to any particular focus or plan. They are neither in the college prep nor the vocational curriculum (Hudson and Hurst 1999). Students seem to be delaying any career preparation until college without a clue as to what to study when they get there. This may result in so many who leave college before completing; they still can't find the connection between school, work, and other elements from the real world.

Conversations about the American high school and its students seemed to elicit some of the most negative reaction from the individuals and groups interviewed for this report. Various groups (and some of the written reports) commented with terms and phrases such as “intellectual wasteland,” a place to “sort and separate” students, a place where students are in the college-bound track and there’s not much for anyone else, filled with departments that model themselves after colleges with very specific subjects and turfs and with little regard for real learning, unresponsive to the needs of the community or businesses, curricula and standards that are dictated by colleges, “huge warehouses,” “cavernous, soulless places,” “too focused on control and too little on learning,” “the rich get it all and the poor get the scraps,” provides a “bleak future” for those not headed to college, and “places that should be sued for alienation of affection.”

Conversely—and this is important—most all spoke of their fondness for teenagers, the desire to see *all* teens have a fair shot at a good education and a good life, and the willingness to invest time and money to reinvigorate American high schools. Thus, several recent reports have addressed specifically the reform of the American high school. As a basis for the reform agenda, many staff and researchers of business coalitions, professional education associations, and the U.S. Department of Education have studied effective high schools, visited countless schools throughout the country in an attempt to determine success factors, and reviewed the literature.

Effective public high schools seem to have a clear vision and mission that integrate well the dual goals of providing (1) *individuals* (their students) with a solid education to enhance their personal income, continued learning opportunities, and responsibility in a democratic society and (2) *communities* with educated citizens and a work force to enhance a competitive and productive society and a higher standard of living for all citizens. Thus, effective or even outstanding high schools seem to be highly responsive to the community and highly responsible to the students’ individual development. Their leaders are visionary and consider the long-term effects of a solid education, use data appropriately for assessment and direction-setting purposes, and involve adults heavily in education processes. As further elaborated in the elements of effective schools, the work of the school and the work of the community—and its families—are integrated in policy, planning, and implementation.

Common denominators from several reports (American Association of School Administrators 1999; Bottoms, Presson, and Johnson 1992; National Association of Secondary School Principals 1996; Toth 1999; U.S. Department of Education 1998) that have evaluated and reported on “outstanding” or “effective” high schools include the following:

- High academic standards that encourage all students to take courses that put them on track to succeed. The best high schools set valid standards and high expectations that will help all graduates perform in the real world and not simply score well on standardized tests. The standards include those that relate to workplaces, communities, and technology. All standards are clear, challenging, and understood by students, teachers, parents, and communities including, of course, businesses and industries.

- Coherent core curriculum that integrates rigorous academic content with real-world applications, enabling students to see relationships between content and future roles they may envision for themselves; curriculum includes those essentials that students must master to high standards to graduate from high school.
- Assessment of student progress, evolving from valid standards, that is authentic, performance based, used to support learning, and considers students' individual talents, abilities, and aspirations.
- Strategies to enhance student success, including tutoring, adult mentoring, coaching, help sessions, counseling, contemporary computer labs and tools and equipment, "second-chance" opportunities, some flexibility with time (e.g., extended block, day, year), evening classes, strong curriculum and career planning programs, and cocurricular activities. Simply stated: There are good human, equipment, and financial resources.
- Availability of school-supervised service- and work-based learning opportunities through internships, youth apprenticeship programs, cooperative education, simulations or integrated projects, and community-based activities.
- Highly qualified teachers—caring, knowledgeable, comfortable with constructivist approaches, who teach to high standards and help students achieve them, and adjust instruction to learning styles of students. This is *the* key to increased student achievement.
- Strong support for teachers—especially mentoring programs in their first 3 years of experience as well as research-driven professional development for more experienced teachers.
- Meaningful partnerships with parents, local colleges including community and technical colleges, business and industry, policymakers, social services and other community groups.
- A small-school or school-within-a-school environment where administrators and teachers know *each* student, often achieved with a team approach through an integrated professional, career, or applied major. All students are treated with respect and taught to be "good people." They have faculty advocates (advisors) who help personalize the educational experiences.
- Governance policies and administrative support systems and structures that enhance student and teacher success, draw on valid and reliable data and research, focus on student learning, encourage student attendance, broker professional development, provide safe and stimulating learning environments and physical facilities, and truly provide leadership.

There is also some evidence and certainly support from many community and some education leaders to open the high schools, and certainly the career and technical

facilities, “around the clock” for lifelong learning to enhance education and achievement for everyone in the community. Previous studies on school finance have also indicated that communities tend to support their schools in very positive ways (including support for increased funding proposals) when they feel they have access to school facilities during those times when students are not using them.

There really is not a lot of hard, statistical or other evaluative data to support most school reform programs, or at least those programs that have a national agenda or focus. This is especially true if the fundamental goal of the reform is increased student achievement as measured by standardized test scores. The denominators that are common across the various reform initiatives seem to make sense and many of their inherent components are reasonably well grounded in data. The initial review by experts who have designed, engaged in, or studied high school reform believe that all 10 of these common denominators or key elements of reform need to be included, to some extent, in the redesign or reform of the American high school.

Recently, the American Institutes for Research (AIR) under contract to the American Association of School Administrators, American Federation of Teachers, National Association of Elementary School Principals, National Association of Secondary School Principals, and National Education Association, published comparison data on 24 schoolwide reform initiatives. The 24 approaches reviewed were selected based on 5 criteria (AIR 1999, p. 7):

1. They are promoted by their developers as a means to improve student achievement in low-performing schools.
2. They are mentioned by name in the federal legislation that created the Comprehensive School Reform Demonstration Program and thus qualified to be considered for receiving federal funds to support their initiatives.
3. They are used in many schools and school districts.
4. They have obtained national visibility in the education and popular press.
5. There is some research evidence about their effects on students and/or their implementation in schools.

The primary factor AIR examined was the reform group’s effectiveness at raising student achievement through such quantitative measures as test scores, grades, and graduation rates. Data and other evaluative measures had to be independently verifiable beyond the claims of the reform group and its developer(s). The research team also described the approaches used by each of the reform groups along a number of dimensions (e.g., years introduced in schools, number of schools, costs, etc.). AIR and the sponsoring organizations essentially wanted to know which reform initiatives now available for adoption worked, which just hold promise, and even perhaps which are dubious.

The review found that only a few of the reform groups have available much in the way of documented positive effects on student achievement through statistically valid and reliable measures. Several reform initiatives appear promising, but lack empirical research or may be just too new in their processes for a valid assessment of student

achievement and other outcomes. Some just never got around to collecting data or evaluating their work. Some are much more concerned with creating a more positive school atmosphere or happier students and teachers than they are with increasing student achievement. Some essentially surround reform processes around tough standards or a rigorous academic curriculum, but haven't assessed the results.

There are three notable exceptions, two of which are focused on elementary school children and one on high school youth. At the elementary level, *Success for All* is a comprehensive approach to restructuring schools, especially those serving students placed at risk in preK-6, directed by Dr. Robert Slavin in Baltimore. The main goal is to ensure success in reading, and at least 90 minutes of daily instruction are devoted to reading. *Direct Instruction* is a model growing from work on teacher-directed instruction begun by Siegfried Engelmann at the University of Illinois in the late 1960s and now continued at the University of Oregon. Direct Instruction serves students in K-6 in traditionally low performing schools in high-poverty areas; it focuses elementary school instruction on particular skills (initially on reading, language, and math) and shows students how to apply these skills in increasingly complex situations.

The third reform initiative with cumulative data showing increases in student achievement according to AIR's criteria is *High Schools That Work*, which is essentially a set of strategies designed to raise the academic achievement of career-bound high school students by combining the content of the college prep curriculum with career and technical education. High Schools That Work is administered by the Southern Regional Education Board (SREB) in Atlanta with Gene Bottoms as its director.

High Schools That Work deserves increased attention by career and technical educators and indeed by the education community as a whole. It does draw into focus much of the literature and research on school reform and targets it to students who are career bound. It advocates strongly that *all* teachers become more engaged with educating and teaching to high standards those students who focus on career and technical studies.

SREB specifies the following as key practices in order to become affiliated with High Schools That Work:

- High expectations for student learning
- Rigorous career and technical courses
- More required academic courses
- Learning in work environments
- Collaboration among academic and career and technical teachers
- An individualized advising system
- Active encouragement of students' interests
- Extra help outside of school and in the summer
- Use of assessment and evaluation data to improve students' learning

In summary, four macro developments underpin reform in vocational education:

1. Major changes in the economy, which call for major changes in the education and skills of the present and future work force;
2. Greater demand from an increasingly vocal public for new and better education for the nation's youth;
3. New research into student learning and achievement, much of which challenges long-standing practices of how youngsters learn; and
4. Reports from prestigious study and reform groups delineating important and needed changes in high school education.

Perhaps the major implication for career and technical education is that the fundamental philosophy or rationale for its purposes within high schools should change.

Purposes of Career and Technical Education in the 21st-Century High School

The “new” career and technical education is integral to reform of the American high school. The public demands and the students need relevant, contemporary career information, knowledge, and skills. Career and technical education is integral to whole school, comprehensive reform; it is not separate from it.

Drawing from a recent extensive array of research and literature and opinion, the purposes for high school *career and technical education*, for the first 5-10 years of the 21st century, appear to be—

- Providing career exploration and planning
- Enhancing academic achievement and motivation to learn more
- Acquiring generic work competencies and skills useful for employment
- Establishing pathways for continuing education and lifelong learning

In the next section of this paper, the substance to bring about these new purposes for career and technical education will be discussed.