

The Important Role of Career and Technical Education

Implications for Federal Policy

by

Marie Cohen and Douglas J. Besharov

Revised May 2004

© 2004 by Douglas J. Besharov

CONTENTS

The Need for Career and Technical Education	1
The High School Dropout Problem	1
High School Graduates and the Transition to Work	3
Unprepared College Students	4
The Importance of Non-College Careers	7
What Employers Really Want	11
The Promise of CTE	13
Background	15
History	15
Current Programs	22
Public Attitudes	28
CTE in Other Countries	35
What the Research Says about the Effectiveness of CTE	38
Limitations of Research Based on National Student Surveys	38
CTE Program Evaluations	41
Findings	42
Synthesis	48
Rethinking the Federal Role	48
Conclusion	54
References	57
Appendix A	A-1
Appendix B	B-1

ACKNOWLEDGMENTS

Many people provided information, materials, and suggestions for this report, and we want to acknowledge their assistance. Particularly helpful were David Boesel, David Goodwin, Robert Muller, and Marcia Silverberg of the U.S. Department of Education; Richard Apling of the Congressional Research Service, Library of Congress; Judy Wagner and Michael Wonacott of the National Dissemination Center for Career and Technical Education; John Bishop of Cornell University; Ferran Mañe of the Universitat Rovira i Virgili; Katherine Hughes and Terry Orr of Columbia University; Harry Holzer of the Urban Institute; James Rosenbaum of Northwestern University; Karlyn Bowman of the American Enterprise Institute; Jean Johnson of Public Agenda; and James Griffith of the Montgomery County, Maryland, Public Schools. The Charles Stewart Mott Foundation provided important support and advice through our project officer, Chris Sturgis. Katharine Leavitt performed the initial research for this report. Christina Imholt provided valuable research assistance and completed editorial work on the final manuscript. Finally, the report also benefitted from the editorial assistance of Susan Freis and the helpful production assistance of Kathy Swain and Kerri Smith.

An early version of this paper was prepared for the U.S. Department of Education and is available at <http://www.ed.gov/about/offices/list/ovae/pi/hs/besharov.doc>.

Marie Cohen
Douglas J. Besharov

In recent years, “get a college education” seems to be the advice given to all young people, and for good reason. Over the past twenty years, the earnings of young adults with a bachelor’s degree increased greatly relative to those with only a high school diploma or its equivalent. Yet, many young people do not go to college, and others enroll but later drop out. Many of these young people may be unsuited for college: by ability, temperament, or interest. And most jobs—including some very good ones—do not require a college degree. For some young people, career and technical education (CTE) might provide a better route to a good job. CTE might even give them a reason to stay in high school and thereby increase the chances that they will eventually get to college.

Many people, however, oppose CTE because they fear it discourages young people from going on to postsecondary education and thus threatens to hold them back from achieving their full potential. Opponents also cite the history of poor and obsolete CTE programs that became a dumping ground for less able students. We believe that these concerns are valid, but we also think that instead of abandoning CTE programs, we should be trying to improve, upgrade, and modernize them.

The federal government could potentially play an important role in the effort to promote CTE by sponsoring high-quality research, disseminating the results of this research, developing curricula and other materials to be used by schools nationwide, and providing technical assistance to states and localities.

The Need for Career and Technical Education

Although “college for all” has become the mantra in today’s education system, this single-minded focus shortchanges larger numbers of students: including those who drop out of high school, those who complete high school and do not continue to college, and those who enter college woefully unprepared and often drop out. CTE could encourage these students—disproportionately poor and minority—to complete high school, ensure that they are better prepared for jobs when they graduate, and perhaps even increase their chances of entering college.

The High School Dropout Problem

Policy makers and concerned citizens have long been worried about the large number of youths who drop out of high school. Young people who do not complete high school tend to have substantially lower employment rates and earnings than those who do graduate. In 1997, for example, only 45 percent of recent high school dropouts were employed, as compared with 67 percent of recent high school graduates who were not enrolled in college.¹ Young male dropouts (with only nine to eleven years of education) earned only 71 percent of what their peers with a high school diploma or General Education Development (GED) credential earned, and young

¹U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1999* (Washington, D.C.: National Center for Education Statistics, 1999), 20, available from: <http://nces.ed.gov/pubs99/condition99/pdf/1999022.pdf>, accessed January 27, 2002.

female dropouts earned only 63 percent of their peers with degrees.² Moreover, high school dropouts are more likely to have children out of wedlock, receive welfare, and go to prison than people who have finished high school.³

Despite the increasing importance of a high school degree in the labor market, high school dropout rates have stagnated over the past decade. The proportion of eighteen- to twenty-four-year-olds who have completed a high school diploma or equivalent rose dramatically in the 1950s and 1960s and more modestly between 1972 and 1985 and has been fairly stable since then. It stood at 86.5 percent in 2000. When another measure is used—the proportion of students who left school each year without successfully completing a high school program—the dropout rate decreased from 1972 to 1987 but has remained relatively unchanged since 1987 at about 5 percent.⁴

Dropout rates are higher in urban areas⁵ and among African Americans and Hispanics.⁶ Moreover, according to Robert Balfanz and Nettie Legters, both of Johns Hopkins University, the dropout problem is particularly acute in a few hundred high schools in the thirty-five largest cities. They found that, in almost half of the high schools in these cities, the number of twelfth graders in 1995 divided by the number of entering high school students three or four years earlier (depending on whether the school begins with ninth or tenth grade) was 50 percent or less. Moreover, comparisons of this ratio, which the authors call “promoting power,” between the 1989–1992 period and the 1992–1995 period indicate “a general shift toward weaker promoting power across all schools in the sample, an absolute increase in the number of schools with promoting power of 50 percent or less . . . , and a significant increase in the number of schools with *extremely* weak promoting power.”⁷

²U.S. Department of Education, 24.

³Philip Kaufman, Martha Naomi Alt, and Christopher D. Chapman, *Dropout Rates in the United States: 2000* (Washington, D.C.: National Center for Education Statistics, November 2001), 1, available from: <http://nces.ed.gov/pubs2002/2002114.pdf>, accessed January 27, 2002; Robert Lerman, “Improving Links between High Schools and Careers,” in *America’s Disconnected Youth: Toward a Preventive Strategy*, edited by Douglas J. Besharov (Washington, D.C.: CWLA Press, 1999), 186.

⁴Kaufman, Alt, and Chapman, iii.

⁵John Wirt et al., *The Condition of Education 2000* (Washington, D.C.: National Center for Education Statistics, 2000), 45, available from: <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000062>, accessed January 27, 2002.

⁶Kaufman, Alt, and Chapman, iii.

⁷Robert Balfanz and Nettie Legters, *How Many Central City High Schools Have a Severe Dropout Problem, Where Are They Located, and Who Attends Them? Initial Estimates Using the Common Core of Data* (Baltimore, Md.: Johns Hopkins University, 2001), available from: <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/balfanz.html>, accessed January 27, 2002.

Why do young people drop out, and what can be done to prevent it? The research indicates, not surprisingly, that family variables such as socioeconomic status and family structure are strongly related to dropping out. However, data also suggest that schools can have an effect. When school-wide dropout rates are adjusted for differences in the background characteristics of students, the variation between schools declines, but there are still widespread differences among schools. Some researchers believe that dropping out is the final stage in a “dynamic and cumulative process of disengagement,” both social and academic.⁸ Studies have found that dropping out is strongly predicted by student behaviors and characteristics such as absenteeism (the most common indicator of student disengagement), poor academic achievement, and student discipline problems. The relationship between these factors and dropping out suggests that school policies and practices can affect dropout rates by helping students become more engaged in school.⁹

High School Graduates and the Transition to Work

Even graduation from high school is no longer sufficient to ensure a good career. Since the 1950s, a high school diploma has changed from a “valued asset” in the labor market to a “minimum requirement” to access jobs or further education.¹⁰ Young people just out of high school experience great difficulty finding a job, or they take “dead-end jobs that offer low status, little training, and pay that is too low to support a family.”¹¹

High youth unemployment rates reflect the difficulty that non-college youth have in making the transition to the labor force: only 67 percent of recent high school graduates not enrolled in college were employed in October 1997.¹² And their situations often do not improve much with age. In constant 2000 dollars, the median earnings for male wage and salary workers aged twenty-five to thirty-four with a high school diploma or equivalent decreased from \$36,726 in 1970 to \$26,842 in 1999, compared with more than \$31,000 for those with some college and more than \$42,000 for those with a bachelor’s degree or higher. For young women, the median earnings of those with a high school degree or equivalent remained extremely low throughout the period with little change, ending at \$16,770 in 1999, compared with \$21,008 for those with some

⁸Russell Rumberger, *Why Students Drop Out of School and What Can Be Done?* (Santa Barbara, Calif.: University of California, 2001), 6, available from: <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/rumberger.pdf>, accessed January 27, 2002.

⁹Rumberger, 6–10.

¹⁰Kaufman, Alt, and Chapman, 1.

¹¹James Rosenbaum, *Beyond College for All: Career Paths for the Forgotten Half* (New York: Russell Sage Foundation, 2001), 1.

¹²U.S. Department of Education, 1999, 20.

college and \$32,145 for those with a bachelor's degree or higher.¹³ For young men, the earnings advantage for a bachelor's degree or higher versus high school grew from 19 percent in 1980 to 58 percent in 1999. For young women, this earnings advantage rose from 52 percent to 92 percent.¹⁴ A number of factors may have contributed to the decreasing returns to a high school degree, including the loss of manufacturing jobs and the increasing importance of computer technology.¹⁵

Unprepared College Students

The response to the declining rewards of a high school diploma has often been to urge all students to go to college. And students are listening. In 1998, fifty-five percent of high school seniors reported that they definitely planned to graduate from a four-year college (up from 36 percent in 1980), and another 23 percent said they would probably do so.¹⁶ The percentage of all high school seniors who expected to complete at least some college rose from 81 percent in 1972 to 95 percent in 1992.¹⁷

Yet, the actual college performance of many high school graduates falls short of their expectations. In 1999, only 63 percent of high school graduates enrolled in a two-year or four-year college in the fall immediately after high school, up from 49 percent in 1972.¹⁸ And college completion rates for those who enroll are very low. David Boesel and Eric Friedland, of the U.S. Department of Education, reviewed various estimates of four-year college completion rates and concluded that "somewhere around half of the freshmen entering four-year colleges eventually graduate."¹⁹ Two-year college completion rates may be even worse.²⁰ Using a longitudinal

¹³John Wirt et al., *The Condition of Education 2001* (Washington, D.C.: National Center for Education Statistics, 2001), 137, available from: <http://nces.ed.gov/pubs2001/2001072.pdf>, accessed February 4, 2002.

¹⁴Wirt et al., 2001, 32.

¹⁵See generally Richard J. Murnane and Frank Levy, *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy* (New York: Free Press, 1996), 3; David Boesel and Eric Friedland, *College for All? Is There Too Much Emphasis on Getting a 4-Year College Degree?* (Washington, D.C.: National Library of Education, January 1999), available from: <http://www.ed.gov/pubs/CollegeForAll/>, accessed March 6, 2002.

¹⁶Wirt et al., 2001, 140.

¹⁷Boesel and Friedland, 5.

¹⁸Wirt et al., 2001, 46.

¹⁹Boesel and Friedland, 14.

²⁰The two-year and four-year college completion rates cited here are not comparable, but using data from the High School and Beyond longitudinal survey of the class of 1982, James Rosenbaum found that high school seniors who plan to get an associate's degree are even less likely to have achieved this goal within ten years than are high school seniors with plans to get a bachelor's degree. See Rosenbaum, 66–67.

survey of postsecondary students, the National Center for Education Statistics (NCES) estimated that only 15 percent of students who enrolled in community college in 1995–1996 with the expectation of gaining an associate’s degree had achieved that goal by 1998. By that year, 6 percent had earned a certificate instead, 39 percent were still enrolled at a two-year or four-year institution, and 41 percent had left without earning a degree or certificate.²¹

Why these dismal college completion rates? A major reason is that many students enter college woefully unprepared, sometimes in need of remedial education. Using the National Educational Longitudinal Survey, Lutz Berkner and Lisa Chavez concluded that about 11 percent of 1992 high school graduates who were enrolled in four-year colleges were either not qualified to attend or were only marginally so, and another 13 percent were “minimally qualified.”²² High school grades and standardized test scores are among the best predictors of whether a student completes college. A high school graduate with an average of C+ and total SAT scores of 700 to 849 who enters a four-year college has only a 25 percent chance of “eventually” receiving a bachelor’s degree.²³ In 1982, only 14 percent of high school seniors with grade point averages of C or lower who planned on attending college had succeeded in getting an associate’s degree or higher within ten years of high school graduation.²⁴ Yet, many high school students seem to be unaware of the importance of gaining the skills (attested to by a good high school record) needed for college success. In a survey of a random sample of more than two thousand high school seniors throughout the Chicago metropolitan area between 1992 and 1994, Northwestern University sociologist James Rosenbaum found that 44 percent of the students who planned on college agreed with the statement that “even if I do not work hard in high school, I can still make my future plans come true.”²⁵

These students are correctly perceiving their chances of *enrolling* in colleges. Kenneth Gray and Edwin Herr of Pennsylvania State University point out that the United States leads the world in the percentage of young people who enter a four-year college. The authors attribute this in part to colleges’ tendency to admit unqualified students to fill their oversupply of slots and the awarding of financial aid based on need instead of merit.²⁶ Community colleges are even easier

²¹Wirt et al., 2001, 47.

²²Lutz Berkner and Lisa Chavez, *Access to Postsecondary Education for the 1992 High School Graduates* (Washington, D.C.: National Center for Education Statistics, October 1997), 28, available from: <http://nces.ed.gov/pubs98/access/98105.pdf>, accessed January 31, 2002.

²³Alexander W. Astin, Lisa Tsui, and Juan Avalos, *Degree Attainment Rates at American Colleges and Universities* (Los Angeles, Calif.: University of California, Los Angeles, Graduate School of Education, Higher Education Research Institute, 1996), as quoted in Boesel and Friedland, 40.

²⁴Rosenbaum, 66.

²⁵Rosenbaum, 61.

²⁶Kenneth Gray and Edwin Herr, *Other Ways to Win: Creating Alternatives for High School Graduates* (Thousand Oaks, Calif.: Corwin Press, 2000), 32–33, 88.

to get into. According to Rosenbaum, “Admission standards are now practically nonexistent in community colleges. For example, Illinois high school graduates can attend a community college even if they have D-average grades and no college prep courses.”²⁷ These students are apparently unaware, however, that their chances of completing college are much less than their chances of enrolling.

A study by Gray and his colleagues suggests that enrolling in a four-year college may not always be the best course of action for some students. They studied the secondary and postsecondary experiences of all 1991 graduates of seven public high schools in affluent suburban districts. The authors found that on graduation from high school, almost half the students failed to meet what the authors identified as the minimal criteria for being prepared to do college academic work (defined as having a C average, a combined SAT score of 800, and a minimal sequence of college preparatory courses). The authors then studied the experiences of the 601 “non-competitive” students who did not meet these criteria. A year after high school graduation, about 56 percent of the latter group were full-time students, and about half of the full-time students were in four-year colleges. Of the noncompetitive students who went on to higher education, the average freshman year GPA was C; 46 percent reported having to take one or more remedial courses, which typically do not count toward a degree. In light of these mediocre outcomes, it is not surprising that only about half of the noncompetitive students who went on to higher education returned as sophomores after their freshman year. The authors also found that 46 percent of these students were receiving financial aid, a sobering statistic in view of their high dropout rate and the possibility that many had taken on loans with the expectation that the higher earnings accruing from college graduation would help to repay them.²⁸

The unrealistic plans of many high school students are not cost free, as Rosenbaum and Stephanie Alter Jones of Northwestern University point out:

Thus, over half of college planners are likely to get no economic benefit from college. These students will therefore end up having only their high school diplomas to bring to the labor market. Of course, in high school, students do not anticipate that this will happen (even though it is highly predictable), so these work-bound students are “unidentified.” As such, they are less likely to prepare themselves for their subsequent risk of failure, to have back-up plans, to get back-up preparation, or to get help in finding jobs from their high schools.²⁹

²⁷Rosenbaum, 65.

²⁸Kenneth Gray, Wen-Jyh Wang, and Sharon Malizia, “Is Vocational Education Still Necessary? Investigating the Educational Effectiveness of the College Prep Curriculum,” *Journal of Industrial Teacher Education* 32 (2) (1995): 6–29.

²⁹James E. Rosenbaum and Stephanie Alter Jones, “Interactions between High Schools and Labor Markets,” in *Handbook of the Sociology of Education*, edited by Maureen T. Hallinan (New York: Kluwer Academic/Plenum Publishers, 2000), 416.

Moreover, many leave college saddled with burdensome loan repayments. One of the most important consequences of this unrealistic planning, however, is that many students ignore CTE programs that might be a better choice for them.

The Importance of Non-College Careers

Even today, most jobs do not require a college degree. Of the total job openings between 2000 and 2010, the Bureau of Labor Statistics (BLS) projects that 70 percent will require no postsecondary education. An additional 9 percent will require an associate's degree or postsecondary vocational award. Only 21 percent will require a bachelor's degree or higher.³⁰

Those who say that all young people should go to college often point to the fastest-growing occupations rather than those that generate the most openings.³¹ For example, of the thirty occupations that will grow the fastest between 2000 and 2010, 70 percent generally require postsecondary education or training.³² However, job growth tells only part of the story. First, more jobs are created by the need to replace workers who move up, move on, or retire than by growth.³³ Between 2000 and 2010, for example, the BLS projects that 35.8 million jobs will result from replacement needs, as compared with only 22.2 million from employment growth.³⁴ Second, a fast-growing job will generate few openings if the original number of positions in that field was small. Thus, of the thirty occupations that will generate the most job openings over the decade, only 23 percent of these occupations will require postsecondary education or training.³⁵

Comparing the supply as well as the demand for workers with different types of education and training also suggests an oversupply of college-educated workers and a shortage of those with technical training. It is difficult to compare job openings with the numbers of degrees or other educational credentials awarded for many reasons, including the fact that many fields of study can lead to a wide variety of occupations, and others cannot be precisely matched with any specific occupations. However, Alan Eck of the BLS attempted to compare job openings with degrees or certificates in the relevant area and found that “in most construction

³⁰Daniel E. Hecker, “Occupational Employment Projections to 2010,” *Monthly Labor Review* 124 (11) (November 2001): 57–82, available from: <http://www.bls.gov/opub/mlr/2001/11/art4full.pdf>, accessed February 1, 2002.

³¹See, for example, Richard L. Lynch, *New Directions for High School Career and Technical Education in the 21st Century* (Columbus, Ohio: ERIC Clearinghouse on Adult, Career and Vocational Education, 2000), 23, available from: http://www.ericacve.org/mp_lynch_01.asp, accessed February 1, 2002.

³²Hecker, 57–82.

³³Hecker, 57–82.

³⁴Hecker, 57–82.

³⁵Unpublished data from Bureau of Labor Statistics Web site, available from: <http://www.bls.gov/asp/oepl/oepl/empoccp.as>

crafts, and in many mechanic and repairer occupations, the number of job openings projected from 1990 to 2005 is much greater than the number of education and training awards received in 1989–90.” In the broad group of “precision production, craft and repair occupations,” only 133,000 degrees and awards were projected in 1989–90, in contrast to the 455,000 annual average job openings that were expected to occur between 1990 and 2005. Of course, some of these jobs may not require any training except that obtained on the job; Eck, however, argues that additional training may be appropriate and useful for many of these workers.³⁶

Although the job openings in the crafts fields far surpassed degrees and awards, Eck found that the number of total degrees and awards appropriate for executive, administrative, and managerial occupations was projected to be approximately about 116 percent of the number of job openings for people with this training. Moreover, the number of degrees awarded for professional specialty occupations was almost twice the number of openings projected for people with such degrees.³⁷

As a result of these imbalances between supply and demand, many college graduates may find themselves “underemployed”—working in jobs that do not require a college degree. Eck analyzed respondents’ answers in the January 1991 Current Population Survey about whether they needed specific skills or training to get their current jobs. He found that 25 percent of the employees were four-year college graduates, but only 16 percent of them reported needing training in a four-year or longer college program to qualify for their job. According to Eck, “This indicates that about 1 in 3 college graduates may have acquired training that is not being used in his or her current job.”³⁸ This result is consistent with another BLS study conducted by Eck.³⁹ Some of these students may have done better if they had not spent the money on four-year college and instead obtained high school or postsecondary CTE that could have helped them obtain a better job. Recognizing this reality, an increasing number of college graduates are entering associate’s degree or certificate programs in technical fields at community colleges with the hope of finding a better job.⁴⁰

Gray and Herr suggest that many students and parents, even knowing that there are too many college graduates, are afraid that college graduates will displace nongraduates in jobs that do not currently require a college degree. But the authors believe that it is unlikely that firms will

³⁶Alan Eck, “Job-Related Education and Training: Their Impact on Earnings,” *Monthly Labor Review* 116 (10) (October 1993): 21–38, available from: <http://www.bls.gov/opub/mlr/1993/10/art2full.pdf>, accessed February 28, 2002.

³⁷Eck, 21–38.

³⁸Eck, 21–38.

³⁹Eck, 21–38.

⁴⁰Gray and Herr, 89, 93–94.

prefer a college graduate to a nongraduate who has the technical skills required for the job.⁴¹

Of course, on average, jobs that actually require more education pay more. In 2000, jobs requiring a bachelor's degree or higher paid on average \$56,553 per year, compared with \$25,993 for those requiring work-related training only.⁴² A substantial proportion of careers requiring less than a college degree, however, pay more than many jobs that require a college degree. More than nine million, or 15 percent, of full-time wage and salary workers aged twenty-five and older without a bachelor's degree earned more than \$821 per week in 1998—the median for college graduates. In this age group, 38 percent of workers without bachelor's degrees earned more than \$572 per week, the median for all workers. Even among workers aged twenty-five to twenty-nine, who do not benefit from years of experience and seniority, 24 percent earned \$572 or more per week, and about 7 percent earned \$821 per week.⁴³ Among the largest groups of workers with less than a bachelor's degree making more than \$821 per week are truck drivers (383,000), supervisors and proprietors in sales occupations (365,000), electricians (203,000), production supervisors (269,000), and computer systems analysts and scientists (196,000).⁴⁴

BLS projections provide numerous examples of occupations that do not require a four-year college degree, have minimum earnings in the top half of the earnings distribution, and are expected to generate at least twenty thousand annual job openings between 2000 and 2010. These include: registered nurses and computer support specialists (usually requiring an associate's degree); carpenters, electricians, and maintenance and repair workers (requiring long-term on-the-job training); truck drivers, wholesale and manufacturing sales representatives, and executive secretaries (requiring moderate-term on-the-job training); first-line retail supervisors, first-line office supervisors, first-line managers in construction and extraction industries, and first-line production managers (requiring experience in a related occupation); and automotive service technicians, licensed practical nurses, and welders (requiring a postsecondary vocational award).⁴⁵

Many of these highly paid non-college jobs fall into one of the major occupational categories used by the U.S. Department of Labor: precision, production, craft, and repair occupations. Only managerial and professional occupations exceeded these occupational groups in their 1999 weekly earnings. And “technicians and related support occupations,” many of

⁴¹Gray and Herr, 98–99.

⁴²Hecker, 57–82.

⁴³Matthew Mariani, “High-Earning Workers Who Don’t Have a Bachelor’s Degree,” *Occupational Outlook Quarterly* 43 (3) (Fall 1999): 11, available from: <http://www.bls.gov/opub/ooq/1999/Fall/art02.pdf>, accessed February 1, 2002.

⁴⁴Mariani, 9–15.

⁴⁵Unpublished data from Bureau of Labor Statistics Web site, available from: <http://www.bls.gov/asp/oeq/noeted/empoccp.as>

which also do not require a college degree, had the next highest median earnings.⁴⁶ “The nation needs technicians, not a flock of discontented young adults who hold worthless baccalaureate degrees and have no job prospects,” argues Gray, a proponent of a revitalized CTE based on preparation for two-year college.⁴⁷ Gray and Herr also note that women, African Americans, and Hispanics are all underrepresented in these occupational groupings.⁴⁸

BLS data analyzed by Eck shed some light on the high earnings of these craft and technical workers. These jobs generally require high levels of training to qualify for the job or to improve skills once on the job. Looking at the utilization of education and training, Eck found that “the proportion of precision production, craft, and repair workers using training (74 percent) and their earnings are exceeded only by those of managerial and professional specialty occupations.”⁴⁹ The BLS data also show that “for all education groups, earnings are higher in jobs that generally require qualifying training or jobs in which training is taken to improve skills.” In addition, “high school graduates who reported that they had both types of training earned slightly more than college graduates with neither type of training.”⁵⁰

Anecdotal information illustrates both the availability of jobs and the difficulty of attracting students to CTE. The *Evansville (Indiana) Courier and Press* reports that “there are plenty of good-paying, interesting, challenging jobs out there for qualified high school graduates. . . . Many . . . vocational education teachers report that businesses start contacting them in August about hiring students who won’t be graduating until May.” Unions come to Evansville’s North High School to recruit apprentices. “We can’t find enough bricklayers,” a union representative is quoted as saying, despite the fact that apprentices start at \$11.05 an hour, receive a four-year training program at no cost, and receive regular increases in pay.⁵¹ News reports from other areas also indicate that employers are having difficulty filling skilled positions that do not require college.⁵² As one employer put it, “As an employer for the past 33 years I can

⁴⁶Randy Ilg and Steven Haugen, “Earnings and Employment Trends in the 1990s,” *Monthly Labor Review* 123 (3) (March 2000): 23; Gray and Herr, 105.

⁴⁷Kenneth Gray, “Vocationalism and the American High School: Past, Present, and Future?” *Journal of Industrial Teacher Education* 33 (2) (1996): 91.

⁴⁸Gray and Herr, 39–40.

⁴⁹Eck, 36.

⁵⁰Eck, 21–38.

⁵¹Patricia Swanson, “Vocational Ed: Many Well-Paying Jobs Await Graduates,” *Evansville (Indiana) Courier and Press*, March 12, 2001.

⁵²Peter Simon, “Trade-School Blues: Harsh Audit Inspires Plan for Reform,” *Buffalo News*, February 18, 2001, 1A; Brian Kates, “Trade Schools Fall through the Cracks,” *New York Daily News*, July 22, 2001, 30; Angela Gonzalez, “Labor Pains: Valley Employers Call for More Vocational Training in Schools,” *Business Journal*, May 11, 2001, vol. 21, no. 33, 35; Jill Hoffman, “Vocational Ed Mixes Old, New-Style Skills,” *Roanoke Times and World News*, October 13, 2001, NRVI; Sherry Jones, “More Jobs than Workers/Skills Unfilled,” *Wilmington*

tell you, as can scores of other employers, that it is easier to find and hire a college graduate without any specific marketable skills than a qualified technician. The skilled technician, when found and hired, generally earns a higher income than many college graduates.”⁵³ According to a president of the New York State Building and Construction Trades Council:

The New York City schools are not meeting the needs of our industry. The schools are not supplied with up-to-date equipment and material, and the students are not always well-prepared. We have expressed our concerns to the Board of Education, but vocational education is just not a priority. According to the secretary of the city’s Central Labor Council, “Vocational education has been under attack for years. It’s gone through transitions and redesigns and funding cuts. In the meantime, we are desperate for plumbers and auto mechanics and electricians.”⁵⁴

The director of economic development policy for the Greater Phoenix Chamber of Commerce told a reporter that “auto mechanics, plumbers, machinists and other occupations that require some technical training are in demand, but few high school students are getting the message that a good auto mechanic with the right computerized training can make a six-figure income.” She described the plight of students who graduate from high school with “no workable skills because their high school curriculum prepared them for college. . . . They have a diploma in their hand but no marketable skills. There’s a gap of those jobs that need to be filled that aren’t being filled. A lot of those kids are working at McDonald’s.”⁵⁵

What Employers Really Want

Many researchers have argued that changing business practices and the shift to a service economy from one based on manufacturing have increased the need for basic academic and social skills among frontline workers while reducing the need for specific occupational skills. Others argue that occupation-specific skills are still important.⁵⁶ Our knowledge of what employers actually want is based on several types of studies. Among the most important are surveys of employers, ethnographic studies documenting what people actually do on the job, studies in personnel psychology attempting to correlate job performance with various personality characteristics, and econometric studies of returns to different levels of education and other

Morning Star, April 13, 2001, 1B, 3B.

⁵³Swanson.

⁵⁴Kates, 30.

⁵⁵Gonzalez, 35.

⁵⁶See, for example, John Bishop, “Expertise and Excellence,” Cornell University, Center for Advanced Human Resource Studies Working Paper, Cornell University, Center for Advanced Human Resource Studies, Ithaca, N.Y., 1995, 31–35, available from: <http://www.ilr.cornell.edu/depts/cahrs/PDFs/WorkingPapers/WP95-13.pdf>, accessed February 1, 2002.

experiences.⁵⁷

These studies paint a mixed picture of the types of skills that jobs require. Studies in personnel psychology suggest that general cognitive ability is the strongest predictor of job performance.⁵⁸ Econometric analysis suggests that basic academic skills, particularly math skills, are good predictors of wage rates.⁵⁹ And surveys and ethnographic work indicate that basic academic skills affect job performance and are important to employers.⁶⁰ The “academic” skills that employers want for good jobs, however, are often not college-level skills, but rather the ninth- or tenth-grade reading, writing, and math skills—skills that should be learned at the high school level, not in college.⁶¹ Surveys and ethnographic studies also suggest that employers place great value on motivation and attitude, as well as generic skills (such as communication) that may or may not be learned in school.⁶² There is also evidence from the testing literature and employer surveys that, at least for some occupations, job-specific knowledge and skills are an important factor in employer hiring decisions and job performance.⁶³ In total, the evidence suggests that employers value not only academic skills, generic work skills, and work attitudes but also the kind of specific occupational skills that CTE traditionally provides. Norton Grubb,

⁵⁷Cathleen Stasz and Dominic Brewer, *Academic Skills at Work: Two Perspectives* (Berkeley, Calif.: National Center for Research in Vocational Education, May 1999), available from: <http://www.nccte.org/publications/ncrve/mds-11xx/mds-1193.html>, accessed February 1, 2002.

⁵⁸David Boesel et al., *National Assessment of Vocational Education: Final Report to Congress: Volume II: Participation in and Quality of Vocational Education* (Washington, D.C.: U.S. Department of Education, July 1994), 143; John E. Hunter and Ronda F. Hunter, “Validity and Utility of Alternative Predictors of Job Performance,” *Psychological Bulletin* 96 (1) (1984): 72–98.

⁵⁹John Bishop, *Schooling, Learning and Worker Productivity* (Ithaca, N.Y.: Cornell University Institute for Labor Relations, 1994); Richard J. Murnane, John B. Willett, and Frank Levy, “The Growing Importance of Cognitive Skills in Wage Determination,” *Review of Economics and Statistics* 77 (2) (May 1995): 251–66.

⁶⁰Harry J. Holzer, *What Employers Want: Job Prospects for Less-Educated Workers* (New York: Russell Sage Foundation, 1996), 47–50; W. Norton Grubb et al., *Between and Between: Education, Skills, and Employment in Sub-Baccalaureate Labor Markets* (Berkeley, Calif.: National Center for Research in Vocational Education, December, 1992), 50–53, available from: <http://www.nccte.com/publications/ncrve/mds-04xx/mds-470.html>, accessed January 31, 2002; Peter Cappelli and Nikolai Rogovski, *Skill Demands, Changing Work Organization, and Performance* (Philadelphia, Pa.: National Center on the Educational Quality of the Workforce, 1995); Rosenbaum, 114–31; Stasz and Brewer.

⁶¹See previous note, as well as Rosenbaum, 267.

⁶²Karen Levesque et al., *Vocational Education in the United States: Toward the Year 2000* (Washington, D.C.: National Center for Education Statistics, February 2000), 25, available from: <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000029>, accessed February 1, 2002; Holzer, 57–62; Grubb et al., 48–49.

⁶³Hunter and Hunter, 72–98; Grubb et al., 55; Bishop, 1994; John E. Hunter, “A Causal Analysis of Cognitive Ability, Job Knowledge, Job Performance, and Supervisor Ratings,” in *Performance Measurement and Theory*, edited by Frank Landy, Sheldon Zedeck, and Jeanette Cleveland (Hillsdale, N.J.: Lawrence Erlbaum Associates Publishers, 1983).

of the University of California, Berkeley’s Graduate School of Education, and his colleagues suggest that there is a contradiction in what employers want:

On the one hand, employers value highly job-specific skills—skills which are sometimes too specific to be taught in education institutions and which must be learned on the job. They then look for experience in using those skills . . . and for educational programs that are as specific to their production processes as possible. . . . On the other hand, employers complain about the lack of general and “academic” capacities, including the abilities to read, write, and communicate in other ways; the ability to understand and apply math in unfamiliar settings; and other “basic” capacities that are more likely to be taught in more general school-based programs.⁶⁴

The Promise of CTE

CTE is a promising strategy for addressing the difficulties faced by high school dropouts and graduates who seek jobs or attend college without adequate preparation. Through contextual learning and connections with adult mentors, CTE can engage students who otherwise might lose interest in school. By providing linkages to employers and a tryout period for new high school graduates, CTE can enhance the chances of finding good jobs that lead to rewarding careers.

Learning in context. Even if employers did not value specific vocational skills, career-related education might be a good way of teaching all of the other skills that are valued by employers: academic skills, computer skills, and basic work behaviors. Teaching these skills in a vocational context may be effective in engaging some students in learning who would not otherwise be so engaged. As Richard J. Murnane, of Harvard University’s Graduate School of Education, and Frank Levy, of Massachusetts Institute of Technology, put it, youth apprenticeships and career academies that teach these skills in an occupational context can motivate some students to pursue a “hidden agenda of mathematics, communication, and problem solving.”⁶⁵ Learning within a career-related context can help students see the relevance of what they are studying, as well as help them gain confidence in their ability to perform in school and on the job. According to Robert Lerman of the Urban Institute, “For disconnected students to become invested in their learning, the payoff to learning must become clearer and more immediate and, ideally, must reorient an entire peer group.”⁶⁶ And, as James McPartland and Will Jordan of Johns Hopkins University put it, “Students who see the relevance of their curriculum to their own goals and are studying things they have chosen to learn are more likely to have a good reason to come regularly to school and to be willing to put attention and effort

⁶⁴Grubb et al., 55.

⁶⁵Murnane and Levy, 121–22.

⁶⁶Lerman, 199.

into their schoolwork.”⁶⁷

A career-oriented approach could clarify the connection between schooling and careers for young people who presently see no reason to do well in school. CTE could also help students develop the types of work habits and social skills that are important to employers. On the basis of interviews with 110 vocational teachers in twelve diverse high schools, Rosenbaum found that many vocational teachers “use their knowledge of work demands to teach work habits and social skills in their classes.”⁶⁸

Connections to employers. By improving the formal system of placement in training and jobs, programs that coordinate CTE with internships and other types of work-based learning can reduce the relative disadvantage of poor youth who lack the informal channels to jobs that their middle-class counterparts enjoy. Many employers use word of mouth and other informal channels to hire new employees.⁶⁹ Because many non-college-bound students come from disadvantaged families, they often have few connections to employers, making the channels provided by school particularly important.⁷⁰ CTE teachers can link their students with employers who have good jobs to offer. Rosenbaum found that some teachers develop trusting relationships with employers and use these relationships to learn employers’ needs and match their students to jobs. Moreover, they are sometimes able to persuade employers to hire students whose credentials do not look impressive or to hire women or minorities into positions formerly held by white men.⁷¹

Adult mentors. CTE classes and work-based learning programs such as internships can ameliorate the sometimes destructive influence of peer groups by connecting youths with adult mentors. Such connections with caring adults can provide crucial support to a young person trying to resist peer pressure to engage in drug use, membership in a gang, or other self-destructive behaviors. As Lerman puts it, “School-to-career programs lead to a natural mentoring process in which the mentor-trainer has a stake in the success of the apprentice not only at the work site but in academic studies as well.”⁷²

Tryout period. One survey of employers in four cities found that roughly 70 percent of

⁶⁷James McPartland and Will Jordan, *Essential Components of High School Dropout Prevention Reforms* (Baltimore, Md.: Johns Hopkins University, 2001), 4, available from: <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/mcpartland.html>, accessed February 1, 2002.

⁶⁸Rosenbaum, 279.

⁶⁹Holzer, 51.

⁷⁰Lerman, 205.

⁷¹Rosenbaum, 233–36.

⁷²Lerman, 205–6.

available jobs require general work experience and that about 73 percent require references.⁷³ A school-based internship gives students an opportunity to gain both the experience and the references they need.⁷⁴ Work-based learning programs that typically form part of a CTE program also give young people who might otherwise be adversely affected by negative employer stereotypes a tryout period in which they can demonstrate their potential. Without such a tryout period, minorities and disadvantaged youths are often the victims of negative stereotypes held by employers.

Background

CTE, originally known as “vocational education,” or “voc ed,” arose in response to the need for skilled workers in manufacturing industries and the entry of working-class students into high school. But vocational education eventually lost popularity in the United States due to an increased emphasis on academic skills and a belief in college for all, coupled with a perception that vocational education was becoming an educational backwater for the disadvantaged. By contrast, in many European countries, CTE is a respected option that is directly linked to good jobs.

History

The earliest roots of CTE can be traced to a debate over “manual education” after the Civil War, which was part of a broader movement to address the social problems caused by industrialization.⁷⁵ Some educators began to advocate manual education as a special form of education for the newly freed African American population in the South. Despite being freed from slavery, African Americans entered a society where they received little additional respect, and yet were forced to support themselves as free men. To help gain their economic footing, they became either indentured servants or mortgaged their crops.⁷⁶ Prominent African American leaders such as Booker T. Washington and W.E.B. DuBois saw education as the way to elevate African Americans from their post-slavery position. But they differed on the kind of education needed, thus initiating the long standing the debate over CTE.

After the Civil War, African Americans found themselves in an economically disadvantaged position, many still living on plantations working for life’s basic needs.⁷⁷ From

⁷³Holzer, 54–55.

⁷⁴Lerman, 206.

⁷⁵Except where otherwise noted, the historical discussion is based on Marvin Lazerson and W. Norton Grubb, *American Education and Vocationalism* (New York: Teachers College Press, 1974).

⁷⁶Booker T. Washington, “The Awakening of the Negro,” *The Atlantic Monthly*, September, 1896, available from: <http://www.theatlantic.com/unbound/flashbks/blacked/washaw.htm>, accessed October 29, 2003.

⁷⁷Booker T. Washington, “The Awakening of the Negro,” *The Atlantic Monthly*, September, 1896, available from: <http://www.theatlantic.com/unbound/flashbks/blacked/washaw.htm>, accessed October 29, 2003.

Booker T. Washington's perspective, "industrial" education was needed to put African Americans on the path to improving their lives.⁷⁸

Our greatest danger is that in the great leap from slavery to freedom we may overlook the fact that the masses of us are to live by the productions of our hands, and fail to keep in mind that we shall prosper in proportion as we learn to dignify and glorify common labour and put brains and skill into the common occupations of life; shall prosper in proportion as we learn to draw the line between the superficial and the substantial, the ornamental gewgaws of life and the useful. No race can prosper till it learns that there is as much dignity in tilling a field as in writing a poem. It is at the bottom of life we must begin, and not at the top. Nor should we permit our grievances to overshadow our opportunities.⁷⁹

In *A New Negro for a New Century*, Washington and his co-editors wrote: "All education is good, but assuredly that is best which enables a man to fit in most readily with the conditions of life in which he finds himself."⁸⁰ From Washington's perspective, the education needed was one that would lead to economic prosperity: industrial education. In 1880, based on this thinking and his own experience with industrial education, Washington founded the Tuskegee Institute, which taught "labor that has an economic value," but more importantly "the dignity of labor."⁸¹ According to the "Nineteenth Annual Report of the Principal of the Tuskegee Normal and Industrial Institute, Tuskegee, Alabama: For the Year Ending May 31, 1900," training for students of Tuskegee spanned:

the following 28 industries, in addition to the religious and academic training:
Agriculture, Dairying, Horticulture, Stock raising, Blacksmithing, Brickmasonry, Carpentry, Carriage Trimming, Cooking, Architectural, Freehand and Mechanical Drawing, Plain Sewing, Plastering, Plumbing, Printing, Sawmilling, Founding, Housekeeping, Harnessmaking, Electrical Engineering, Laundering, Machinery, Mattress-making, Millinery, Nurse Training, Painting, Shoemaking, Tailoring, Tinning,

⁷⁸ Booker T. Washington, "Nineteenth annual report of the principal of the Tuskegee Normal and Industrial Institute, Tuskegee, Alabama : for the year ending May 31, 1900," American Memory Project, 1900, available from: http://memory.loc.gov/cgi-bin/query/D?aap:3:/temp/~ammem_8UdV::, accessed October 22, 2003.

⁷⁹Booker T. Washington, "The Atlanta Exposition Address" in *Up From Slavery: An Autobiography* (Electronic Text Center, University of Virginia Library, 1901).

⁸⁰Booker T. Washington, *A New Negro for a New Century*, (Chicago: American Publishing House, 1900), 92.

⁸¹Booker T. Washington, "The Awakening of the Negro," *The Atlantic Monthly*, September, 1896, available from: <http://www.theatlantic.com/unbound/flashbks/blacked/washaw.htm>, accessed October 29, 2003.

and Wheelwrighting.⁸²

By learning new skills through industrial education and, in turn, making economic contributions to society, Washington thought that the African American would eventually “find his way to the enjoyment of all his rights.”⁸³ Based on their condition at that time, however, to gain these rights the focus had to be on industrial education and economic prosperity.

W.E.B. DuBois, however, was harshly critical of Washington’s support of industrial education for its limited scope and focus on economics, while ignoring what DuBois saw as life’s higher goals. DuBois condemned Washington’s system of industrial education declaring, “Mr. Washington’s programme practically accepts the alleged inferiority of the Negro races.”⁸⁴

Mr. Washington distinctly asks that black people give up, at least for the present, three things,—First, political power, Second, insistence on civil rights, Third, higher education of Negro youth,—and concentrate all their energies on industrial education, and accumulation of wealth, and the conciliation of the South.⁸⁵

In contrast, DuBois envisioned an educational system for African Americans like that provided to whites. He advocated for a broader educational system that would “strengthen the Negro’s character, increase his knowledge and teach him to earn a living,” ultimately, educating the man as a whole and not just the worker.⁸⁶ This type of education, in DuBois’ mind, would give African Americans the means with which to fight against the racial divide of the country.⁸⁷ “Nevertheless, I insist that the object of all true education is not to make men carpenters, it is to

⁸²Booker T. Washington, “Nineteenth annual report of the principal of the Tuskegee Normal and Industrial Institute, Tuskegee, Alabama : for the year ending May 31, 1900,” American Memory Project, 1900, available from: http://memory.loc.gov/cgi-bin/query/D?aap:3:./temp/~ammem_8UdV:, accessed October 22, 2003.

⁸³Booker T. Washington, “The Awakening of the Negro,” *The Atlantic Monthly*, September, 1896, available from: <http://www.theatlantic.com/unbound/flashbks/blacked/washaw.htm>, accessed October 29, 2003.

⁸⁴W.E.B. DuBois, “Of Mr. Booker T. Washington and Others,” *The Souls of Black Folk* (Electronic Text Center, University of Virginia Library, 1903).

⁸⁵W.E.B. DuBois, “Of Mr. Booker T. Washington and Others,” *The Souls of Black Folk* (Electronic Text Center, University of Virginia Library, 1903).

⁸⁶ W.E.B. DuBois, “The Talented Tenth,” September 1903, available from: <http://teachingamericanhistory.org/library/index.asp?document=174>, accessed March 3, 2004.

⁸⁷As he writes in *Of the Training of Black Men*, African Americans needed “such human training as will best use the labor of all men without enslaving or brutalizing; such training as will give us poise to encourage the prejudices that bulwark society, and stamp out those that in sheer barbarity deafen us to the wail of prisoned souls within the Veil, and the mounting fury of shackled men.” W.E.B. DuBois, “Of Training of Black,” *The Atlantic Monthly*, September, 1902, p. 2-3, available from: <http://www.theatlantic.com/unbound/flashbks/blacked/dutrain.htm>, accessed March 3, 2004.

make carpenters men.”⁸⁸

This early history has left a legacy of antipathy toward CTE among some African American leaders and parents.⁸⁹

In the early part of the twentieth century, vocational education emerged as a response to the needs of the business community for skilled labor in industry and to the entry, for the first time, of large numbers of working-class students into high school. Federal aid to vocational education began in 1917 with the passage of the Smith-Hughes Act. The act required separate state boards, funds, teacher preparation and certification, students, and curriculum for vocational education.

Over time, fields of study matching specific industrial categories were developed, each with separate teacher certification programs and state administrators. As a result of vocational education’s separation from academic education, it was often not on the “radar screen” of educational policy makers, principals of comprehensive high schools, or school superintendents.⁹⁰ The conflict over whether vocational education should be provided in separate schools or in comprehensive schools was, in most places, ultimately resolved in favor of the comprehensive approach. Within comprehensive schools, vocational education evolved into a separate “track.” Critics of vocational education argue that students were often placed in the vocational track based on the educators’ subjective view of their prospects, which may have reflected class perceptions rather than an objective assessment of a student’s innate talents.

The focus of federal legislation shifted over the years to reflect a variety of concerns. For example, the emphasis shifted from reducing unemployment in the 1930's to assisting the war

⁸⁸W.E.B. DuBois, “The Talented Tenth,” September 1903, available from: <http://teachingamericanhistory.org/library/index.asp?document=174>, accessed March 3, 2004.

⁸⁹See, for example, Gregory N. Price, “The Idea of a Black University,” North Carolina Agricultural and Technical State University Department of Economics and Transportation/Logistics Working Paper, September 1999, 15, available from: <http://www.ncat.edu/~econdept/wp/ideabu.pdf>, accessed March 14, 2002, stating: “A vocational curriculum degrades men as rational beings and fails to equip them for the demands that a liberal society places on cultivated reason. If presumably educated black men are ill-equipped to participate in a valid intellectual culture, the likely consequence is the arrested development of black America. It is only through the language of the great texts and their manner of organizing reality and contextualizing the big questions, that the best and brightest of black America can continue to secure and expand upon the stake that black America has in liberal democracy.” See also Susan G. Foster, “Vocational Training for Blacks Debated,” *Education Week on the Web*, (Bethesda Md.: Education Week on the Web, December 14, 1981), available from: <http://www.edweek.org/ew/ewstory.cfm?slug=01140066.h01>, accessed March 14, 2002, stating: “Despite a longstanding philosophical disagreement among black educators about the value of vocational-education programs, and their view that racial discrimination prevails in such programs, many now argue that black students should be encouraged to enter the programs as a solution to growing unemployment in their age group. According to vocational educators meeting here last week, black students are not taking advantage of vocational-education programs as they should because such programs are viewed negatively in the schools and by the students’ parents.”

⁹⁰Lynch, 9–10.

effort in the 1940's, and aiding the shift to a peacetime economy in the 1950's. In the 1960s, a new concern about poverty was incorporated into the law with set-asides to serve poor and disabled students and those in economically depressed communities. The Carl H. Perkins Act, passed in 1984, set aside 57 percent of the federal grants to states for disadvantaged groups. In response to this legislative push and to the increasing emphasis on academics among other students, the percentage of poor and disabled students in vocational education increased in the late 1980s and 1990s.⁹¹

A growing concern about deficiencies in the academic skills of the American workforce gained momentum in the early 1980s with the publication of *A Nation at Risk*, in which the Commission on Excellence in Education called for higher standards and more rigorous academics in elementary and secondary school.⁹² States responded by increasing the academic courses required to graduate from high school and to be admitted to state colleges and universities.⁹³ The new academic focus and increased requirements led to declining vocational enrollments in the 1980s and 1990s.⁹⁴ High school officials in many states and communities began to stress college preparation for all students while reducing or dismantling vocational programs.⁹⁵ In California, one education official estimated that “about 60 percent of high school vocational programs have disappeared in the last 30 years.”⁹⁶

In 1994, the U.S. Department of Education issued the final report of the National Assessment of Vocational Education (NAVE), expressing concern that vocational education was becoming an educational backwater, a dumping ground for the economically disadvantaged and the disabled. The writers also expressed concerns about the quality of vocational education, citing “deficits in the formal education of teachers, insufficient homework in vocational courses, and inadequate requirements for vocational program completion.”⁹⁷ They found that most districts did not meet the federal requirements for a coherent sequence of academic and vocational courses. They argued that current vocational programs were too narrow and should be

⁹¹Lynch, 9–10.

⁹²U.S. Department of Education, National Commission on Excellence in Education, *A Nation at Risk: The Imperative for Educational Reform* (Washington, D.C.: U.S. Department of Education, 1983).

⁹³David Boesel and Laurel McFarland, *National Assessment of Vocational Education Final Report to Congress: Volume I: Summary and Recommendations* (Washington, D.C.: U.S. Department of Education, 1994), 11.

⁹⁴Levesque et al., 49–50.

⁹⁵Rosenbaum, 1, 83; Ferran Mane, “Trends in the Payoff to Academic and Occupation-Specific Skills: The Short and Medium Run Returns to Academic and Vocational High School Courses for Non-College-Bound Students,” *Economics of Education Review* 18 (1999): 434; Elizabeth Bell, “Hands-on Education,” *San Francisco Chronicle*, January 14, 2002, B1; Sandy Banks, “Let’s Talk Shop about Kids and Careers,” *Los Angeles Times*, February 12, 2002, Southern California Living, 1.

⁹⁶Bell, B1.

⁹⁷Boesel and McFarland, 15.

changed to focus on industries rather than occupations. They also recommended that vocational education should emphasize preparation for postsecondary education (including two-year colleges) for most students.⁹⁸

In response to this and other critiques (and the flight of students from vocational education), the vocational education community began to shift its philosophy to incorporate a greater focus on academic skills and preparation for postsecondary education.⁹⁹ The Perkins Acts of 1990 and 1998 reflected the new concerns by focusing on program improvement, standards, and academics. The set-asides for special populations were reduced, and states were required to provide data on key performance indicators.¹⁰⁰ In order to avoid the stigma attached to the name “vocational education,” the American Vocational Association (AVA) changed its name to the Association for Career and Technical Education (ACTE), urging its members to adopt the new nomenclature.¹⁰¹

In the same year that the NAVE report was released, Congress passed the School-to-Work Opportunities Act of 1994 (STWOA). This legislation reflected concern about youth who graduate high school and do not go on to college. The act states that the United States lacked “a comprehensive and coherent system to help its youths . . . make the transition from school to career-oriented work or to further education and training.”¹⁰² Congressional interest was spurred, in part, by favorable reports about European apprenticeship systems, which combine school-based instruction and workplace training for occupations that do not require a university education.¹⁰³ The act, which expired in 2001, provided funds for school-based learning centered around career majors that would integrate academic and vocational instruction, work-based learning, and “connecting activities such as matching students with work-based learning opportunities.”

An early evaluation report found two diverging views of the program’s purpose, based on a duality in the act itself. On one hand, STWOA, based on a concern about non-college-bound

⁹⁸Boesel and McFarland, 15–16, 21–23.

⁹⁹Morris Castellano and Samuel Stringfield, *Career and Technical Education Reforms and Comprehensive School Reforms in High Schools and Community Colleges: Their Impact on Educational Outcomes for At-Risk Youth* (Minneapolis, Minn.: National Research Center for Career and Technical Education, 2001), 13, available from: http://www.nccte.org/publications/infosynthesis/r&dreport/CTE%20Rfrms_Stringfield.pdf, accessed January 29, 2002.

¹⁰⁰Lynch, 10.

¹⁰¹Lynch, 2.

¹⁰²*School-to-Work Opportunities Act of 1994*, U. S. Public Law 103-239, 103rd Congress(May 4, 1994)..

¹⁰³Alan M. Hershey et al., *Expanding Options for Students: Report to Congress on the National Evaluation of School-to-Work Implementation* (Princeton, N.J.: Mathematica Policy Research, Inc., February 1999), 4, available from: <http://www.mathematica-mpr.com/PDFs/Expanding.pdf>, accessed February 1, 2002.

youth, emphasized structured programs incorporating career majors and the integration of academic and vocational education. On the other hand, STWOA stressed that programs should be available to all students, and authorized many nebulous activities, such as “career awareness and exploration” and “general workplace competencies,” designed to provide general background for all youth rather than specific occupational skills.¹⁰⁴ Based on surveys conducted in 1996 and 1997, evaluators found that most local programs—perhaps following the leadership of the federal government—emphasized such general activities, including job shadowing, work site visits, and career awareness classes. More intensive and specific programs, which might benefit non-college bound students, were less common. In part, this may have been due to the unpopularity of approaches that seem to lead students away from college.¹⁰⁵ By creating a whole new system rather than strengthening CTE—and then by emphasizing services for the broad student population rather than for those who are not college bound—Congress and the nation’s schools missed an opportunity to help non-college youth find their place in a changing economy.

Between 1982 and 1998, the percentage of students who completed a “vocational concentration” (defined as the completion of three or more credits in a single program area such as business) declined from 34 percent to 25 percent. Over the same period, the percentage of students completing a college preparatory curriculum increased from 9 to 39 percent, and the percentage having a “general education preparation” declined from 58 percent to 43 percent.¹⁰⁶ This implies that the percentage of students combining a vocational concentration with a college preparatory curriculum increased from less than 1 percent in 1982 to almost 7 percent in 1998¹⁰⁷—an increase that may reflect the development of new CTE programs that combine academic and vocational studies.¹⁰⁸

The decline in vocational course taking and concentration may have leveled off in recent years. The proportion of high school graduates who concentrated in a vocational area and the share of vocational credits as a percentage of total credits stayed the same between 1994 and

¹⁰⁴Hershey et al., 4.

¹⁰⁵Hershey et al.

¹⁰⁶See David Hurst and Lisa Hudson, *Changes in High School Vocational Coursetaking in a Larger Perspective* (Washington, D.C.: National Center for Education Statistics, 2001), available from: <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001026>, accessed February 1, 2002. A college preparatory curriculum is defined as the completion of at least four credits in English; three credits in mathematics at the algebra I level or higher; two credits in biology, chemistry, and/or physics; two credits in social studies with at least one credit in history; and two credits in a single foreign language. A general education curriculum is one that meets neither the vocational nor college preparatory criteria.

¹⁰⁷Mario Delci and David Stern came up with the identical result using a different database in *Who Participates in New Vocational Programs? A Preliminary Analysis of Student Data from NLSY97* (Berkeley, Calif.: National Center for Research in Vocational Education, November 1999), 26, available from: <http://www.nccte.org/publications/ncrve/mds-13xx/mds-1300.pdf>, accessed February 1, 2002.

¹⁰⁸Delci and Stern.

1998.¹⁰⁹ In some areas, vocational enrollment has risen in recent years, and there is even a shortage of slots at some vocational schools.¹¹⁰

The composition of CTE course taking has also changed. The NCES found that the decline in vocational course taking and concentration between 1982 and 1998 was due mainly to declines in the areas of trade and industry and business—which roughly correspond to occupations that “have experienced below-average growth rates since the early 1980s.”¹¹¹ In contrast, the researchers found that four vocational program areas—child care and education, health care, food service and hospitality, and technology and communications—had seen an increase in student concentrators as a percentage of all high school graduates. These areas have actually experienced above average growth rates. The authors conclude that “these findings suggest that changes in vocational coursetaking may at least in part reflect responses to labor market trends.”¹¹² On the other hand, the percentages of graduates concentrating in the areas of agriculture and renewable resources and marketing and distribution were essentially unchanged during the period, despite a higher-than-average growth in marketing and sales occupations and a relative decline in agricultural occupations over the period.¹¹³

Current Programs

Most U.S. high schools offer some CTE. One or more courses identified with CTE are offered in 93 percent of the nation’s public comprehensive high schools. Nearly all public comprehensive high schools offer general labor market preparation or family and consumer sciences. About 75 percent offer specific labor market preparation classes. In addition to CTE offered in comprehensive high schools, some states have area vocational centers where students attend part of the day or evening for specialized programs, attending their local comprehensive high school for their general or academic courses. A few states also have full-time vocational high schools that focus on CTE but offer academic and general courses as well. These high schools may be organized under occupational or industry themes and may be called magnet or

¹⁰⁹Hurst and Hudson. The 1998 data are based on the U.S. Department of Education’s 1998 High School Transcript Study. We compared these figures with the 1994 figures cited by Levesque et al.

¹¹⁰Alan Crowell, “Popularity in Vocational Education Creates Shortages,” *Central Maine Morning Sentinel*, May 20, 2001; Emily Shartin, “Demand Surging at Vocational Schools: More Students Seek Career Skills, Ignore Weak Academic Image,” *Boston Globe*, July 22, 2001, 1; Cathy Wilfong, “Demand Increases for Vocational Education Degrees,” *Chattanooga Times/Chattanooga Free Press*, June 3, 2001; Bell, B1; Jessica Wehrman, “Growing Demand for High School Vocational Courses,” *Scripps Howard News Service*, March 21, 2002; Josh Gohlke, “County Advances \$26M Vocational School Expansion; Plan Is to Boost Enrollment by 875,” *Record (Bergen County, N.J.)*, March 27, 2002, 102.

¹¹¹Hurst and Hudson, 2.

¹¹²Hurst and Hudson, 2.

¹¹³Hurst and Hudson mention that the “agriculture and renewable resources” category includes some nonfarm occupations, such as veterinary assistants and gardening assistants, that have grown over the period.

theme schools.¹¹⁴ There are also more than fifteen hundred “career academies,” which are separate schools, or schools within schools, that prepare students for a cluster of related occupations (such as health care, for example.)¹¹⁵

Vocational education has traditionally been divided into general labor market preparation (such as keyboarding and industrial arts), family and consumer sciences education (formerly home economics), and specific labor market preparation (such as agriculture, health care, and trade and industry). The specific labor market preparation categories used by NCES are agriculture and renewable resources, business, marketing and distribution, health care, public and protective services, trade and industry, technology and communications, personal and other services, food service and hospitality, child care and education, and “unidentified subject.” Each of these categories includes a number of more specific occupational programs, such as construction trades, which in turn may include still more specific subjects such as electricity or carpentry. The most popular field is trade and industry, with 9.8 percent of 1998 public high school graduates concentrating (accumulating three or more credits) in the field. Business, with 4.8 percent of high school graduates concentrating, was the next most popular. Agriculture, at 2.6 percent, technology and communications, at 2.2 percent, and health care, at 1.9 percent, drew the next largest groups of concentrators.¹¹⁶

In a recent study, NCES asked public secondary schools in 1999 about any programs they had that prepared students for twenty-eight selected occupations that fell under six broad occupational areas. NCES found that among all public secondary schools that offered at least one occupational program, the broad occupational areas most commonly offered were business and marketing (offered by 85 percent of the schools) and technical occupations (offered by 60 percent of the schools). About half of the schools offered at least one program in the other broad areas: mechanical occupations, the building trades, health/life sciences, and service occupations. The specific occupations for which programs were most commonly provided were accountant/bookkeeper, administrative assistant/secretary, drafter or CADD (computer-aided drafting and design) operator, carpenter, and automotive mechanic/technician.¹¹⁷

There has been considerable concern about gender inequities in vocational course taking.

¹¹⁴Levesque et al., 5–6.

¹¹⁵James J. Kemple and Jason C. Snipes, *Career Academy Impacts for Students at High Risk of Dropping Out* (New York: Manpower Demonstration Research Corporation, December 2000), 3, available from: <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/kemple.html>, accessed February 1, 2002.

¹¹⁶Hurst and Hudson. Results are based on the High School and Beyond Sophomore Cohort 1998 High School Transcript Study. The base of these percentages is all high school graduates, not just those concentrating in vocational education.

¹¹⁷Richard P. Phelps, Basmat Parsad, Elizabeth Farris, and Lisa Hudson, *Features of Occupational Programs at the Secondary and Postsecondary Education Levels* (Washington, D.C.: National Center for Education Statistics, June 2001), available from: <http://nces.ed.gov/pubs2001/2001018.pdf>, accessed February 21, 2002.

An analysis of 1992 national data show that female students are more likely to take classes in business, marketing, health, and home economics, whereas male students are more likely to take industrial and agricultural classes.¹¹⁸ In 2002, the National Women’s Law Center examined the gender breakdown of students in CTE programs in twelve states.¹¹⁹ On the basis of this review, the center concluded that young women remain clustered in programs that prepare them for low-wage, traditionally female careers, whereas young men are filling most slots in the programs that lead to “higher wage careers that can provide true economic self-sufficiency.”¹²⁰ For example, the center found that female students comprise 96 percent of the students enrolled in cosmetology, 87 percent of those studying child care, and 86 percent of those preparing to be health assistants in all twelve states. On the other hand, the center found that male students comprise 94 percent of those studying to be plumbers or electricians, 93 percent of those preparing to be welders or carpenters, and 92 percent of those studying automotive technologies. The center also found that this sex segregation results in substantial disparities between the wages earned by male and female CTE graduates. Young women enrolled in traditionally female CTE programs often have fewer opportunities to take advanced level classes and high technology programs and often receive “inferior instruction.”¹²¹ The center concluded that the pervasive concentration by gender in vocational classes is due to “[b]iased counseling, the provision of incomplete information to students on the consequences of their career training courses, sexual harassment of girls who enroll in nontraditional classes, and other forms of discrimination.”¹²²

Tech Prep is a special model of CTE that is offered in more than half of American comprehensive high schools.¹²³ A key component of Tech Prep is a formal articulation agreement between high schools and postsecondary institutions that provide for a pathway from one to the other. The original Tech Prep design included a “2 + 2” approach, encompassing grades 11 and 12 plus two years of postsecondary education. Other models have also come into being, including “2 + 2 + 2,” which incorporates an additional two years at a four-year college; “4 + 2,” which encompasses grades 9 to 12 as well as two years of college, and even “4 + 2 + 2,” which encompasses grades 9 to 12, two years at a two-year college, and two years at a four-year

¹¹⁸Mark Hugo Lopez and Andrea Hetling, “Participation in Vocational Education: Evidence from NELS:88” (unpublished paper prepared for the American Enterprise Institute, April 12, 1999).

¹¹⁹National Women’s Law Center, *Title IX and Equal Opportunity in Vocational and Technical Education: A Promise Still Owed to the Nation’s Young Women* (Washington, D.C.: National Women’s Law Center, June 2002), available from: <http://www.nwlc.org/pdf/TitleIXCareerEducationReport.pdf>, accessed June 7, 2002.

¹²⁰National Women’s Law Center, 3.

¹²¹National Women’s Law Center, 5.

¹²²National Women’s Law Center, 3.

¹²³Mary G. Visher et al., *School-to-Work in the 1990s: A Look at Programs and Practices in American High Schools* (Berkeley, Calif.: MPR Associates, Inc., August 1998), 9.

college.¹²⁴

CTE programs are usually offered as a sequence of courses supplemented by work-based learning experiences.¹²⁵ Work-based learning takes two basic forms: classic apprenticeship and work experiences tied to schooling. Classic apprenticeship generally gives trainees some of the rights and benefits of regular employees as well as some special entitlements.¹²⁶ School-based work experience, more commonly used in the United States, can take several forms, including job shadowing, service learning and unpaid internships, school-based enterprises, jobs, government-funded training, cooperative education, and paid internships.¹²⁷

In 1998, about 25 percent of high school graduates completed three or more credits in a single vocational area, which is the Department of Education's definition of concentration in vocational education.¹²⁸ About 39 percent had completed a college preparatory curriculum as defined by the National Center for Education Statistics. The largest group of students—43 percent—had completed neither a college preparatory curriculum nor a vocational curriculum.¹²⁹ As Gray and Herr put it, "*Thus, the largest group of students in high school are really in the general curriculum, meaning that they graduate neither prepared for college nor for full-time employment.*"¹³⁰

Moreover, Gray and Herr suggest that many students who complete a "college preparatory" program are not truly prepared for college, because the college preparatory program has bifurcated into two programs. According to them, "Honors" or Advanced Placement courses have replaced the college prep program of old; the "regular" college preparatory classes are

¹²⁴Bettina Lankard Brown, "Promising Tech Prep Outcomes," *The Highlight Zone: Research@Work 3* (2001), available from: <http://www.nccte.org/publications/infosynthesis/highlightzone/highlight03/highlight03-techprep.pdf>, accessed February 1, 2002.

¹²⁵Association for Career and Technical Education, *Frequently Asked Questions*, available from: <http://www.acteonline.org/faqs/faqs.html>, accessed February 1, 2002.

¹²⁶David Stern, Thomas Bailey, and Donna Merritt, *School-to-Work Policy Insights from Recent International Developments* (Berkeley, Calif.: National Center for Research in Vocational Education, December 1996), 25, available from: <http://www.nccte.com/publications/ncrve/mds-09xx/mds-950.html>, accessed February 1, 2002.

¹²⁷Lynch, 68.

¹²⁸Hurst and Hudson.

¹²⁹Hurst and Hudson. Some students had completed both a college preparatory and a vocational curriculum, so the percentages add up to more than 100 percent.

¹³⁰Gray and Herr, 48 (emphasis in original).

taught on a much lower level and do not really prepare students for college-level work.¹³¹

Certain groups of students are more likely to concentrate in CTE. In 1994, 29 percent of male public high school graduates were vocational concentrators, compared with 22 percent of their female classmates. Disabled and low-achieving students are more likely than others to be vocational concentrators. African American students are slightly more likely than whites and Hispanics to concentrate in CTE. Rural students are considerably more likely to concentrate in CTE than suburban or urban students. About 32 percent of rural 1994 graduates were CTE concentrators, compared with 22 percent of suburban graduates and 19 percent of urban graduates.¹³²

Quality concerns. CTE teachers and administrators have long complained about “dumping,” that is, the inappropriate placement of low-achieving students into their programs. The disproportionate share of disabled and disadvantaged students in CTE and the increase in their participation as a percentage of all CTE students have exacerbated these concerns. Several factors contribute to dumping. To offset the declines in CTE enrollment, schools have tried to recruit students to CTE. Low-achieving students are often easier to attract, in part because regular programs are more willing to see them go. Federal legislation has also encouraged the placement of “special population” students into CTE. In a survey performed for the 1994 NAVE, 44 percent of all school administrators and 55 percent of vocational school administrators rated the placement of problem students into vocational education programs regardless of appropriateness as a moderate to serious problem in their schools. Moreover, case studies of vocational education programs in local communities yield many examples of inappropriate placement, especially in vocational schools.¹³³

Relegating poorly performing students to CTE programs may make it more difficult to maintain program quality and rigor.¹³⁴ Surveys suggest that the vocational classes of the past were often undemanding. Fifty-four percent of students in vocational classes surveyed by the National Longitudinal Survey of Youth in 1987 rated these courses as very easy, a much higher percentage than students in any academic subjects.¹³⁵ The 1994 NAVE Teacher Survey revealed that only 59 percent of vocational classes assigned any homework. On average, vocational classes were about three-fifths as likely as academic classes to have homework, and the amount of homework assigned in vocational classes was about two-thirds the amount assigned in

¹³¹Gray and Herr, 48–49, 60–61, 84–85.

¹³²Levesque et al., 59–62.

¹³³Boesel et al., 25–27, 31.

¹³⁴Boesel et al., 35.

¹³⁵Bishop, 1995, 83.

academic classes.¹³⁶ According to John Bishop of Cornell University, the expectations for vocational students were too low, and as a result many vocational graduates lacked the skills that they needed to get good jobs.¹³⁷ There is evidence that dumping resulted in the stigmatization of vocational education, making it in turn more difficult to attract good students. In the 1994 NAVE report, the Department of Education found numerous examples of a downward spiral in which classes were made easier to accommodate poorer students, prompting a further exodus of higher achievers.¹³⁸

Quality concerns have led to an increased emphasis on standards and accountability in CTE, as in education in general. Schools have used several types of standards-related methods to attempt to improve quality. Most schools have adopted lists of “skill competencies” that students should obtain from their CTE courses. The NCES found that, in 1999, 78 percent of public secondary schools that offered at least one of the specific occupational programs it asked about had developed or adopted skill competency lists for all of their programs, and 95 percent had developed or adopted skill competencies for at least one program. These competency lists were most commonly developed by educators with input from industry.¹³⁹ Some schools also link their occupational programs to a credentialing process. NCES also found that 41 percent of schools with listed occupational programs prepared students for a state or industry regulatory exam in at least one of their programs, and 55 percent prepared students in at least one program to earn a school-awarded occupational skill certificate. These credentials are more common in certain fields than others. Some schools have also developed criteria to determine whether a student has completed an occupational program: 77 percent of schools had such criteria for all of their occupational programs. The most commonly used criterion was passing certain courses. Other criteria, such as exams or grade point averages, were used by only a minority of schools for any of their programs.¹⁴⁰

There has been considerable concern in past years that vocational education programs may be teaching outdated skills. There are several mechanisms that current programs use to keep up to date. The NCES asked schools about their use of five procedures to ensure that course content matches the skill requirements of the occupation. These procedures were industry advisory committees, surveys of employers’ skill needs, follow-up surveys of graduates, student work experience, and faculty “externships” (work experience). The researchers found that all of the procedures except faculty externships were employed by at least two-thirds of public

¹³⁶Boesel et al., 99.

¹³⁷Bishop, 1995, 84.

¹³⁸Boesel et al., 29–30.

¹³⁹Richard Phelps et al., *Features of Occupational Programs at the Secondary and Postsecondary Education Levels* (Washington, D.C.: National Center for Education Statistics, June 2001), 18, 21, 24, 25, available from <http://nces.ed.gov/pubs2001/2001018.pdf>, accessed February 21, 2002.

¹⁴⁰Phelps et al., 24.

secondary schools with occupational programs; almost half of the schools used faculty externships to ensure that courses teach appropriate job skills.¹⁴¹

Public Attitudes

From the limited amount of data available, it appears that the public supports the concept of CTE for students who are not bound for college. However, most parents prefer the college option for their own children. Moreover, CTE is seen as a poor quality option for the worst students. Let us examine these attitudes in more detail.

“CTE is worthwhile for those who are not college bound.” Public opinion data on CTE are very limited, but they suggest that most Americans support the concept of CTE for students who are not college bound. However, CTE appears to have less support among educators and leaders in business and government. For example, in a 1990 Gallup poll, 74 percent of the public would require that students who are not planning to go to college take “vocational training” in school, whereas only 29 percent would require such training for students who are college bound.¹⁴² Fifty-seven percent of the public says that it is “absolutely essential” for the schools to teach “practical skills for office or industry,” according to a 1995 survey by Public Agenda. But only one of every three leaders in business, government, media, and other sectors agreed, and the authors of the report cite other surveys suggesting that business leaders prefer that the school concentrate on “academics and good work habits.”¹⁴³

In Oregon, a 1995 poll showed that 56 percent of the general public and 53 percent of parents agreed that high school students should be “divided into a college-bound track and a professional-vocational track.” But only 43 percent of educational administrators and 28 percent of teachers agreed with this statement. Moreover, 67 percent of the general public, 68 percent of parents, and 72 percent of employers agreed that high schools should “be expected to provide the skills necessary for students to succeed in the workforce without a college education.”¹⁴⁴ Interestingly, in a 1996 Gallup poll, 67 percent of people surveyed thought that “more vocational or job training courses in public schools” would be very effective in reducing violence in the public schools, and another 25 percent thought it would be somewhat effective in reducing

¹⁴¹Phelps et al., 16.

¹⁴²Stanley M. Elam, “The 22nd Annual Gallup Poll of the Public’s Attitudes toward the Public Schools,” *Phi Delta Kappan* 74 (September 1990): 41–55.

¹⁴³Jean Johnson, *Assignment Incomplete: The Unfinished Business of Education Reform* (New York: Public Agenda, 1995), 22.

¹⁴⁴The Nelson Report, *Oregon Department of Education, Oregon Educational Act for the 21st Century, School to Work System* (Salem, Ore.: Public Affairs Counsel, May 18, 1995). Administrators and teachers were not asked the second question.

violence.¹⁴⁵

“*But my child should go to college.*” Despite favoring the general concept of CTE for youths who are not college bound, most parents seem to prefer college, and a traditional academic curriculum, for their own children.

- Ninety-eight percent of public and private school parents polled by Gallup and Phi Delta Kappa International in 1995 said they would like their oldest child to go on to college after graduating from high school; 82 percent of public and 85 percent of nonpublic school parents thought that their child would indeed attend college.¹⁴⁶ Similarly, 83 percent of parents in a 1995 Public Agenda poll said they expected their own children to attend college.¹⁴⁷
- A 1998 Public Agenda poll found that 86 percent of Americans believe that “high school graduates should go on to college because in the long run they’ll have better job prospects.” This is an increase from 79 percent in 1993.¹⁴⁸
- Eighty-two percent of teens believe they need a college degree to get a good job, and the majority seem determined that they will follow this path.¹⁴⁹ The percentage of all high school seniors who expected to complete at least some college rose from 81 percent in 1972 to 95 percent in 1992.¹⁵⁰

Lack of accurate labor market information may contribute to the high level of college expectations. In Washington State, most respondents to a telephone survey of 603 adults conducted in December 1996 estimated that more than 40 percent of today’s jobs require a four-year college degree, including nearly a quarter who put that figure at more than 60 percent. By contrast, the State Employment Security Department estimated that only about 19 percent of jobs

¹⁴⁵Stanley M. Elam, Lowell C. Rose, and Alec M. Gallup, “The 26th Annual Phi Delta Kappa/Gallup Poll of the Public’s Attitudes toward the Public Schools,” *Phi Delta Kappan* 76 (September 1994): 41–56.

¹⁴⁶Stanley M. Elam and Lowell C. Rose, “The 27th Annual Gallup Poll of the Public’s Attitudes toward the Public Schools,” *Phi Delta Kappan* 77 (September 1995): 41–56.

¹⁴⁷Johnson, 32.

¹⁴⁸John Immerwahr, *The Price of Admission* (San Jose, Calif.: The National Center for Public Policy and Higher Education, Spring 1998), 4.

¹⁴⁹Jean Johnson and Steve Farkas, *Getting By: What American Teenagers Really Think about Their Schools* (New York: Public Agenda, 1997), 12.

¹⁵⁰Boesel and Friedland, 5. Data are from the National Longitudinal Study of 1972 and the National Education Longitudinal Study of 1988, Second Followup.

required a college degree.¹⁵¹

A general prejudice against blue-collar jobs is part of the problem. The *Evansville (Indiana) Courier and Press* interviewed the son of an associate dean of a science and engineering school, who had to battle his family and teachers in order to go into high school's CTE program. He was too smart, and his SATs too high, to be an auto mechanic, he was told.¹⁵² The last high school bricklaying program in northern Virginia closed down in 2000 because students lacked interest, and enrollment in bricklaying programs is declining around the area, despite the fact that most skilled masons earn more than \$22 an hour.¹⁵³ Ironically, masonry was just added to the CTE offerings at Montachusets Regional Vocational Technical High School (in Massachusetts) with assistance from trade associations who had "a stake in getting more qualified masons into the work force because the lack of masons is causing architects to forgo using brick and concrete products in their designs."¹⁵⁴ As one CTE administrator put it, "Society has defined success as clean fingernails and that's hurting people."¹⁵⁵

Despite the desire of most parents that their children go to college, a majority of the public seems to believe that too many unqualified students are entering four-year institutions. For example, on the basis of a 1993 random sample telephone survey of residents of the continental United States, Public Agenda concluded that 77 percent of Americans think it is a problem that many young people are "wasting their time and money in college because they don't know what to do with their lives." Moreover, in another poll, 54 percent of Americans said that it was a problem that "too many people are going to college instead of alternatives to college where they can learn trades like plumbing or computer repair."¹⁵⁶

Many leaders in business, education, and government agree with the public that too many young people are going to college. Half of faculty members, 60 percent of business leaders, and slightly less than half of higher education administrators and government officials surveyed by Public Agenda in 1998 agree that "many young people are wasting time and money in college

¹⁵¹Washington State Workforce Training and Education Coordinating Board, *Education and Workforce Issues: Public Attitudes and Awareness, 1997* (Olympia, Wash.: Washington State Workforce Training and Education Coordinating Board, 1997), 17.

¹⁵²Swanson.

¹⁵³Jennifer Lenhart, "A Few Students Shy of a Load: N. Va. Schools' Last Bricklaying Program Dies for Lack of Interest," *Washington Post*, June 19, 2000, B1.

¹⁵⁴Anna L. Griffin, "School Cements Program; Monty Tech Will Offer Masonry," *Montachusett (Millbury, Mass.) Telegram and Gazette*, October 10, 2001.

¹⁵⁵Tracy Turner, "Vocational Careers in Spotlight at Anthis; Open House at Center Seeks to Change Public Perception," *Fort Wayne (Ind.) News Sentinel*, February 13, 2001, A1, final edition.

¹⁵⁶John Immerwahr and Steve Farkas, *The Closing Gateway: Californians Consider Their Higher Education System* (San Jose, Calif.: California Higher Education Policy Center, September 1993), 19.

because they don't know what else to do." Moreover, nearly 90 percent of the entire group said they "want to make trade and technical school a more appealing option for high school graduates who are not qualified for college."¹⁵⁷

"*CTE offers poor quality education.*" In addition to preferring the college preparatory option, many parents, students, and educators seem to have a negative view of CTE, seeing it as "dumbed down" and a "dumping ground" for poor students.¹⁵⁸ The National Dissemination Center for Career and Technical Education reported that, in a series of conference calls with CTE administrators, teachers, representatives of unions and business with an interest in CTE, and other interested parties to identify the major needs of CTE in the year 2000, participants most often mentioned the need to improve the image of CTE. "The underlying theme was the need to change the perception that CTE offers an inferior curriculum, appropriate only for those students who cannot meet the demands of a college preparatory program."¹⁵⁹ CTE's image problem has been recognized by the American Vocational Association (now ACTE), which dedicated three journal issues to this topic between 1987 and 1997.¹⁶⁰

Guidance counseling and job placement. Guidance counseling practices also contribute to the overemphasis on college. Whereas counselors in the 1960s saw their role as selecting only a limited number of students who should go to college, recent research suggests that they now advise college for almost everyone, steering students away from CTE and blue-collar jobs.¹⁶¹ The conference calls just described yielded comments such as "It is a common practice that, all too often, counselors and school administrators view career-technical education as a 'dumping ground' for problem or low achieving students, especially minorities." Some of the employers

¹⁵⁷John Immerwahr, *Taking Responsibility: Leaders' Expectations of Higher Education* (San Jose, Calif.: National Center for Public Policy and Higher Education and Public Agenda, 1999), 10–11. The questionnaire specified that "college" referred to both two-year and four-year institutions, so it is not clear what the respondents meant by "trade and technical school." Although some of the four-year-college staff may have been thinking of two-year schools, some respondents may have been thinking of trade schools that are not colleges.

¹⁵⁸Lynch, 18; A-Plus Communications and Jobs for the Future, *Understanding Attitudes about School-to-Career: A Review of Public Opinion Data* (Arlington, Va.: A-Plus Communications, 1997), 8.

¹⁵⁹Morgan V. Lewis, *Major Needs of Career and Technical Education in the Year 2000: Views from the Field* (Columbus, Ohio: National Dissemination Center for Career and Technical Education, The Ohio State University, April 2001), vi, available from: <http://www.nccte.org/publications/infosynthesis/r&dreport/Major%20Needs%20of%20CTE.pdf>, accessed January 29, 2002.

¹⁶⁰Deborah Bingham Catri, *Vocational Education's Image for the 21st Century* (Columbus, Ohio: ERIC Clearinghouse on Adult, Career and Vocational Education, 1998), available from: <http://www.ericacve.org/docgen.asp?tbl=digests&ID=41>, accessed February 1, 2002.

¹⁶¹James E. Rosenbaum, Shazia Miller, and Melinda Krei, "Gatekeeping in an Era of More Open Gates: High School Counselors' Views of Their Influence on Students' College Plans," *American Journal of Education* 104 (5) (August 1996): 257–79. See also Kates; Beverly A. Carrol, "Leaders: Vocational Training Needs Tout," *Chattanooga Times/Chattanooga Free Press*, October 16, 2001.

reported that they had attempted to interest students in preparing for their industries through career days, but that interested students were often discouraged by high school counselors from pursuing CTE.¹⁶² Evidence from longitudinal surveys indicates that between 1982 and 1992, the percentage of seniors who said their guidance counselors urged them to go to college doubled.¹⁶³ Most businesspeople interviewed for a recent report on the future of CTE “seem to believe that teachers and counselors guide students to consider 4-year colleges as the option to a good career and a successful life.”¹⁶⁴

A survey of twenty-seven counselors in eight Chicago metropolitan area high schools between 1992 and 1995 found that most of the counselors urged all students to attend college, even when they were not interested and did not like school or had extremely poor grades. Counselors did not tailor their recommendations according to students’ achievements or interests. Moreover, the majority of counselors were “reluctant to confront students who had unrealistic expectations regarding college or job plans.”¹⁶⁵ Instead, they allowed students to carry out their plans and let them find out for themselves that they were unrealistic, “regardless of the costs to those student in lost time, money, and effort.”¹⁶⁶ The researchers attribute counselors’ reluctance to provide realistic advice to pressure from parents who want their children to go to college. However, this study was based on a very small sample in a limited geographical area, so it cannot be assumed to represent schools in general. Moreover, it reports on counselors’ self-reported behaviors, not observation of their actual behaviors.¹⁶⁷

Another area in which guidance counseling often seems to fall short is in encouraging girls to take CTE courses in traditional male fields. According to the report from the National Women’s Law Center mentioned above, schools have not addressed the problem of career counseling that relies on gender stereotypes. The center found that in places including Los Angeles, guidance counselors often steer girls into traditionally female fields such as cosmetology.¹⁶⁸

Not only do many guidance counselors stress college for all, but they seem to be poorly equipped to help students who are not interested in college to find jobs. Many guidance counselors get no training in job counseling, have little knowledge of the job market for high

¹⁶²Lewis, 7.

¹⁶³Gray and Herr, 24.

¹⁶⁴Lynch, 50.

¹⁶⁵Melinda Scott Krei and James E. Rosenbaum, “Career and College Advice to the Forgotten Half: What Do Counselors and Vocational Teachers Advise?” *Teachers College Record* 103 (October 2001): 829.

¹⁶⁶Rosenbaum, 103

¹⁶⁷Krei and Rosenbaum; Rosenbaum, Miller, and Krei; Rosenbaum, 88–107.

¹⁶⁸National Women’s Law Center, 6.

school graduates, and lack contacts with employers.¹⁶⁹ It is thus not surprising that research suggests that guidance counselors rarely provide any sort of vocational guidance.¹⁷⁰ Moreover, the literature suggests that teachers—even vocational teachers—do not generally see dealing with employers as one of their responsibilities and are not encouraged to do so by schools.¹⁷¹ In addition, most of the American employers surveyed by Rosenbaum do not look to schools for help in finding new employees. Many report that they do not trust most teachers to be candid about their students’ shortcomings.¹⁷² Moreover, “because job placement falls squarely outside American definitions of a teacher’s professional responsibilities, there is neither an incentive to reward them for this placement work nor relief from other job duties.”¹⁷³

Some employers hire through schools, but this is the exception and not the rule. A 1987 survey that asked owners of independent businesses about the jobs for which they had hired the most people in the past two or three years suggested that about 10 percent of these new hires were referred by their schools (about 6 percent through vocational teachers and 4 percent through other teachers).¹⁷⁴ Another survey suggests that 3 to 5 percent of non-college-educated new hires are hired through schools.¹⁷⁵ About 9 percent of the 1982 high school graduates in the High School and Beyond survey got jobs through their schools.¹⁷⁶ There is evidence that many vocational teachers in America cultivate employers and arrange job placements for their students, even though they may not be required or even encouraged to do so.¹⁷⁷

The educational context. As described earlier, the increased emphasis on standards and testing has been blamed for driving students out of CTE. According to a report issued in January 2001, forty-nine states have statewide academic standards for what students should know and be able to do in at least some subjects. Fifty states test how well their students are learning, and twenty-seven hold schools accountable for results, either by rating the performance of all their

¹⁶⁹Rosenbaum, 93.

¹⁷⁰Rosenbaum, 93.

¹⁷¹Rosenbaum, 219.

¹⁷²Rosenbaum, 135–37, 141.

¹⁷³Kathryn Newman, *No Shame in My Game* (New York City: Alfred A. Knopf and the Russell Sage Foundation, 1999), 278.

¹⁷⁴John Bishop, “Improving Job Matches in the U.S. Labor Market,” in *Brookings Papers on Economic Activity: Microeconomics*, edited by M. N. Bailey (Washington, D.C.: Brookings Institution, 1993), Table 6.

¹⁷⁵Holzer, 52.

¹⁷⁶Rosenbaum, 199.

¹⁷⁷Rosenbaum, 219, 223–36.

schools or identifying low-performing schools.¹⁷⁸

The No Child Left Behind Act of 2001 has put the federal government behind the movement toward standards and testing. Under No Child Left Behind, each state must measure every public school student's progress in reading and math in each of grades 3 through 8 and at least once during grades 10 through 12. These assessments must be aligned with state academic content and achievement standards. States are required to set annual goals for improvement in test scores, and schools that do not meet these goals will be identified and subject to a series of interventions.¹⁷⁹

As a result, an increasing number of states are implementing graduation exit examinations, which students must pass to graduate. As of July 2002, eighteen states had exit examinations in place, and six more states were phasing in exit examinations but not yet withholding diplomas.¹⁸⁰

Many CTE supporters argue that these course requirements and tests leave students less time for CTE.¹⁸¹ In fact, the proliferation of testing and standards may threaten some of the most promising new CTE programs. For example, the evaluators of nine career academies say they fear that these institutions will have to choose between aligning their curricula and instructional strategies with rising academic standards and high-stakes tests and investing in an improved academic/vocational curriculum. Career academy advocates have complained that current assessment instruments do not capture the kinds of competencies that academy students may gain.¹⁸²

In the 1994 NAVE final report, David Boesel and Laurel McFarland reported that most vocational educators believe that increased academic requirements for high school graduation have reduced vocational enrollments by leaving students less time for vocational courses. Boesel and McFarland argue, however, that statistical analysis does not support this view. Districts that

¹⁷⁸National Governors' Association, *Graduation Exit Exam Matrix*, January 8, 2002, available from: http://www.nga.org/center/divisions/1,1188,C_ISSUE_BRIEF^D_3007,00.html, accessed February 19, 2002.

¹⁷⁹See U.S. Department of Education, No Child Left Behind Web site, *Introduction and Overview*, available from: <http://www.nclb.gov/next/overview/>, and U.S. Department of Education, No Child Left Behind Web site, *The Facts About Making Gains Every Year*, available from: http://www.nclb.gov/start/facts_pdf/yearly_gains.pdf, accessed August 3, 2003.

¹⁸⁰Naomi Chudowski et al., *State High School Exit Exams: A Baseline Report*, Washington, D.C.: Center on Education Policy, August 2002, available from: <http://www.ctredpol.org/pubs/statehighschoolexitexams2002/statehighschoolexitexams2002.pdf>, accessed August 3, 2003.

¹⁸¹Rowena Coetsee, "Supporters Want to Revive Vocational Classes," *Contra Costa Times*, July 26, 2001; Hoffman.

¹⁸²Kemple and Snipes, 11–12.

had higher graduation requirements displayed no greater decline in vocational enrollments than other districts. Moreover, the vocational education enrollment decline started before the school reform movement. The authors believe that other factors, such as reduced labor market demand for traditional vocational skills, may have been responsible for the vocational education enrollment decline.¹⁸³ Whether or not academic requirements were responsible for past declines in vocational education enrollment, it seems clear that these requirements are making it more difficult now for students to pursue CTE programs.

In at least New York City and Massachusetts, CTE advocates have lobbied for exemptions for CTE students from graduation exams.¹⁸⁴ Recently, the New York State Board of Regents refused a petition by the chancellor of the New York City schools to allow vocational students to take only the English and math exams, not the other three.¹⁸⁵ However, in 2001, the regents did vote to give CTE students more flexibility in the kinds of courses they may take to meet the new higher graduation standards that were adopted five years earlier. CTE students would be allowed to take one less course in each of the four core academic subject areas of English, math, social studies, and science and to replace these courses with four electives combining these subjects with their CTE work. Schools were given the option, but not required, to develop such integrated courses. The new policy was adopted in response to complaints about the earlier decision to require all high school seniors to pass at least five state exams.¹⁸⁶

In Massachusetts, vocational schools have lobbied unsuccessfully for a reprieve from the requirement, which took effect in 2003, that all students must pass the English and mathematics sections of the Massachusetts Comprehensive Assessment System (MCAS) tests in order to graduate. Legislation was introduced to allow CTE students to take tests in vocational fields as an alternative to, or in combination with, MCAS. Those supporting such an alternative are concerned that CTE students are at a disadvantage on the MCAS because they spend only about half the time in academic classes as other students. CTE students have done poorly on MCAS exams since they were first given, and some career and technical schools in the state have responded by cutting back on hands-on training to spend more time on academics.¹⁸⁷

CTE in Other Countries

¹⁸³Boesel and McFarland, 29.

¹⁸⁴Kates; Shartin, 1.

¹⁸⁵Kates, 30.

¹⁸⁶Kate Zernike, "Graduation Rule Adjusted for Vocational Students," *New York Times*, February 7, 2001.

¹⁸⁷Heidi B. Perlman, "Educators Seek Alternative Testing Requirements for Vocational Students," *Associated Press State and Local Wire*, April 23, 2001; Clive McFarlane, "MCAS-voke Schools Debate Continues," *Worcester (Mass.) Telegram & Gazette*, April 26, 2001, A2; Peter Schworm, "Tech Students Buckle Down for MCAS; Concerned Sophomores Stay after School Three Days a Week for Voluntary Sessions," *Boston Globe*, January 31, 2002, 1.

It is instructive to look at the experience of European systems and Japan, which have been much more rigidly “tracked” than the American system. Most of these systems have historically been stratified into an academic system for elite students and a vocationally oriented system for the working class. Most European systems generally grant occupationally related secondary school credentials. Students in Europe are more likely to receive secondary school credentials that are relevant to specific occupations than are American students. Nearly one-fourth of American adults have a university-level degree, in contrast with only 13 percent of German adults and 9 percent of French adults.¹⁸⁸ Where CTE is more well developed, young people may choose it rather than attempting to acquire more education to get ahead in the labor market.¹⁸⁹ Yet, Americans with higher degrees may not necessarily do better than similar Europeans without university training. In societies with greater proportions of people with university degrees, the credential required for a given job may rise as well.¹⁹⁰

Germany offers perhaps the clearest example of a highly stratified or tracked system.¹⁹¹ After four years of primary school, students are sorted into three tracks. About a third are directed to Gymnasium, which offers nine more years of general schooling and prepares students for the university. About 70 percent are directed to one of the other two tracks—the Hauptschule, which provides five more years of education, or the Realschule, which provides six more years of education. These assignments are based on teacher evaluations, which most parents accept. If they object, the school must follow their wishes, but the pupils must pass their yearly final exam or else shift into the track that was originally proposed. After completing these programs, Hauptschule and Realschule students move on to CTE via the “dual system”—a combination of apprenticeship training and part-time schooling. The apprentice generally spends one or two days per week in the classroom and three to four days per week in a firm. The state pays the vocational schooling costs, and the employer pays a reduced wage. The vocational training system prepares students for a highly structured labor market. There are 498 officially qualified occupations, each with its requirements for apprenticeship or school-based vocational education and with a defined wage structure determined by industry-wide collective bargaining agreements. Workers can rarely progress beyond the ceiling of the occupation for which their education qualifies them. There is an alternate route to the university for apprentices who want to change career paths, but it is open only to those who perform well in the school-based portion of

¹⁸⁸Alan Kerckhoff, “Transition from School to Work in Comparative Perspective,” in *Handbook of the Sociology of Education*, edited by Maureen T. Hallinan (New York: Kluwer Academic/Plenum Publishers, 2000), 455–58.

¹⁸⁹Yossi Shavit and Walter Muller, “Vocational Secondary Education, Tracking, and Social Stratification,” in *Handbook of the Sociology of Education*, edited by Maureen T. Hallinan (New York: Kluwer Academic/Plenum Publishers, 2000), 446.

¹⁹⁰Kerckhoff, 455.

¹⁹¹Kerckhoff, 456.

the apprenticeship.¹⁹²

As Yossi Shavit and Walter Muller have put it, many education systems face a conflict between two goals: “On one hand, they wish to equalize the life chances of their students, whereas on the other hand, they are expected to prepare them for positions in a differentiated labor market.”¹⁹³ The distinctions between the American and German systems illustrate this conflict. A major drawback of the German system is that many opportunities are closed off to children at a relatively young age (between ten and twelve). If not selected for the Gymnasium, they are unlikely to achieve a higher-level professional or managerial position. At the age of thirteen to fifteen, these young Germans must commit to the occupation at which they may spend their entire lives.¹⁹⁴ Moreover, the German system may not be as effective in the face of rapid technological or economic change. It takes a long time to change official educational programs and curricula, and young people may not be well prepared to explore new opportunities or acquire new skills.¹⁹⁵

On the other hand, German students who do not get into Gymnasium may not feel disheartened. “To become a qualified worker is completely normal and acceptable in Germany, worthy of striving and of youthful aspiration.”¹⁹⁶ Moreover, the German system “encourages, one might even say, forces the student to be actively engaged in an intensive process of acquiring vocationally relevant information and planning for occupational entry.”¹⁹⁷ The German system also gives non-college-bound students more incentives to stay in school and do well—in contrast to the United States, where “[l]acking any clear vocational payoff, youths who are not college-bound often underutilize the educational resources that are available to them, underachieve, and become alienated from school.”¹⁹⁸ Moreover, these tracked, vocationally oriented systems, particularly those where the curriculum is standardized, ease the transition from school to work by allowing employers to gauge the qualifications of young people seeking employment. As a result, young people in these societies are less likely to suffer the early “career turbulence” seen in the United States as young people move from job to job, looking for a good

¹⁹²Jeylan T. Mortimer and Helga Kruger, “Pathways from School to Work in Germany and the United States,” in *Handbook of the Sociology of Education*, edited by Maureen T. Hallinan (New York: Kluwer Academic/Plenum Publishers, 2000), 475–97.

¹⁹³Shavit and Muller, 438.

¹⁹⁴Mortimer and Kruger, 487.

¹⁹⁵Mortimer and Kruger, 493.

¹⁹⁶Mortimer and Kruger, 489.

¹⁹⁷Mortimer and Kruger, 492.

¹⁹⁸Mortimer and Kruger, 493.

fit.¹⁹⁹

In many other nations, teachers have formal responsibilities to help place their students in jobs.²⁰⁰ Japan is particularly notable in this regard. Schools have long-standing relationships with certain employers “who offer the same number of jobs to a school each year and expect schools to nominate seniors of dependable quality for those jobs.” Students apply for their school’s nomination. A committee of teachers nominates and ranks students for job openings. The employers select from the nominated students. Because employers rely so heavily on school nominations, fewer than 3 percent of all students have to apply to three or more employers. Teachers use grades as their primary criterion for nominating students, thereby giving students an incentive to do well in school. The system encourages both parties to behave in a way that maintains the relationship. “Schools must select students who satisfy employers in order to continue receiving job allocations in the future, and employers must continue hiring a school’s graduates in order to maintain a stable source of employees of dependable quality.”²⁰¹

What the Research Says about the Effectiveness of CTE

The research on CTE falls into two major categories: (1) statistical studies based on national longitudinal surveys of students, and (2) evaluations of individual CTE programs or groups of programs. The national student surveys were designed to capture all kinds of information about education, not specifically CTE. The latest of these surveys gathered information on students who were in eighth grade in 1988, and the others occurred substantially earlier. The second set of studies focuses on self-contained CTE programs, such as career academies, career magnets, and apprenticeship programs—most of them specialized schools or programs within schools. These studies, which tend to be more recent than the student surveys, generally suggest that CTE can reduce dropout rates and improve economic outcomes for some young people. These modest results, however, may mask major improvements for some young people or some specific programs.

Limitations of Research Based on National Student Surveys

Most of the analyses of student outcomes use the large databases of one or more of three major national surveys conducted by the National Center for Education Statistics: the National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB), and the National Educational Longitudinal Study 1988–1992 (NELS-88). All of these surveys used a two-stage sample design, selecting first schools and then a sample of students

¹⁹⁹Kerckhoff, 464, 466.

²⁰⁰Rosenbaum and Jones, 430.

²⁰¹Rosenbaum, 13–15.

from each school.²⁰² High school transcripts were collected for the respondents. A few studies used the National Longitudinal Survey of Youth (NLSY), conducted by the Bureau of Labor Statistics, a national probability sample of young people who were between the ages of fourteen and twenty-one in the fall of 1978. These studies compare outcomes for vocational students to outcomes for other students, often using regression analysis to control for differences between vocational students and others. There are several methodological problems with this literature, however.

- **Age of study.** Many of these studies are quite dated. Most of them contain information collected in the 1980s from people who may have graduated from high school several years earlier. There have been many changes in CTE programs since then, such as the new emphasis on integrating academic with vocational courses and a proliferation of new approaches such as career academies. In addition, changes in the economy may have changed the value of different types of training in the labor market.²⁰³
- **Selection bias.** Because the studies were not based on random assignment of students between different tracks, one cannot be sure that the “effects” they found were not due to unmeasured differences between the students in the different tracks, rather than to the tracks themselves. If factors such as motivation and ability affected both enrollment in vocational education and later outcomes such as dropping out and labor market success, selection bias can cloud the results. Serious studies attempted to remove such biases by statistically controlling for such factors as ability and motivation. It is difficult or impossible, however, to measure and control for attributes such as motivation, and information on ability may not be available. Unfortunately, neither HSB senior cohort data nor the NLS-72 have test results from before the senior year.
- **Definition of vocational education participation.** To measure participation in vocational education, some researchers used the number of vocational courses taken, whereas others used participation in a curricular “track” or area of concentration—academic, vocational, or general (neither academic nor vocational), based on the researchers’ definitions of these tracks. Using concentration or track may be more relevant to policy than the number of vocational courses taken, because the major policy questions center around the value of pursuing a vocational curriculum rather than the value added by taking one more vocational course. However, there is a problem with measuring the impact of concentration on dropout rates. As Kenneth Rasinski and Steven Pedlow put it, “Students who drop out may not be in school long enough to qualify for membership in either the academic or vocational programs. Such students drop by default

²⁰²Thomas S. Dee, William N. Evans, and Sheila E. Murray, “Data Watch: Research Data in the Economics of Education,” *Journal of Economic Perspectives* 13 (3) (Summer 1999): 205–16.

²⁰³Boesel et al., 132–33.

into the general track, thus artificially inflating the dropout rate for that track.”²⁰⁴

- **Measurement of vocational education participation.** Whether they defined vocational education participation as the number of vocational courses taken or participation in a vocational track or curriculum, researchers have generally used self-reports or analysis of transcripts to determine vocational participation. Self-reported data, whether on track or on courses, are often inaccurate, partly because students have difficulty differentiating academic from vocational subjects.²⁰⁵ Students’ reports of their track seem to be most often inflated, resulting in an exaggerated number of students reported as completing academic programs and an artificially low proportion completing vocational programs.²⁰⁶ Transcript data is a more accurate source of information on vocational education participation.²⁰⁷
- **Grouping together of diverse programs.** Studies rarely distinguished between different types of vocational education. Thus, they grouped together programs that varied greatly in content, quality, and the types of employment opportunities for which they prepared students.²⁰⁸ If some of these types of programs were much more effective than others, then failing to distinguish between them may have produced misleading results.
- **Timing.** Researchers who use the number of courses taken to define vocational education participation can make this measurement earlier or later in the high school career. In dropout studies, both of these approaches can produce problems. Making the measurement earlier, for example in the tenth grade, fails to capture the bulk of vocational course-taking, especially specific labor market preparation courses, which are largely taken in the junior and senior years. But making the measurement later in the high school years means that students who drop out will have less opportunity to take vocational (or academic courses), thus confounding the effect of curriculum with the dropout rate. Another timing issue concerns the measurement of student background characteristics. Some authors controlled for motivation or ability measured toward the end of a student’s high school career, usually senior year. Because these variables may themselves be affected by a student’s educational program, using them as control variables can absorb some of the impact of the curriculum. For example, controlling for

²⁰⁴Kenneth A. Rasinski and Steven Pedlow, “The Effect of High School Vocational Education on Academic Achievement Gain and High School Persistence: Evidence from NELS:88,” in *The Quality of Vocational Education: Background Papers from the 1994 National Assessment of Vocational Education*, edited by Adam Gamoran (Washington, D.C.: U.S. Department of Education, 1998), 188.

²⁰⁵Boesel et al., 132; Richard Arum and Yossi Shavit, “Secondary Vocational Education and the Transition from School to Work,” *Sociology of Education* 86 (July 1995): 187-204.

²⁰⁶Arum and Shavit, 193; Boesel et al., 132.

²⁰⁷Boesel et al., 132.

²⁰⁸Arum and Shavit, 187–204.

academic achievement measured in the senior year may absorb much of the impact of academic courses so that they seem to have little or no impact.²⁰⁹

- **Comparisons and counterfactuals.** Studies differ not only in how they measure participation in vocational education but also in the alternative to which they compare it. Whereas some studies compare a vocational concentration to a “general curriculum,” others compare vocational concentration or course taking to academic concentration or course taking. Regardless of the relative merits of these two approaches, however, the variation itself makes cross-study comparisons difficult, if not impossible.
- **Use of data on high school graduates only.** Many of the studies of economic outcomes of vocational education use data on high school graduates only. Yet, evidence suggests that vocational education reduces dropping out to some extent. By not taking dropouts into account, these studies may underestimate the impact of vocational education.
- **Short-term follow-up.** Many studies followed vocational education and other graduates for only a short period of time, sometimes as short as two years. Yet, it is possible that the relative economic situations of vocational and nonvocational graduates might change in later years.

CTE Program Evaluations

A second set of studies looks at individual CTE programs, or groups of programs, such as career academies or other freestanding schools or schools within schools. By comparing students in these programs with a comparison group or a randomly selected control group, these studies attempt to assess the impact of the specific program under study. The selection bias that weakens the first set of studies also presents a problem for those that did not use a randomly selected control group. The apparent impacts may be due to unobserved differences between the groups, rather than the type of education received. Only the few studies that used a randomly selected control group allow researchers to assert with confidence that the outcomes observed are due to the program.²¹⁰ Although some studies attempt to select a comparison group that is “matched” with the program group on certain variables, this does not ensure that there will be no variation between the groups. Some studies use statistical controls to attempt to account for differences between the groups, but unmeasured differences may remain. Other studies do not use controls

²⁰⁹James Kulik, “Curricular Tracks and High School Vocational Education, in *The Quality of Vocational Education: Background Papers from the 1994 National Assessment of Vocational Education*, edited by Adam Gamoran (Washington, D.C.: U.S. Department of Education, 1998), 91; Boesel et al., 157.

²¹⁰New York City used a lottery to randomly select students for the magnet schools, but because a large proportion of lottery losers were actually accepted for a career magnet and many lottery winners did not attend a career magnet, the random assignment design was severely compromised. See Robert L. Crain et al., *The Effects of Academic Career Magnet Education on High Schools and Their Graduates* (Berkeley, Calif.: National Center for Research in Vocational Education, 1999), available from: <http://vocserve.berkeley.edu/abstracts/MDS-779/>, accessed February 2, 2002.

or matching. Thus, without random assignment, there is no way of knowing the extent to which pre-existing differences between the groups have contributed to the results.

Other problems with some of these studies include: deviations from classic random assignment design; small sample sizes and sometimes failure to report statistical significance; program sites' failure to implement fully the model being evaluated; differences in program implementation across sites; low response rates; high attrition rates; short follow-up periods; lack of generalizability of the results to other populations and locations; and unclear presentation of the methodology or results. Finally, some of the programs studied combined a vocational emphasis with other features designed to retain students, such as small school size, small class size, and more personal attention, making it impossible to determine the effect of the career and technical curriculum per se.²¹¹

Findings

Research on CTE looks at a number of different outcomes, including dropout rates, school performance, educational attainment, employment and earnings, and high risk behaviors and alienation. Research on each outcome is discussed separately below.

Dropout rates. In general, the more credible studies using large databases suggest that CTE has a modest positive effect on high school completion.²¹² More specifically, taking a vocational course or being on the vocational track as compared with the general track seems to increase students' chances of completing high school.²¹³ A recent study using the National Educational Longitudinal Study of the class of 1992 found a relationship between course-taking patterns and dropout rates. "After controlling for prior achievement, grades, and student background characteristics, the risk of dropping out is estimated to be at its lowest near the point at which a student completes three Carnegie units of CTE for every four Carnegie units of academic subjects." As the CTE-to-academic ratio gets smaller or larger, the risk of dropping out is estimated to increase. The relationship seems to be strongest for those who are at the highest

²¹¹Robert B. Pitman, "Social Factors, Enrollment in Vocational/Technical Courses, and High School Dropout Rates," *Journal of Educational Research* 84 (5) (May/June 1991): 288.

²¹²For two reviews of the literature, see Kulik and Boesel et al., 107–30.

²¹³The effects of the vocational track or vocational courses compared with the academic track or academic courses are less clear. Some authors do not report on it, whereas others find mixed results. See John T. Grasso and John R. Shea, *Vocational Education and Training: Impact on Youth* (Berkeley, Calif.: Carnegie Foundation for the Advancement of Teaching, 1979), finding greater or lesser effects of academic curriculum compared with vocational, depending on gender and the specific vocational field. See also Kenneth A. Rasinski and Steven Pedlow, "Using Transcripts to Study the Effectiveness of Vocational Education," *Journal of Vocational Education Research* 19 (3) (1994): 23–43, finding that academic courses reduce dropout rates more than vocational courses.

risk for dropping out.²¹⁴ The results of studies of individual CTE programs are mixed. Some of the California Peninsular Academies (not a random assignment study) and the Dropout Prevention and Re-entry Projects in Vocational Education were found to reduce dropout rates among their students.²¹⁵ The career academies were found to have no effect on high school completion a year after scheduled graduation, and students attending the New York City career magnets had a higher dropout rate than comparison students attending comprehensive high schools.²¹⁶ (There is almost no evidence from the statistical studies or program evaluations about whether CTE has a greater impact on dropping out for males or females or whether different vocational fields are more effective at retaining students.)

Student performance. The number of vocational credits that public high school graduates earn is inversely related to their grade point averages.²¹⁷ A crucial question is whether this difference is due mainly to pre-existing differences between the students or to their participation in CTE. It is known that vocational students have traditionally started out with lower academic ability because lower-achieving students have chosen, or been encouraged to pursue, a vocational program.

In order to estimate the real impact of vocational education, researchers working with national longitudinal survey data have used regression analysis to control for factors, such as initial ability, motivation, and family background, that could affect achievement. Generally, these studies suggest that most of the differences in academic achievement (or achievement gains) between academic and vocational students stem from their aptitude and other characteristics when entering the programs. Academic programs may have provided slightly better academic preparation than vocational programs, but the difference is small, and the general track seems to have had approximately the same impact on achievement as does the vocational track.²¹⁸ The results of the newer programs are somewhat more encouraging, suggesting that under some circumstances these programs can actually increase student achievement. Specifically, students in some of the California Peninsular Academies and the

²¹⁴Stephen Plank, *Career and Technical Education in the Balance: An Analysis of High School Persistence, Academic Achievement, and Postsecondary Destinations* (St. Paul, Minn.: National Research Center for Career and Technical Education, 2001), vii–viii, available from: http://www.nccte.org/publications/infosynthesis/r&dreport/CTE%20in%20Blnce_Plank.pdf, accessed January 29, 2002.

²¹⁵David Stern et al., “Benefits and Costs of Dropout Prevention in a High School Program Combining Academic and Vocational Education: Third-Year Results from Replications of the California Peninsula Academies,” *Educational Evaluation and Policy Analysis* 11 (4) (Winter 1989): 405–16; Becky Jon Hayward and G. Kasten Tallmadge, *Strategies for Keeping Kids in School: Evaluation of Dropout Prevention and Reentry Projects in Vocational Education: Final Report* (Washington, D.C.: U.S. Department of Education, June 1995).

²¹⁶Crain et al.

²¹⁷Levesque et al., 57.

²¹⁸Kulik, 93–105.

Dropout Prevention and Re-entry Projects showed improvements in academic performance relative to control or comparison groups.²¹⁹

Educational attainment. Vocational students have traditionally been much less likely to attend college than students in academic programs. Some researchers attributed this lower rate of college attendance to the fact that students who did not plan to go to college were more likely to choose vocational education.²²⁰ However, regression analyses, mostly using national longitudinal studies, that control for factors such as ability, background, and student aspirations, still find large differences in educational attainment between vocational and academic students.²²¹ According to one review of the literature, the typical student would complete about fourteen years of schooling if enrolled in an academic program and about twelve and one-half years if enrolled in a nonacademic program.²²² However, researchers have found very little difference in postsecondary education between vocational and general track students, and this difference is due mostly to pre-existing differences in background, aspirations, or attitude.²²³ There is very little credible information on college attendance or completion from evaluations of newer programs. However, the evaluators of the career academies found no difference in attendance at two-year or four-year colleges between academy and nonacademy students a year after scheduled high school graduation.²²⁴

Employment and earnings. Graduates of academic programs tend to earn more than graduates of vocational and general programs. These higher earnings are probably due at least partly to the higher levels of educational attainment of academic program graduates. However, these data do not tell us whether and to what extent the curriculum—as opposed to pre-existing differences among students—was responsible for these different economic outcomes. Many researchers have used statistical analysis to attempt to answer this question. Studies of the labor market results of high school vocational education using data collected during the 1970s came up with mixed or negative results, but many of these studies were methodologically problematic.²²⁵

²¹⁹Stern et al., 1989; Hayward and Tallmadge.

²²⁰Kulik, 106.

²²¹Kulik, 106–18; Arum and Shavit, 1995; Joseph G. Altonji, “The Effects of High School Curriculum on Education and Labor Market Outcomes,” *Journal of Human Resources* 30 (3) (1994): 409–38.

²²²Kulik, 116.

²²³Kulik, 117.

²²⁴James J. Kemple, *Career Academies: Impacts on Students’ Initial Transitions to Post-Secondary Education and Employment (Executive Summary)* (New York: Manpower Demonstration Research Corporation, December 2001), available from: http://www.mdrc.org/Reports2001/CareerAcademies/CAExecutive_Summary.pdf, accessed February 2, 2002.

²²⁵Boesel et al., 135; Bishop, 1995, 58–59; Mane, 417–37.

Recently, more sophisticated studies have been fairly consistent in finding labor market gains from vocational education.²²⁶ As one group of reviewers concluded, “For certain subgroups of secondary and postsecondary students, there appears to be evidence of a positive effect on wages and employment, at least in the short run, when other important individual characteristics are controlled for via statistical techniques.”²²⁷ They conclude that the strongest and most consistent finding in the literature is that “improved earnings do accrue in situations where vocational training is directly related to job tasks.”²²⁸ Even so, the effects tend to be modest. For example, one study found that a vocational concentrator will, on average, work about two more weeks each year than a graduate of the general curriculum, whereas the academic curriculum provided no advantage or disadvantage in maintaining employment relative to the general curriculum.²²⁹ In the same study, vocational concentrators who found employment related to their training had monthly earnings that were 7 to 10 percent higher than those who followed a general curriculum, whereas those who pursued an academic curriculum showed no advantage.²³⁰ Most of these studies used data on high school graduates only. Employment and earnings results might have been stronger if students who did not graduate were also included, because vocational education seems to have reduced the dropout rate.²³¹ However, the effects of vocational education seemed to dwindle over time, at least for some vocational graduates.²³²

There is mixed evidence from the statistical studies (and none from the program evaluations) about differences in the effects of vocational education on economic outcomes for

²²⁶Boesel et al., 135; Bishop, 1995, 60–61; Mane.

²²⁷Boesel et al., 135.

²²⁸Boesel et al., 137.

²²⁹Paul B. Campbell et al., *Outcomes of Vocational Education for Women, Minorities, the Handicapped, and the Poor* (Columbus, Ohio: The National Center for Research in Vocational Education, 1986), 60.

²³⁰Campbell et al., 1986, 61. See also Suk Kang and John Bishop, “Vocational and Academic Education in High School: Complements or Substitutes?” *Economics of Education Review* 8 (2) (1989): 133–48, although criticized by some reviewers, estimating that substituting four vocational courses for four academic courses boosted total earnings during the twelve to eighteen months following graduation by 18 percent for non-college-bound male graduates and 36 percent for females; Mane, estimating that non-college-bound males from the class of 1980 who took four vocational courses earned \$1,500 more in 1981, \$1,100 more in 1983, and \$670 more in 1985 than similar young men who took four academic courses rather than the vocational courses. Females had gains of \$1,232 in 1982, \$1,396 in 1983, and \$1,324 in 1985.

²³¹Boesel et al., 137.

²³²Paul B. Campbell et al., *Dynamics of Vocational Education: Effects on Labor Market Outcomes* (Columbus, Ohio: National Center for Research in Vocational Education, 1987), 26; Mane, 417–37.

men and women. Some studies find better results for men²³³ and others for women,²³⁴ and others find different relative effects depending on the field of study.²³⁵ There is too little evidence of the effect of different fields of study to draw any conclusions.

One international study had some interesting results. The authors found that in nine of ten countries for which data were available, the chances of entering the labor market as an unskilled, rather than a skilled, worker were greater for those young people with academic secondary records that did not qualify for university admission than for those with vocational qualifications. The authors concluded, “By focusing primarily on the process by which people gain entry to the most prestigious occupations and on the admittedly negative role of vocational education in this regard, [those who support the abolition of vocational education] fail to notice that vocational education can reduce the likelihood of unemployment and of employment in the least desirable jobs.”²³⁶

Studies of self-contained CTE programs have yielded few useful results so far. The evaluators found no impact of career academies on employment or earnings one year after scheduled graduation, relative to the control group.²³⁷ A review of a number of school-to-work initiatives concluded that graduates of these programs have “better labor market outcomes” than do other high school graduates. However, the reviewers used some studies that lacked comparison groups and others that had methodological problems, such as small sample sizes, low response rates, and differences between the program and comparison groups that may have affected the results.²³⁸

High-risk behaviors and alienation. A few studies have looked at the impact of career academies or career magnets on high-risk behaviors, such as drug use or engaging in unprotected sex. One of these studies found no effect, whereas another found a reduced incidence of some

²³³Arum and Shavit; Campbell et al., 1986.; Kenneth Gray, Neng-Tang Huang, and Li Jie, “The Gender Gap in Yearly Earnings: Is It Lack of Education or Occupational Segregation?” *Journal of Vocational Education Research* 18 (3) (1993): 1–14.

²³⁴Kang and Bishop, 1989; Mane.

²³⁵Grasso and Shea; Suk Kang and John Bishop, “Effects of Curriculum on Labor Market Success Immediately after High School,” *Journal of Industrial Teacher Education* 23 (4) (1986): 15–29.

²³⁶Shavit and Muller.

²³⁷Kemple. There was a positive impact on earnings for the medium-risk subgroup.

²³⁸Katherine L. Hughes, Thomas R. Bailey, and Melinda J. Mechur, *School-to-Work: Making a Difference in Education* (New York: Institute on Education and the Economy, Teachers College, Columbia University, 2001), 27–28. See also Jobs for the Future, *School-to-Career Initiative Demonstrates Significant Impact on Young People* (Boston, Mass: Jobs for the Future and Boston Private Industry Council, May 1998); and James Griffith and Julie Wade, *The Relation of High School Career and Technology Education to Postsecondary Employment and College Performance: A Six-Year Longitudinal Study of Public High School Graduates* (Rockville, Md.: Montgomery County Public Schools, February 7, 2001).

self-reported risk behaviors.²³⁹ Some researchers have hypothesized that traditional vocational education programs increased students' alienation and disaffection from school. A study using data from a national survey of fifteen thousand students per year at five-year intervals shows that vocational students were less likely than academic students to say that doing well in school was more important for getting a good job, and they were more likely to say that their schooling would prevent them from getting the job they desired, that their classmates would admire them if they cheated, that their friends encouraged them to do things their teachers would not like, or that they had damaged school property in the last year. Moreover, differences between vocational and academic students on these indicators widened between 1976 and 1999. The author attributes this divergence in attitudes to the "marginalization and stigmatization" of some vocational programs in the 1980s and 1990s, some of which had grown out of date or become regarded as dumping grounds for poorly performing students, as well as changes in the labor market, which increased the value of a college degree.²⁴⁰

Outcomes of work-based learning programs. Studies of the effect of work-based learning programs, a common component of CTE, have produced mixed results. A review of studies on cooperative education and other school-supervised work experience programs found no consistent association between participation in cooperative education and subsequent success in the labor market.²⁴¹ Cooperative education programs, however, vary from "well-planned learning sequences for conscientious students to hastily arranged escapes for students unengaged in school."²⁴² It is possible that higher-quality programs have better effects. It is also possible that cooperative education is not an intense enough intervention to have an effect by itself, even if it may serve as a useful component of an effective program. One review of evaluations of work-based learning programs (including cooperative education, youth apprenticeship, and other programs) found that work-based learning has "generally had small positive effects on students' attendance, grades, graduation rates, and participation in postsecondary education."²⁴³ Few of these evaluations, however, included random assignment, and many lacked data on large proportions of the students in the programs, so results should be viewed with caution.

Studies also indicate that students who worked while in high school are generally much more successful in the labor market than those who did not.²⁴⁴ A recent school-to-work

²³⁹Kemple and Snipes; Crain et al.

²⁴⁰David Boesel, "Student Attitudes toward High School and Educational Expectations," paper prepared for the annual meeting of the American Educational Research Association, Seattle, Wash., April 2001.

²⁴¹David Stern et al., *School to Work: Research on Programs in the United States* (London: Flamer Press, 1995), 18–20.

²⁴²U.S. Congress, Office of Technology Assessment, *Learning to Work: Making the Transition from School to Work* (Washington, D.C.: Office of Technology Assessment, 1995), 68.

²⁴³U.S. Congress, Office of Technology Assessment, 60–61.

²⁴⁴Bishop, 1995, 70–71.

evaluation report from Mathematica Policy Research, Inc. found that the paid and unpaid internships offered through schools tend to be more diverse and offer more learning opportunities than students find on their own. They also found that “students generally find internships and job-shadowing experiences helpful in clarifying career goals.”²⁴⁵ These results suggest that well-designed work-based learning programs could have a positive impact on students’ future labor market success.

Synthesis

In general, these studies tell a story of modest reductions, at best, in dropout rates and modest improvements in labor market performance for those students who took vocational courses or concentrated in vocational education. However, most of the studies, especially those using large databases, group together programs of different levels of quality, intensity, and coherence. Some studies attempt to assess the impact of one course, even though effectiveness might depend on reaching a certain “critical mass” of courses. Even when the effect of “concentrating” in vocational education is measured, a concentration may not mean that a student had a coherent sequence of classes leading to a competency in general or in a particular occupational field. Moreover, the quality of past vocational education programs has varied greatly and has often been less than one might desire. Some of the newer studies, such as the California Peninsular Academies study, suggest that there are great differences in outcomes between individual programs, which suggests that higher-quality programs might produce better outcomes. Moreover, most of the studies did not assess the impacts of vocational education for different subgroups of students, and the modest results might be masking more impressive gains for some students.

Research suggests that traditional vocational education reduced college attendance and perhaps slightly reduced academic achievement compared with the academic track. This may not be surprising in light of traditional vocational education’s focus on preparing young people for immediate employment. However, there are suggestions that some newer stand-alone programs may improve students’ achievement levels without reducing college attendance. The lack of rigorous evaluations of modern programs is a serious program. More and better evaluations are needed before we can understand the impact of these programs.

Rethinking the Federal Role

The federal role in CTE is very limited. Federal funding provides only a small proportion of the funds that support CTE around the country. Therefore, we recommend that the federal government concentrate on funding research that could inform state education departments and local school districts on questions of how to best provide CTE.

²⁴⁵Joshua Haimson and Jeanne Bellotti, *Schooling in the Workplace: Increasing the Scale and Quality of Work-Based Learning* (Princeton, N.J.: Mathematica Policy Research, Inc.: January 22, 2001), xii–xiii, available from: <http://www.mathematica-mpr.com/PDFs/schooling.pdf>, accessed February 2, 2002.

The Carl H. Perkins Act is the main source of federal funding for CTE at the high school level, although it funds postsecondary CTE as well. Currently funded at \$1.5 billion per year through 2003, the federal Perkins Act probably provides less than 10 percent of national spending on CTE at all levels, although no figure for total spending is available.²⁴⁶ Congress has attempted to use this small amount of funds to generate change in CTE by imposing requirements on state and local programs (such as a requirement to provide an understanding of “all aspects of an industry”), requiring that a certain proportion of funds be spent for specific purposes (for example, on “gender equity” programs), setting aside funds for disadvantaged groups or other purposes, and requiring states to provide data on performance. Through the federally funded National Research Center and National Dissemination Center for Career and Technical Education, the Office of Vocational and Adult Education (OVAE) sponsors research and development activities in CTE.

With its small share of total CTE spending, the federal government is not in a strong position to influence the size and shape of programs at the local level.²⁴⁷ The federal government could potentially play a more important role, however, by sponsoring high-quality research, disseminating the results, developing curricula and other materials to be used by schools nationwide, and providing technical assistance. Building on the efforts of the National Research Center and National Dissemination Center for Career and Technical Education, OVAE could play a major role in shaping the direction of the field in the twenty-first century.

Many crucial questions remain about what works in CTE and how programs should be retooled to meet the needs of a new century. Here are some of the most important:

- *How effective is CTE as an alternative to other options for different groups of young people?* Most studies of the effectiveness of CTE have major methodological flaws or are out of date. We need better studies testing different models of CTE for different types of young people.
- *In what settings should CTE be provided? What mix of comprehensive high schools, programs within schools, or freestanding vocational schools makes sense? Should CTE be provided as part of a broader high school reform?* We do not know much about the relative effectiveness and costs of different settings for providing CTE, and yet such information is important for determining how to make CTE programs most effective. Some experts argue that we must restructure large comprehensive high schools in order to reduce dropout rates. They stress that large high-poverty high schools require organizational, instructional, and teacher support reforms. Reforms of any one component, such as curriculum, will not be enough.²⁴⁸ Richard Lynch (who interviewed

²⁴⁶Richard N. Apling, *Vocational Education: The Carl D. Perkins Vocational and Technical Education Act of 1998* (Washington, D.C.: Congressional Research Service, January 11, 1999), 3.

²⁴⁷But see Lynch, 9.

²⁴⁸McPartland and Jordan, 15–16.

representatives from business and industry, professional education associations, and public schools to develop a paper about the future of CTE) reported that nearly every individual or group he interviewed “commented that it is insufficient to reform only vocational education into a new CTE without major changes in public schools, especially high schools.”²⁴⁹ The career academy is one of several approaches that combine a vocational focus with other educational reforms. But there are few good evaluations of the effects of these approaches, and more are needed.

- *For whom should CTE be designed: the most at-risk students, those who are not college bound, or also for some students who may be college bound? And how rigorous should the curriculum be?* Some experts advocate that CTE be targeted primarily to the students who are educationally disadvantaged, will probably not attend college, and need extensive job training to enter the labor market on graduating high school, as well as for those students who do not do well in traditional schools and are at risk of dropping out. Others advocate targeting CTE toward the broader group of high school graduates who are not college bound. Still others want to use vocational subject matter to teach traditional academic content—to everyone.²⁵⁰ On one hand, recruiting better students might improve the quality, rigor, and reputation of CTE. Some researchers note that new, more challenging vocational programs combining occupational and academic studies seem to bring CTE “into the mainstream of the high school curriculum and engaging a broader cross-section of the student population.”²⁵¹ On the other hand, one major rationale for spending public funds on CTE is to help prevent at-risk youth from becoming disconnected from the labor force and mainstream society. And a more rigorous curriculum might cause such students to drop out.²⁵² Researchers found that students in New York City career magnet schools had lower graduation rates than comprehensive students and hypothesized that the magnets tended to push out weaker students.²⁵³
- *Should training be structured around broad industry areas or specific occupations?* Proponents of an updated CTE have advocated structuring programs around broad industry areas rather than specific occupations, arguing that, in the new economy, workers will need to change jobs and duties over the course of their careers.²⁵⁴ This trend suggests a focus on “all aspects of an industry,” which has been incorporated into the

²⁴⁹Lynch, 36.

²⁵⁰Lynch, 16–17.

²⁵¹Delci and Stern, 34.

²⁵²Boesel et al., 101.

²⁵³Crain et al.

²⁵⁴See, for example, Boesel and McFarland, 16.

Carl H. Perkins Act. Some school systems are starting to use a concept called “career clusters,” which are broad occupational categories encompassing a variety of careers. Several states have developed education targeted to different career clusters. The U.S. Department of Education has identified sixteen clusters, including health science, information technology services, and manufacturing, and has developed information and materials for some of the clusters, and the National Association of State Directors of Career and Technical Education Consortium is developing a curriculum framework, assessment system, and certification system for each of the remaining clusters.²⁵⁵ The question is, when training is around broad industries instead of specific jobs, whether students acquire the skills that they need in order to be attractive to employers.²⁵⁶

- *To what extent is outdated curricula still a problem? In an era of fast technological change, how can schools deal with obsolescence of curricula?* According to one recent report on the state of CTE, many programs are outdated and no longer relevant to the workplaces for which they are supposed to prepare students.²⁵⁷ In order to ensure that students obtain training-related jobs, training must reflect existing job opportunities. Schools should identify outdated programs and eliminate or refocus them. Ways for keeping curricula up to date need to be identified and disseminated.
- *How can high schools attract and retain a good CTE faculty? Do teaching methods and teacher training need to be updated? What credentials should teachers be required to have?* More research needs to be done on how schools in the United States and in other countries attract and retain good CTE faculty. One report sees a “dramatic” shortage of career and technical teachers in most subject areas in the United States.²⁵⁸ Moreover, many educators argue that career and technical teaching methods need updating to accommodate changes in the economy, which require students to be prepared for broader and changing occupational roles. Others cite the need for changes in teacher training to incorporate new knowledge about how students learn, a greater focus on academic skills, an increasing proportion of career and technical students with special needs, an increasing emphasis on work-based learning, and a new trend toward preparation for a

²⁵⁵Michael E. Wonacott, *Career Clusters* (Columbus, Ohio: National Dissemination Center for Career and Technical Education, 2001), available from: <http://www.nccte.org/publications/infosynthesis/highlightzone/highlight06/highlight06-careerclusters.pdf>, accessed January 31, 2002.

²⁵⁶Paula Hudis, *Making Schools Career-Focused* (Princeton, N.J.: Mathematica Policy Research, Inc., 2001), 31, available from: <http://www.mathematica-mpr.com/PDFs/makingschools.pdf>, accessed February 2, 2002.

²⁵⁷Lynch, 16.

²⁵⁸Kenneth Gray and Richard A. Walter, *Reforming Career and Technical Education Teacher Licensure and Preparation: A Public Policy Synthesis* (Columbus, Ohio: National Dissemination Center for Career and Technical Education, 2001), available from: <https://www.nccte.org/publications/infosynthesis/infopaper/infopaper01/infopaper01.pdf>, accessed January 30, 2002.

cluster of related occupations as opposed to a single occupation.²⁵⁹ Traditionally, vocational teachers have had less formal education and more work experience (outside of teaching) than other secondary school teachers.²⁶⁰ A recent report recommends changes in CTE licensure and teaching, including requiring all teachers to have a bachelor's degree to be permanently certified, and changes in teacher education to include training in the teaching of academic subjects, education of special-needs students, supervision of work-based learning, and "workforce education and career development theory and practice."²⁶¹ However, it is not clear that anyone has studied classroom teachers to determine whether the more effective teachers are really those who have these qualifications and training.

- *What should be the role of work-based learning opportunities, such as internships or apprenticeships?* Supporters of work-based learning argue that it helps students see the connection between what they are learning in school and how it is used in the "real world" and seems to result in a "deeper" understanding of the subject matter.²⁶² Moreover, for students who are making the transition from school to work, work-based learning can provide crucial employment references. As mentioned earlier, there is mixed evidence on the impact of work-based learning. More evaluations are needed to identify the effectiveness of different types of work-based learning opportunities, as well as the optimal length and intensity of the experience.
- *What is the appropriate role for high school "tech prep" programs, that is, instruction coordinated with community and technical college programs?* High school CTE programs that are articulated with community college programs can provide a coherent program spanning secondary and postsecondary schools and enable students to continue on to postsecondary education. In interviewing business and education representatives, Richard Lynch found widespread support of the concept of Tech Prep "as a conceptual and structural model for high school CTE reform."²⁶³ However, reliable data are lacking on the impact of Tech Prep on students.²⁶⁴ Interim data from a longitudinal study of Tech Prep participants and comparison groups one to three years after high school graduation suggest some increases in college attendance and work, but low response rates and the

²⁵⁹Robert G. Berns and Patricia M. Erickson, "Contextual Teaching and Learning: Preparing Students for the New Economy," *The Highlight Zone: Research@Work* 5, 2001, available from: <http://www.nccte.org/publications/infosynthesis/highlightzone/highlight05/highlight05-CTL.pdf>, accessed March 5, 2002; Lynch, 59–66; Gray and Walter, viii.

²⁶⁰Boesel et al., 64–66.

²⁶¹Gray and Walter, ix–xi.

²⁶²Lynch, 67.

²⁶³Lynch, 79.

²⁶⁴Lynch, 82.

procedures the researchers used to select the comparison group limit the usefulness of this study.²⁶⁵

- *How can the coherence of CTE be increased?* The Perkins Act requires school districts to provide “a coherent sequence of academic and vocational courses.” But the 1994 National Assessment of Vocational Education reported that only a third of school districts require that a student take a sequence of vocational courses to be considered a vocational program graduate.²⁶⁶ Career academies and other schools that focus on a specific occupational theme can provide students with a coherent career-related education. Studies should look at other ways in which school systems, both here and abroad, are providing a coherent sequence of courses to career and technical students.
- *To what degree do tougher academic standards and testing discourage participation in CTE? Should consideration be given to adjusting these standards and tests for CTE students?* As mentioned earlier, the increasing emphasis on standards and assessment may put at risk some of the most promising CTE programs, such as career academies. Future research might attempt to assess the effects of standards on students’ curricular choices. Demonstration projects could assess the feasibility and effectiveness of replacing some academic tests with vocational assessments. Such assessments “might include ‘scores’ or evaluative commentary from portfolios, demonstrations, oral and written reports, work-based activities, student productions, term papers or projects, essays, student critiques of literary and technical work, paper-and-pencil tests, employers’ and teachers’ formal and informal observations, [and] case study analyses.”²⁶⁷ In addition, researchers could investigate the use of exams and nationally recognized certificates awarded by expert groups.²⁶⁸
- *How can the poor image of CTE be improved so that students, parents, and teachers see it as a viable option to prepare for a good career? How can school counselors be encouraged to be more supportive of CTE?* Essentially, there are two ways to respond to the identification of CTE with non-college-bound youth. One approach is to educate parents and students about the evidence indicating that college is not the best route to success for every student. In their book *Other Ways to Win*, Kenneth Gray and Edwin Herr outline a comprehensive strategy to reform guidance practices and inform parents

²⁶⁵Debra D. Bragg, *Promising Outcomes for Tech Prep Participants in Eight Local Consortia: A Summary of Initial Results* (St. Paul, Minn.: National Research Center for Career and Technical Education, 2001), available from: <http://www.nccte.org/publications/infosynthesis/r&dreport/Promising%20Outcomes.pdf>, accessed January 31, 2002. The comparison groups were matched to the program groups on academic performance, which limited the researchers’ ability to measure the effect of Tech Prep on secondary-level outcomes such as dropping out, graduation, and academic attainment, as described on page 10.

²⁶⁶Boesel et al., 86.

²⁶⁷Lynch, 73–74; Kemple and Snipes, 12.

²⁶⁸Bishop, 1995, 73–80, 85.

about their children's readiness (or lack thereof) for postsecondary education.²⁶⁹ This strategy includes the development of an individual career plan for all students by the tenth grade. Through a parent involvement strategy including meetings, involvement in development of the career plan, provision of feedback at "strategic times," and the provision of opportunities for individual assistance, parents are to be informed of the low odds of success for most students who enter college and the "other ways to win," such as pursuing high-paid technical careers.

Another approach is to try to define CTE as an alternate route to college and to connect it with the ideas of high standards and rigorous academics.²⁷⁰ It may be possible to adopt both approaches, informing people of the good jobs available without college, of high college costs and dropout rates, and that CTE can lead to postsecondary entrance and completion. Research is needed to better understand public opinion on career and technical education, determine what the main misconceptions are, and assess different strategies for changing opinion.

- *What proportion of CTE graduates find training-related jobs? How can training-related job placements be increased and linkages between schools and employers be improved?* The literature indicates that the benefits of CTE depend on whether graduates find jobs related to their training. Yet, as mentioned earlier, less than half of vocational graduates were working in jobs related to their curriculum in 1985—the most recent year for which data are available. We need to update these data in order to determine the extent of the problem, and then we need more research on how training-related placements can be increased. The literature reviewed by Bishop suggests that a number of factors are related to the ability to find training-related jobs, including the time teachers spend on placement and the involvement of employers.²⁷¹ Eliminating outdated curricula is clearly important, as described earlier. Rosenbaum has documented the way some American vocational teachers, as well as Japanese schools, work with employers to place vocational students in good jobs. More research should be conducted on how some teachers and schools, both here and abroad, link their students with employers and jobs and how these approaches could be adapted more widely.

Conclusion

The "college for all" myth is shortchanging those young people who are either uninterested in or unsuited for college. CTE has the potential to create a better future for these young people. Getting schools to pursue this potential, however, will not be an easy task. As one author puts it: "Unfortunately, policy is now moving in the wrong direction. Perpetuating the

²⁶⁹Gray and Herr.

²⁷⁰A-Plus Communications and Jobs for the Future, 14.

²⁷¹Bishop, 1995, 66.

college-for-all myth, schools are de-emphasizing employers' needs, reducing vocational education, and retiring vocational teachers who have employer contacts. These are terrible losses."²⁷² The federal government can lead the way through research and demonstration programs that help identify the needs of America's non-college-bound youth and help shape the response of its educational institutions.

²⁷²Rosenbaum, 279.

References

- A-Plus Communications and Jobs for the Future. 1997. *Understanding Attitudes About School-to-Career: A Review of Public Opinion Data*. Arlington, Va.: A-Plus Communications.
- Altonji, Joseph G. 1994. "The Effects of High School Curriculum on Education and Labor Market Outcomes." *Journal of Human Resources* 30 (3): 409–38.
- Apling, Richard N. 1999. *Vocational Education: The Carl D. Perkins Vocational and Technical Education Act of 1998*. Washington, D.C.: Congressional Research Service. January 11.
- Arum, Richard, and Yossi Shavit. 1995. "Secondary Vocational Education and the Transition from School to Work." *Sociology of Education* 86 (July): 187–204.
- Association for Career and Technical Education. *Frequently Asked Questions*. Available from: <http://www.acteonline.org/faqs/faqs.html>. Accessed February 1, 2002.
- Astin, Alexander W., Lisa Tsui, and Juan Avalos. 1996. *Degree Attainment Rates at American Colleges and Universities*. Los Angeles, Calif.: University of California, Los Angeles, Graduate School of Education, Higher Education Research Institute.
- Balfanz, Robert, and Nettie Legters. 2001. *How Many Central City High Schools Have a Severe Dropout Problem, Where Are They Located, and Who Attends Them? Initial Estimates Using the Common Core of Data*. Baltimore, Md.: Johns Hopkins University. Available from: <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/balfanz.html>. Accessed January 27, 2002.
- Banks, Sandy. 2002. "Let's Talk Shop about Kids and Careers." *Los Angeles Times*, February 12, Southern California Living, 1, home edition.
- Bell, Elizabeth. 2002. "Hands-on Education." *San Francisco Chronicle*, January 14, B1, final edition.
- Berkner, Lutz, and Lisa Chavez. 1997. *Access to Postsecondary Education for the 1992 High School Graduates*. Washington, D.C.: National Center for Education Statistics. October. Available from: <http://nces.ed.gov/pubs98/access/98105.pdf>. Accessed January 31, 2002.
- Berns, Robert G., and Patricia M. Erickson. 2001. "Contextual Teaching and Learning: Preparing Students for the New Economy." *The Highlight Zone: Research@Work* 5. Available from: <http://www.nccte.org/publications/infosynthesis/highlightzone/highlight05/highlight05-CTL.pdf>. Accessed March 5, 2002.

- Bishop, John. 1993. "Improving Job Matches in the U.S. Labor Market." In *Brookings Papers on Economic Activity: Microeconomics*. Edited by M. N. Bailey. Washington, D.C.: Brookings Institution.
- Bishop, John. 1994. *Schooling, Learning and Worker Productivity*. Ithaca, N.Y.: Cornell University Institute for Labor Relations.
- Bishop, John. 1995. "Expertise and Excellence." Center for Advanced Human Resource Studies Working Paper. Cornell University, Center for Advanced Human Resource Studies. Ithaca, N.Y. Available from: <http://www.ilr.cornell.edu/depts/cahrs/PDFs/WorkingPapers/WP95-13.pdf>. Accessed February 1, 2002.
- Boesel, David. 2001. "Student Attitudes toward High School and Educational Expectations." Paper prepared for the annual meeting of the American Educational Research Association. Seattle, Wash. April.
- Boesel, David, and Eric Friedland. 1999. *College for All? Is There Too Much Emphasis on Getting a 4-Year College Degree?* Washington, D.C.: National Library of Education. January.
- Boesel, David, Lisa Hudson, Sharon Deich, and Charles Masten. 1994. *National Assessment of Vocational Education: Final Report to Congress: Volume II: Participation in and Quality of Vocational Education*. Washington, D.C.: U.S. Department of Education. July.
- Boesel, David, and Laurel McFarland. 1994. *National Assessment of Vocational Education Final Report to Congress: Volume I: Summary and Recommendations*. Washington, D.C.: U.S. Department of Education.
- Bragg, Debra D. 2001. *Promising Outcomes for Tech Prep Participants in Eight Local Consortia: A Summary of Initial Results*. St. Paul, Minn.: National Research Center for Career and Technical Education. Available from: <http://www.nccte.org/publications/infosynthesis/r&dreport/Promising%20Outcomes.pdf>. Accessed January 31, 2002.
- Brown, Bettina Lankard. 2001. "Promising Tech Prep Outcomes." *The Highlight Zone: Research@Work* 3. Available from: <http://www.nccte.org/publications/infosynthesis/highlightzone/highlight03/highlight03-techprep.pdf>. Accessed February 1, 2002.
- Campbell, Paul B., Karen S. Basinger, Mary Beth Dauner, and Marie A. Parks. 1986. *Outcomes of Vocational Education for Women, Minorities, the Handicapped, and the Poor*. Columbus, Ohio: The National Center for Research in Vocational Education.

- Campbell, Paul B., Jack Elliot, Suzanne Laughlin, Ellen Seusy, George Farkas, Lawrence Hotchkiss, and Ernst Stromsdorfer. 1987. *Dynamics of Vocational Education: Effects on Labor Market Outcomes*. Columbus, Ohio: National Center for Research in Vocational Education.
- Cappelli, Peter, and Nikolai Rogovski. 1995. *Skill Demands, Changing Work Organization, and Performance*. Philadelphia, Pa.: National Center on the Educational Quality of the Workforce.
- Carrol, Beverly A. 2001. "Leaders: Vocational Training Needs Tout." *Chattanooga Times/Chattanooga Free Press*, October 16.
- Castellano, Morris, and Samuel Stringfield. 2001. *Career and Technical Education Reforms and Comprehensive School Reforms in High Schools and Community Colleges: Their Impact on Educational Outcomes for At-Risk Youth*. Minneapolis, Minn.: National Research Center for Career and Technical Education. Available from: http://www.nccte.org/publications/infosynthesis/r&dreport/CTE%20Rfrms_Stringfield.pdf. Accessed January 29, 2002.
- Catri, Deborah Bingham. 1998. *Vocational Education's Image for the 21st Century*. Columbus, Ohio: ERIC Clearinghouse on Adult, Career and Vocational Education. Available from: <http://www.ericacve.org/docgen.asp?tbl=digests&ID=41>. Accessed February 1, 2002.
- Chudowski, Naomi, Nancy Kober, Keith S. Gayler, Madlene Hamilton. 2002. *State High School Exit Exams: A Baseline Report*. Washington, D.C.: Center on Education Policy. August. Available from: <http://www.ctredpol.org/pubs/statehighschoolexitexams2002/statehighschoolexitexams2002.pdf>. Accessed August 3, 2003.
- Coetsee, Rowena. 2001. "Supporters Want to Revive Vocational Classes." *Contra Costa Times*, July 26.
- Crain, Robert L., Anna Allen, Robert Thaler, Debora Sullivan, Gail L. Zellman, Judith Warren Little, and Denise D. Quigley. 1999. *The Effects of Academic Career Magnet Education on High Schools and their Graduates*. Berkeley, Calif.: National Center for Research in Vocational Education. Available from: <http://vocserve.berkeley.edu/abstracts/MDS-779/>. Accessed February 2, 2002.
- Crowell, Alan. 2001. "Popularity in Vocational Education Creates Shortages." *Central Maine Morning Sentinel*, May 20.
- Dee, Thomas S., William N. Evans, and Sheila E. Murray. 1999. "Data Watch: Research Data in the Economics of Education." *Journal of Economic Perspectives* 13 (3) (Summer): 205–16.

- Delci, Mario, and David Stern. 1999. *Who Participates in New Vocational Programs? A Preliminary Analysis of Student Data from NLSY97*. Berkeley, Calif.: National Center for Research in Vocational Education. Available from: <http://www.nccte.org/publications/ncrve/mds-13xx/mds-1300.pdf>. Accessed February 1, 2002.
- Eck, Alan. 1993. "Job-Related Education and Training: Their Impact on Earnings." *Monthly Labor Review* 116 (10) (October): 21–38. Available from: <http://www.bls.gov/opub/mlr/1993/10/art2full.pdf>. Accessed February 28, 2002.
- Elam, Stanley M. 1990. "The 22nd Annual Gallup Poll of the Public's Attitudes toward the Public Schools." *Phi Delta Kappan* 74 (September): 41–55.
- Elam, Stanley M., and Lowell C. Rose. 1995. "The 27th Annual Gallup Poll of the Public's Attitudes toward the Public Schools." *Phi Delta Kappan* 77 (September): 41–56.
- Elam, Stanley M., Lowell C. Rose, and Alec M. Gallup. 1994. "The 26th Annual Phi Delta Kappa/Gallup Poll of the Public's Attitudes toward the Public Schools." *Phi Delta Kappan* 76 (September): 41–56.
- Foster, Susan G. 1981. "Vocational Training for Blacks Debated." *Education Week on the Web*. Bethesda Md.: Education Week on the Web. Available from: <http://www.edweek.org/ew/ewstory.cfm?slug=01140066.h01>. Accessed March 12, 2002.
- Gohlke, Josh. 2002. "County Advances \$26M Vocational School Expansion; Plan Is to Boost Enrollment by 875." *Record (Bergen County, N.J.)*, March 27, 102.
- Gonzalez, Angela. 2001. "Labor Pains: Valley Employers Call for More Vocational Training in Schools." *Business Journal*. May 11, vol. 21, no. 33, 35.
- Grasso, John T., and John R. Shea. 1979. *Vocational Education and Training: Impact on Youth*. Berkeley, Calif.: Carnegie Foundation for the Advancement of Teaching.
- Gray, Kenneth. 1996. "Vocationalism and the American High School: Past, Present, and Future?" *Journal of Industrial Teacher Education* 33 (2): 86–92.
- Gray, Kenneth, and Edwin Herr. 2000. *Other Ways to Win: Creating Alternatives for High School Graduates*. Thousand Oaks, Calif: Corwin Press.
- Gray, Kenneth, Neng-Tang Huang, and Li Jie. 1993. "The Gender Gap in Yearly Earnings: Is It Lack of Education or Occupational Segregation?" *Journal of Vocational Education Research* 18 (3): 1-14.
- Gray, Kenneth, and Richard A. Walter. 2001. *Reforming Career and Technical Education*

- Teacher Licensure and Preparation: A Public Policy Synthesis*. Columbus, Ohio: National Dissemination Center for Career and Technical Education. Available from: <http://www.nccte.org/publications/infosynthesis/infopaper/infopaper01/infopaper01.pdf>. Accessed January 30, 2002.
- Gray, Kenneth, Wen-Jyh Wang, and Sharon Malizia. 1995. "Is Vocational Education Still Necessary? Investigating the Educational Effectiveness of the College Prep Curriculum." *Journal of Industrial Teacher Education* 32 (20): 6–29.
- Griffin, Anna L. 2001. "School Cements Program: Monty Tech Will Offer Masonry." *Montachusett (Millbury, Mass.) Telegram and Gazette*, October 10.
- Griffith, James, and Julie Wade. 2001. *The Relation of High School Career and Technology Education to Postsecondary Employment and College Performance: A Six-Year Longitudinal Study of Public High School Graduates*. Rockville, Md.: Montgomery County Public Schools. February 7.
- Grubb, W. Norton, Torry Dickinson, Lorraine Giordano, and Gail Kaplan. 1992. *Betwixt and Between: Education, Skills, and Employment in Sub-Baccalaureate Labor Markets*. Berkeley, Calif.: National Center for Research in Vocational Education. December. Available from: <http://www.nccte.com/publications/ncrve/mds-04xx/mds-470.html>. Accessed January 31, 2002.
- Haimson, Joshua, and Jeanne Bellotti. 2001. *Schooling in the Workplace: Increasing the Scale and Quality of Work-Based Learning*. Princeton, N.J.: Mathematica Policy Research, Inc.: January 22. Available from: <http://www.mathematica-mpr.com/PDFs/schooling.pdf>. Accessed February 2, 2002.
- Hayward, Becky Jon, and G. Kasten Tallmadge. 1995. *Strategies for Keeping Kids in School: Evaluation of Dropout Prevention and Reentry Projects in Vocational Education: Final Report*. Washington, D.C.: U.S. Department of Education. June.
- Hecker, Daniel E. 2001. "Occupational Employment Projections to 2010." *Monthly Labor Review* 124 (11) (November): 57–82. Available from: <http://www.bls.gov/pub/mlr/2001/11/art4full.pdf>. Accessed February 1, 2002.
- Hershey, Alan M., Marsha K. Silverberg, Joshua Haimson, Paula Hudis, and Russell Jackson. 1999. *Expanding Options for Students: Report to Congress on the National Evaluation of School-to-Work Implementation*. Princeton, N.J.: Mathematica Policy Research, Inc. February. Available from: <http://www.mathematica-mpr.com/PDFs/Expanding.pdf>. Accessed February 1, 2002.
- Hoffman, Jill. 2001. "Vocational Ed Mixes Old, New-Style Skills." *Roanoke Times and World News*. October 13, NRV1.

- Holzer, Harry J. 1996. *What Employers Want: Job Prospects for Less-Educated Workers*. New York City: Russell Sage Foundation.
- Hudis, Paula. 2001. *Making Schools Career-Focused*. Princeton, N.J.: Mathematica Policy Research, Inc. Available from: <http://www.mathematica-mpr.com/PDFs/makingschools.pdf>. Accessed February 2, 2002.
- Hughes, Katherine L., Thomas R. Bailey, and Melinda J. Mechur. 2001. *School-to-Work: Making a Difference in Education*. New York: Institute on Education and the Economy, Teachers College, Columbia University.
- Hunter, John E. 1983. "A Causal Analysis of Cognitive Ability, Job Knowledge, Job Performance, and Supervisor Ratings." In *Performance Measurement and Theory*. Edited by Frank Landy, Sheldon Zedeck, and Jeanette Cleveland. Hillsdale, N.J.: Lawrence Erlbaum Associates Publishers.
- Hunter, John E., and Ronda F. Hunter. 1984. "Validity and Utility of Alternative Predictors of Job Performance." *Psychological Bulletin* 96 (1): 72–98.
- Hurst, David, and Lisa Hudson. 2001. *Changes in High School Vocational Coursetaking in a Larger Perspective*. Washington, D.C.: National Center for Education Statistics. Available from: <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001026>. Accessed February 1, 2002.
- Ilg, Randy, and Steven Haugen. 2000. "Earnings and Employment Trends in the 1990s," *Monthly Labor Review* 123 (3) (March): 21–33.
- Immerwahr, John. 1998. *The Price of Admission*. San Jose, Calif.: The National Center for Public Policy and Higher Education. Spring.
- Immerwahr, John. 1999. *Taking Responsibility: Leaders' Expectations of Higher Education*. San Jose, Calif.: National Center for Public Policy and Higher Education and Public Agenda.
- Immerwahr, John, and Steve Farkas. 1993. *The Closing Gateway: Californians Consider Their Higher Education System*. San Jose, Calif.: California Higher Education Policy Center. September.
- Jobs for the Future and Boston Private Industry Council. 1998. *School-to-Career Initiative Demonstrates Significant Impact on Young People*. Boston, Mass.: Jobs for the Future and Boston Private Industry Council. May.
- Johnson, Jean. 1995. *Assignment Incomplete: The Unfinished Business of Education Reform*. New York: Public Agenda.

- Johnson, Jean, and Steve Farkas. 1997. *Getting By: What American Teenagers Really Think about Their Schools*. New York: Public Agenda.
- Jones, Sherry. 2001. "More Jobs than Workers/Skills Unfilled." *Wilmington Morning Star*, April 13, 1B, 3B.
- Kang, Suk, and John Bishop, 1986. "Effects of Curriculum on Labor Market Success Immediately after High School." *Journal of Industrial Teacher Education* 23 (4): 15–29.
- Kang, Suk, and John Bishop. 1989. "Vocational and Academic Education in High School: Complements or Substitutes?" *Economics of Education Review* 8 (2): 133–48.
- Kates, Brian. 2001. "Trade Schools Fall through the Cracks." *New York Daily News*, July 22, news section, 30, final edition.
- Kaufman, Philip, Martha Naomi Alt, and Christopher D. Chapman. 2001. *Dropout Rates in the United States: 2000*. Washington, D.C.: National Center for Education Statistics. November. Available from: <http://nces.ed.gov/pubs2002/2002114.pdf>. Accessed January 27, 2002.
- Kemple, James J. 2001. *Career Academies: Impacts on Students' Initial Transitions to Post-Secondary Education and Employment (Executive Summary)*. New York: Manpower Demonstration Research Corporation. December. Available from: http://www.mdrc.org/Reports2001/CareerAcademies/CAExecutive_Summary.pdf. Accessed February 2, 2002.
- Kemple James J., and Jason C. Snipes. 2000. *Career Academy Impacts for Students at High Risk of Dropping Out*. New York: Manpower Demonstration Research Corporation. December. Available from: <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/kemple.html>. Accessed February 1, 2002.
- Kerckhoff, Alan. 2000. "Transition from School to Work in Comparative Perspective." In *Handbook of the Sociology of Education*. Edited by Maureen T. Hallinan. New York: Kluwer Academic/Plenum Publishers, 453–74.
- Krei, Melinda Scott, and James E. Rosenbaum. 2001. "Career and College Advice to the Forgotten Half: What Do Counselors and Vocational Teachers Advise?" *Teachers College Record* 103 (5) (October): 823–42.
- Kulik, James. 1998. "Curricular Tracks and High School Vocational Education." In *The Quality of Vocational Education: Background Papers from the 1994 National Assessment of Vocational Education*. Edited by Adam Gamoran. Washington, D.C.: U.S. Department of Education, 65–131.

- Lazerson, Marvin, and W. Norton Grubb. 1974. *American Education and Vocationalism*. New York: Teachers College Press.
- Lenhart, Jennifer. 2000. "A Few Students Shy of a Load: N. Va. Schools' Last Bricklaying Program Dies for Lack of Interest." *Washington Post*, June 19, B1, final edition.
- Lerman, Robert. 1999. "Improving Links between High Schools and Careers." In *America's Disconnected Youth: Toward a Preventive Strategy*. Edited by Douglas J. Besharov. Washington, D.C.: CWLA Press, 185–212.
- Levesque, Karen, Doug Lauen, Peter Teitelbaum, Martha Alt, and Sally Librera. 2000. *Vocational Education in the United States: Toward the Year 2000*. Washington, D.C.: National Center for Education Statistics. February. Available from: <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000029>. Accessed February 1, 2002.
- Lewis, Morgan V. 2001. *Major Needs of Career and Technical Education in the Year 2000: Views from the Field*. Columbus, Ohio: National Dissemination Center for Career and Technical Education, The Ohio State University. April. Available from: <http://www.nccte.org/publications/infosynthesis/r&dreport/Major%20Needs%20of%20CTE.pdf>. Accessed January 29, 2002.
- Lopez, Mark Hugo, and Andrea Hetling. 1999. "Participation in Vocational Education: Evidence from NELS:88." Unpublished paper prepared for the American Enterprise Institute, April 12.
- Lynch, Richard L. 2000. *New Directions for High School Career and Technical Education in the 21st Century*. Columbus, Ohio: ERIC Clearinghouse on Adult, Career and Vocational Education. Available from: http://www.ericacve.org/mp_lynch_01.as Accessed February 1, 2002.
- Mane, Ferran. 1999. "Trends in the Payoff to Academic and Occupation-Specific Skills: The Short and Medium Run Returns to Academic and Vocational High School Courses for Non-College Bound Students." *Economics of Education Review* 18: 417–37.
- Mariani, Matthew. 1999. "High-Earning Workers Who Don't Have a Bachelor's Degree." *Occupational Outlook Quarterly* 43 (3) (Fall): 9–15. Available from: <http://www.bls.gov/opub/ooq/1999/Fall/art02.pdf>. Accessed February 1, 2002.
- McFarlane, Clive. 2001. "MCAS-voke Schools Debate Continues." *Worcester (Mass.) Telegram and Gazette*, April 26.
- McPartland, James, and Will Jordan. 2001. *Essential Components of High School Dropout Prevention Reforms*. Baltimore, Md.: Johns Hopkins University. Available from:

- <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/mcpartland.html>. Accessed February 1, 2002.
- Mortimer, Jeylan T., and Helga Kruger. 2000. "Pathways from School to Work in Germany and the United States." In *Handbook of the Sociology of Education*. Edited by Maureen T. Hallinan. New York: Kluwer Academic/Plenum Publishers, 475–97.
- 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) (May): 251–66.
- National Governors' Association. 2002. *Graduation Exit Exam Matrix*. January 8. Available from: http://www.nga.org/center/divisions/1,1188.C_ISSUE_BRIEF^D_3007,00.html. Accessed February 19, 2002.
- National Women's Law Center. 2002. *Title IX and Equal Opportunity in Vocational and Technical Education: A Promise Still Owed to the Nation's Young Women*. Washington, D.C.: National Women's Law Center, June. Available from: <http://www.nwlc.org/pdf/TitleIXCareerEducationReport.pdf>. Accessed June 7, 2002.
- Nelson Report, The. 1995. *Oregon Department of Education, Oregon Educational Act for the 21st Century, School-to-Work System*. Salem, Ore.: Public Affairs Counsel. May.**
- Newman, Kathryn. 1999. *No Shame in My Game*. New York: Alfred A. Knopf and the Russell Sage Foundation.
- Perlman, Heidi B. 2001. "Educators Seek Alternative Testing Requirements for Vocational Students." *Associated Press State and Local Wire*, April 23.
- Phelps, Richard P., Basmat Parsad, Elizabeth Farris, and Lisa Hudson. 2001. *Features of Occupational Programs at the Secondary and Postsecondary Education Levels*. Washington, D.C.: National Center for Education Statistics, June. Available from: <http://nces.ed.gov/pubs2001/2001018.pdf>. Accessed February 21, 2002.
- Pitman, Robert B. 1991. "Social Factors, Enrollment in Vocational/Technical Courses, and High School Dropout Rates." *Journal of Educational Research* 84 (5) (May/June): 288–95.
- Plank, Stephen. 2001. *Career and Technical Education in the Balance: An Analysis of High School Persistence, Academic Achievement, and Postsecondary Destinations*. St. Paul, Minn.: National Research Center for Career and Technical Education. Available from: http://www.nccte.org/publications/infosynthesis/r&dreport/CTE%20in%20BInce_Plank.

- [pdf](#). Accessed January 29, 2002.
- Price, Gregory N. 1999. "The Idea of a Black University." North Carolina Agricultural and Technical State University Department of Economics and Transportation/Logistics Working Paper. September. Available from: <http://www.ncat.edu/~econdept/wp/ideabu.pdf>. Accessed March 14, 2002.
- Rasinski, Kenneth A., and Steven Pedlow. 1994. "Using Transcripts to Study the Effectiveness of Vocational Education." *Journal of Vocational Education Research* 19 (3): 23–43.
- Rasinski, Kenneth A., and Steven Pedlow. 1998. "The Effect of High School Vocational Education on Academic Achievement Gain and High School Persistence: Evidence from NELS:88." In *The Quality of Vocational Education: Background Papers from the 1994 National Assessment of Vocational Education*. Edited by Adam Gamoran. Washington, D.C.: U.S. Department of Education.
- Rosenbaum, James. 2001. *Beyond College for All: Career Paths for the Forgotten Half*. New York: Russell Sage Foundation.
- Rosenbaum, James E., and Stephanie Alter Jones. 2000. "Interactions between High Schools and Labor Markets." In *Handbook of the Sociology of Education*. Edited by Maureen T. Hallinan. New York: Kluwer Academic/Plenum Publishers, 411–36.
- Rosenbaum, James E., Shazia Miller, and Melinda Krei. 1996. "Gatekeeping in an Era of More Open Gates: High School Counselors' Views of Their Influence on Students' College Plans." *American Journal of Education* 104 (August): 257–79.
- Rumberger, Russell. 2001. *Why Students Drop Out of School and What Can Be Done?* Santa Barbara, Calif.: University of California. Available from: <http://www.law.harvard.edu/groups/civilrights/publications/dropouts/dropout/rumberger.pdf>. Accessed January 27, 2002
- School-to-Work Opportunities Act of 1994*. 1994. U.S. Public Law 103-239. 103rd Congress, May 4.
- Schworm, Peter. 2002. "Tech Students Buckle Down for MCAS; Concerned Sophomores Stay after School Three Days a Week for Voluntary Sessions." *Boston Globe*, January 31.
- Shartin, Emily. 2001. "Demand Surging at Vocational Schools: More Students Seek Career Skills, Ignore Weak Academic Image." *Boston Globe*, July 22, South Weekly Section, 1, third edition.
- Shavit, Yossi, and Walter Muller. 2000. "Vocational Secondary Education, Tracking, and Social Stratification." In *Handbook of the Sociology of Education*. Edited by Maureen T.

- Hallinan. New York: Kluwer Academic/Plenum Publishers, 437–52.
- Simon, Peter. 2001. “Trade-School Blues: Harsh Audit Inspires Plan for Reform.” *Buffalo News*, February 18, 1A, final edition.
- Stasz, Cathleen, and Dominic Brewer. 1999. *Academic Skills at Work: Two Perspectives*. Berkeley, Calif.: National Center for Research in Vocational Education. May. Available from: <http://www.nccte.org/publications/ncrve/mds-11xx/mds-1193.html>. Accessed February 1, 2002.
- Stern, David, Thomas Bailey, and Donna Merritt. 1996. *School-to-Work Policy Insights from Recent International Developments*. Berkeley, Calif.: National Center for Research in Vocational Education. December. Available from: <http://www.nccte.com/publications/ncrve/mds-09xx/mds-950.html>. Accessed February 1, 2002.
- Stern, David, Charles Dayton, Il-Woo Paik and Alan Weisberg. 1989. “Benefits and Costs of Dropout Prevention in a High School Program Combining Academic and Vocational Education: Third-Year Results from Replications of the California Peninsula Academies.” *Educational Evaluation and Policy Analysis* 11 (4) (Winter): 405–16.
- Stern, David, Neal Finkelstein, James R. Stone III, John Latting, and Carolyn Dornsifel. 1995. *School to Work: Research on Programs in the United States*. London: Flamer Press.
- Swanson, Patricia. 2001. “Vocational Ed: Many Well-Paying Jobs Await Graduates.” *Evansville (Ind.) Courier and Press*, March 12.
- Turner, Tracy. 2001. “Vocational Careers in Spotlight at Anthis; Open House at Center Seeks to Change Public Perception.” *Fort Wayne (Ind.) News Sentinel*, February 13, 1A, final edition.
- U.S. Congress, Office of Technology Assessment. 1995. *Learning to Work: Making the Transition from School to Work*. Washington, D.C.: Office of Technology Assessment.
- U.S. Department of Education, National Center for Education Statistics. 1999. *The Condition of Education 1999*. Washington, D.C.: U.S. Department of Education, National Center for Education Statistics. Available from: <http://nces.ed.gov/pubs99/condition99/pdf/1999022.pdf>. Accessed January 27, 2002.
- U.S. Department of Education, National Commission on Excellence in Education. 1983. *A Nation at Risk: The Imperative for Educational Reform*. Washington, D.C.: U.S. Department of Education.
- U.S. Department of Education, No Child Left Behind Web site. *The Facts about Making Gains*

- Every Year*. Available from: http://www.nclb.gov/start/facts_pdf/yearly_gains.pdf. Accessed August 3, 2003.
- U.S. Department of Education, No Child Left Behind Web site. *Introduction and Overview*. Available from: <http://www.nclb.gov/next/overview/>. Accessed August 3, 2003.
- Visher, Mary G., Doug Lauen, Linda Merola, and Elliott Medrich. 1998. *School-to-Work in the 1990s: A Look at Programs and Practices in American High Schools*. Berkeley, Calif.: MPR Associates, Inc. August.
- Washington State Workforce Training and Education Coordinating Board. 1997. *Education and Workforce Issues: Public Attitudes and Awareness, 1997*. Olympia, Wash.: Washington State Workforce Training and Education Coordinating Board.
- Wehrman, Jessica. 2002. "Growing Demand for High School Vocational Courses." *Scripps Howard News Service*, March 21.
- Wilfong, Cathy. 2001. "Demand Increases for Vocational Education Degrees." *Chattanooga Times/Chattanooga Free Press*, June 3.
- Wirt, John, Susan Choy, Debra Gerald, Stephen Provasnik, Patrick Rooney, Satoshi Watanabe, Richard Tobin, and Mark Glander. 2001. *The Condition of Education 2001*. Washington, D.C.: National Center for Education Statistics. Available from: <http://nces.ed.gov/pubs2001/2001072.pdf>. Accessed February 4, 2002.
- Wirt, John, Susan Choy, Allison Gruner, Jennifer Sable, Richard Tobin, Yupin Bae, Jim Sexton, Janis Stennett, Satoshi Watanabe, Nicholas Zill, Jerry West, and Kristin Denton. 2000. *The Condition of Education 2000*. Washington: D.C.: National Center for Education Statistics. Available from: <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000062>. Accessed January 27, 2002.
- Wonacott, Michael E. 2001. *Career Clusters*. Columbus, Ohio: National Dissemination Center for Career and Technical Education. Available from: <http://www.nccte.org/publications/infosynthesis/highlightzone/highlight06/highlight06-careerclusters.pdf>. Accessed January 31, 2002.
- Zernike, Kate. 2001. "Graduation Rule Adjusted for Vocational Students." *New York Times*, February 7.

Appendix A

Statistical Studies of CTE's Effectiveness: Summary and Assessment

This appendix summarizes the studies that assessed career and technical education (CTE) effectiveness by analyzing data from large national surveys of youth that capture information on thousands of students from schools around the country. Appendix B reviews studies of individual programs or groups of programs.

We identified the studies in this appendix by several means. We examined literature reviews of CTE impacts.²⁷³ We also searched the ERIC database (ERIC Clearinghouse on Adult, Career and Vocational Education [<http://ericacve.org>]) for documents on vocational and career and technical education. We reviewed materials available on several additional Web sites, including the National Centers for Career and Technical Education (www.nccte.com) and the National Center for Research in Vocational Education (NCRVE). Finally, we consulted with research staff at the U.S. Department of Education and other experts in the field to identify the most recent studies.²⁷⁴

We did not summarize every study of this type. We included studies that compared CTE students with non-CTE students; that looked at the impact of CTE on dropping out of high school or labor market success; and that explained how they obtained their results. We excluded studies that examined outcomes for CTE students only (lacking a comparison group); studies that failed to explain how they obtained their results; and some studies that relied on data from before 1980. We also excluded some studies published before 1994 that focused on the impact of CTE on academic achievement and educational attainment, relying instead on James Kulik's review of these studies for the 1994 National Assessment of Vocational Education.

Most of the studies reviewed here analyzed data from one of three major national surveys conducted by the National Center for Education Statistics: the National Longitudinal Study of the High School Class of 1972 (NLS-72), High School and Beyond (HSB), and the National

²⁷³See James Kulik, "Curricular Tracks and High School Vocational Education, in *The Quality of Vocational Education: Background Papers from the 1994 National Assessment of Vocational Education*, edited by Adam Gamoran (Washington, D.C.: U.S. Department of Education, 1998); John Bishop, "Expertise and Excellence," Center for Advanced Human Resource Studies Working Paper, Cornell University, Center for Advanced Human Resource Studies, Ithaca, N.Y., 1995; and Ferran Mane, "Trends in the Payoff to Academic and Occupation-Specific Skills: The Short and Medium Run Returns to Academic and Vocational High School Courses for Non-College-Bound Students," *Economics of Education Review* 18 (1999).

²⁷⁴These experts included John Bishop of Cornell University; David Boesel, David Goodwin, Robert Muller, and Marsha Silverberg at the U.S. Department of Education; and Michael Wonnacott of the National Centers for Career and Technical Education.

Educational Longitudinal Study 1988–1992 (NELS:88). All of these surveys used a two-stage sample design, selecting first a sample of schools and then a sample of students from each school. In addition, a few of the studies in this appendix used data from a fourth survey, the National Longitudinal Survey of Youth (NLSY), conducted by the Bureau of Labor Statistics. NLSY is a national probability sample of young people who were between the ages of fourteen and twenty-one in the fall of 1978. All four of these studies include detailed background information on the youth, including standardized test scores, and all performed post–high school follow-ups. Some details of the scope of these four surveys follow.

- **National Longitudinal Study of the High School Class of 1972.** NLS-72 began with a sample of about 19,000 youth who were high school seniors during the spring of 1972. About 4,500 respondents were added in 1973. Additional follow-ups were conducted in 1974, 1976, 1979, and 1986. Standardized test scores are available for the baseline year.²⁷⁵
- **High School and Beyond.** HSB began with surveys of about 30,000 high school sophomores and about 28,000 high school seniors in 1980, including students from more than one thousand high schools. HSB surveyed both cohorts every two years through 1986 and, for the 1980 sophomore class, again in 1992.²⁷⁶ The sophomore cohort took achievement tests in both their sophomore and senior years, whereas the senior year cohort took these tests in their senior year only.²⁷⁷ HSB also collected about 12,000 transcripts for the sophomore cohort students during their senior year.²⁷⁸
- **National Educational Longitudinal Study 1988–1992.** NELS:88 is a longitudinal study of a national cohort of young people who were in the eighth grade in 1988. NELS:88 selected a national probability sample of more than one thousand schools and more than twenty-four thousand eighth-grade students in 1988 and interviewed the students, their parents, their teachers, and school administrators that year. The students also took achievement tests in mathematics, science, reading, and social studies. NELS:88

²⁷⁵Thomas S. Dee, William N. Evans, and Sheila E. Murray, “Data Watch: Research Data in the Economics of Education,” *Journal of Economic Perspectives* 13 (3) (Summer 1999): 210; U.S. Department of Education, National Center for Education Statistics, *National Longitudinal Survey of 1972*, available from: <http://www.nces.ed.gov/surveys/nls72/>, accessed May 16, 2002.

²⁷⁶U.S. Department of Education, National Center for Education Statistics, *High School and Beyond*, available from: <http://nces.ed.gov/surveys/hsb/>, accessed June 5, 2002.

²⁷⁷Aurora D’Amico, U.S. Department of Education, personal communication, June 6, 2002.

²⁷⁸U.S. Department of Education, National Center for Education Statistics, *High School Transcript Studies*, available from: www.nces.ed.gov/surveys/hst/, accessed May 17, 2002.

interviewed and tested the students again in 1990, 1992, and 1994 and collected their high school and postsecondary transcripts.²⁷⁹

- **National Longitudinal Survey of Youth.** NLSY is a national probability sample of 12,686 people who were between the ages of fourteen and twenty-two when first interviewed in 1979. NLSY interviewed participants annually through 1994, and interviews are continuing biennially. Data collected include test scores on the Armed Services Vocational Aptitude Battery (ASVAB), achievement test data on the youths, and information about their schools, collected via a school survey. Transcript data are available for 8,778 NLSY respondents who were expected to complete high school during the 1980–1983 survey years.²⁸⁰ During the period 1979–1986, parents of youth who were living at home completed a household interview in which they were asked about the income of and highest grade completed by family members, among other questions.²⁸¹

Two of the studies reviewed here used additional data sets: David Boesel used the Monitoring the Future survey and the John T. Grasso and John R. Shea study used the National Longitudinal Surveys of Labor Market Experience. The scope of these two sources is discussed within the summaries.

These surveys have different strengths and weaknesses, some of which carry over to the studies reviewed here.²⁸² NLS-72 and the senior cohort of HSB include only those young people who entered their senior year of high school, precluding the possibility of measuring the effect of vocational education on dropping out prior to that time. In contrast, NELS:88, the sophomore cohort of HSB, and NLSY included students who dropped out before their senior year. NLS-72 has followed up with students into their early thirties, and NLSY has followed up with its oldest respondents into their forties. In contrast, NELS:88 followed up with its participants and HSB followed up with its senior cohort only through their early twenties, and the HSB sophomore cohort was followed up into their late twenties. The HSB senior cohort data and the NLS-72 include test scores from the senior year only, which may reflect the impact of curriculum. Controlling for these test scores, as some researchers do, may thus absorb some of the effects of the academic curriculum, thus artificially depressing its effect.

²⁷⁹Dee, Evans, and Murray, 210; Steven J. Ingels et al., *Coming of Age in the 1990s: The Eighth-Grade Class of 1988 12 Years Later*, Report No. NCES 2002-321 (Washington, D.C.: National Center for Education Statistics, U.S. Department of Education: March 2002), 1, available from: <http://nces.ed.gov/pubs2002/2002321.pdf>, accessed May 16, 2002.

²⁸⁰U.S. Department of Labor, Bureau of Labor Statistics, *National Longitudinal Surveys: NLSY79*, available from: <http://www.bls.gov/nls/y79summary.htm>, accessed May 16, 2002.

²⁸¹Steve McClaskie, NLS User Services, personal communication, May 20, 2002.

²⁸²See Dee, Evans, and Murray, 210–11; David Boesel et al., *National Assessment of Vocational Education: Final Report to Congress: Volume II: Participation in and Quality of Vocational Education* (Washington, D.C.: U.S. Department of Education, July 1994), 132–33.

Transcript data were not collected for NLS seniors²⁸³ nor for the HSB senior cohort, so researchers using these cohorts must rely on self-reported data. Transcripts were collected for only a subsample of the HSB sophomore cohort and for NLSY respondents.

Most of the family background information in NLS-72 and HSB was reported by the students themselves, with high nonresponse rates on items such as family income and parent's education and other possible inaccuracies. NELS:88 had a larger parent survey than HSB, probably producing more reliable family background data.²⁸⁴

Finally, all of these data sources are somewhat dated. The most recent survey, NELS:88, concerns a cohort that was scheduled to graduate from high school in 1992, and the others rely on data collected in the 1970s and 1980s. There have been many changes in the mix of available jobs, as well as changes in the nature of vocational education, since that time.

This appendix discusses several research studies in turn, describing the major findings, including outcomes, such as dropping out and employment. Studies reviewed are arranged alphabetically by the name of the primary author. Kulik's review of the literature on CTE's impact on educational achievement and attainment is treated as an individual study and can be found under the author's name. However, because it is not comparable to the other studies, we have not included an assessment of Kulik's work. Studies not reviewed are listed at the end of this appendix, alphabetically by author's name.

²⁸³Patricia Green, Bernard L. Dugon, and Stephen J. Ingels, *Trends among High School Seniors, 1972–1992* (Washington, D.C.: National Center for Education Statistics, March 1995), 20, available from <http://nces.ed.gov/pubs95/95380.pdf>, accessed June 26, 2002.

²⁸⁴Dee, Evans, and Murray, 211.

Altonji, Joseph G. 1994. "The Effects of High School Curriculum on Education and Labor Market Outcomes." *Journal of Human Resources* 30 (3): 409–38.

Methodology. Altonji used data from the NLS-72 to estimate the effects of curriculum on postsecondary academic education. The author surveyed individuals who were high school seniors during the 1971–1972 academic year. He studied a subsample of 9,239 individuals who met various sample selection criteria and had “valid” data on the variables used in the analysis. He studied the effect of vocational and academic course taking on the number of years of postsecondary education that an individual had completed by 1979, seven years after graduation. He also examined the impact of curriculum on a composite of wage information collected between 1977 and 1986. His independent variables, based on information provided by the schools, included semester hours of commercial courses, industrial arts courses, and various academic courses in tenth, eleventh, and twelfth grades. He also included a dummy variable representing an academic course of study (as reported by the school). He included several types of models to predict wages, all of which controlled for the extent of postsecondary education. Some variables, such as parental socioeconomic status, parental involvement, and student achievement and ability—as measured by twelfth-grade test scores—were controlled in some models but not others. Some of his models used an “instrumental variables procedure that relies upon variation across schools in what students take to identify the effects of curriculum” (434).

Findings. Altonji concluded that industrial arts and commercial courses had consistently negative effects on educational attainment, although the magnitudes declined somewhat when he controlled for background, aptitude, and ability. He also found that completing an academic curriculum had a substantial positive effect on educational attainment. Examining wages, he estimated that a year-long industrial arts course raised wage levels by about 1 percent, depending on the model. Commercial courses either had no effect or increased the wage by about 1 percent as well, depending on the model. He found that the effects of year-long academic courses varied from negative to modestly positive, depending on the subject, and were mostly lower than the effects of industrial arts and vocational courses. He suggested that his estimates of the effects of academic courses were, if anything, “overstated” (412).

Assessment. As in the other studies reviewed in this appendix, the data in Altonji’s study are quite old, casting doubt on their relevance today. (Wage data, for example, are from 1977 and 1986.) In addition, despite the controls the author used, it is likely that unmeasured differences biased the results, especially because there is reason for concern that some of the family background information in NLS-72 may have been inaccurate and such information was missing for many youth in the sample. Altonji himself noted that the positive coefficients for vocational education were obtained “in spite of negative selection bias,” because vocational course taking was negatively related to most of the ability and background measures he used (426). Because none of his models controlled for all of these measures, there is clearly some bias remaining, and unmeasured factors may have increased this bias. Altonji also acknowledged that he controlled for a number of achievement measures, such as test scores and student perceptions of their own abilities and how teachers ranked them, which were measured in twelfth grade.

Because these variables may have been influenced by curriculum, using this control might have biased downward the effects of the academic curriculum.

Altonji defined vocational education participation as taking one credit in industrial or commercial arts, which assumed that each additional course would have the same effect. In fact, the difference between concentrating or not concentrating in vocational education may create a critical mass of knowledge and skills that may be greater than the sum of the impacts of the individual courses taken, and his model disregarded this possibility. His method of measurement, using information provided by schools, was probably fairly accurate, however.

The NLS-72 included only those students who remained in school into their senior year. By leaving out those students who dropped out earlier, Altonji's analysis may have understated the dropout reduction effects of vocational education. A strength of Altonji's study, however, was his use of long-term wage information, which included data on wages earned as late as fourteen years after graduation.

Arum, Richard, and Yossi Shavit. 1995. "Secondary Vocational Education and the Transition from School to Work." *Sociology of Education* 68 (July): 187–204.

Methodology. Unlike the economists who conducted most studies of the labor market outcomes of vocational education, Arum and Shavit used a sociological measure of labor market success, dividing employment into four "classes." They analyzed data on the 13,749 students in the HSB data set who were surveyed in their sophomore year in 1980 and included in the follow-up studies through 1986. Data on variables that Arum and Shavit analyzed, however, were missing for about a third of the cases, causing them to be dropped from the analysis. In order to determine whether this loss of cases would bias their results, Arum and Shavit imputed data for about half of these cases on the basis of their scores on other variables or the mean scores for other students in their scholastic track. They found that the results remained "virtually unchanged" (189). Arum and Shavit used both self-reported and transcript-based measures in the HSB data set to assign students to the general, vocational, academic, and combined academic/vocational programs.²⁸⁵ They analyzed student transcripts to classify them as (1) vocational course concentrators (those who earned four or more credits in a single vocational instructional program, such as business), (2) limited concentrators (those who earned four or more credits in vocational courses but not in a single occupational program), (3) samplers (those who took at least one but less than four credits in vocational courses), or (4) nonparticipants in vocational classes. They considered students who were classified as concentrators or limited concentrators to be in the vocational track. The authors also used students' self-reports in twelfth grade to create three separate subcategories of vocational programs: (1) a vocational business track; (2) a trade, technical, and industrial track; and (3) a miscellaneous track.

Arum and Shavit used HSB survey data to control for ability level, socioeconomic background, presence of two parents, number of siblings, race/ethnicity, type of school, urban/rural/suburban location, and region. The researchers examined labor market outcomes for young adults after they had been out of high school for four years. They divided employment into four classes: (1) a category that includes supervisors and self-employed,²⁸⁶ (2) skilled manual labor, (3) routine nonmanual labor, and (4) unskilled or semiskilled.²⁸⁷ Because the HSB data set used the 1970 U.S. census occupational codes, the researchers had to re-code each

²⁸⁵Richard Arum and Yossi Shavit, "Secondary Vocational Education and the Transition from School to Work," *Sociology of Education* 86 (July 1995): 187–204. Arum and Shavit reported that they ran their models with both measurements of track location and found "relatively consistent results" (193).

²⁸⁶The authors described this category as consolidating "the original EGP classes of higher controllers, lower controllers, self-employed with employees, self-employed without employees, and self-employed farmers" (190). We assume that this category included all professional jobs.

²⁸⁷This classification schema is a condensed version of the EGP schema (developed by Erikson, Goldthorpe, and Portocarero) for occupational classifications, which the authors report is "in wide use among stratification researchers, especially those engaged in comparative research." See Arum and Shavit, 190.

individual into their own schema for occupational classification. Using logistic regression, they estimated the effects of placement in the vocational or academic tracks compared with the general track on the likelihood of being either (1) in one of these four classes or postsecondary school or (2) neither employed nor in school. They also estimated the odds of being in unskilled work versus any other category.

Findings. Arum and Shavit found that vocational secondary education (measured using school transcripts) “enhances the chances for employment, in general, and for employment in higher-quality jobs, in particular” (199 and 202). For young men, they found that, when compared with the alternative of general education, vocational education (using the transcript-based classification) significantly increased the odds of being employed in three of the four categories used (all except routine nonmanual labor) and of being a skilled rather than an unskilled worker. They also found that a combined vocational and academic curriculum seemed to be even more beneficial at improving employment chances than either an academic education or a vocational education alone. For men—when compared with academic students, but not those in a general curriculum—vocational students had less chance of continuing on to college and probably of entering the professions. For young women, they found that a vocational curriculum significantly increased the odds of being employed in skilled manual labor or routine nonmanual labor (versus not being employed), but it did not significantly improve the likelihood of being a skilled (versus an unskilled) worker. It also significantly reduced a young woman’s chance of attending postsecondary school relative to both the academic and general tracks. The authors found that the effects of vocational programs were less pronounced when self-reports, rather than transcript-based measures, were used to determine high school track, perhaps because young people tend to underreport participation in the vocational track.

Using student self-reports to differentiate among three distinct types of vocational programs, the authors found that, for young men, vocational business programs increased the odds of unemployment. Trade and technical programs increased the odds of obtaining employment as skilled workers when compared with the general and even to the academic track. For young women, they concluded that vocational business programs, in which women were concentrated, enhanced women’s likelihood of “routine nonmanual employment” relative to nonemployment (202). Trade and technical programs provided a path to skilled manual occupations for the few women who enrolled in them.

Assessment. As in the other studies reviewed in this appendix, the data used are quite dated. (The HSB data set reports on 1986 labor market outcomes for students who graduated from high school in 1982.) The authors used many control variables, but included no attitudinal variables, raising the possibility of selection bias. The large amount of missing family background data in HSB is also a matter of concern, although the authors claimed that the loss of cases due to missing data did not bias their results. The authors used a concentration-based definition of vocational education, which seems more accurate than a course-based definition. It would have been still better, however, if they could have estimated the outcomes separately for the concentrators and the limited concentrators because their data were coded that way. The use of transcript data to assign students to concentrations was also laudable, although self-reported

data were used as well. Like other authors, Arum and Shavit were not able to distinguish among vocational education programs of different levels of quality, although they did examine the effects of different fields. Moreover, four years after leaving high school is still fairly early for measuring labor market outcomes, and the apparent effects of vocational education might dwindle with time. A strength of the study is that the HSB contains representative data on all who were sophomores in 1980, not just those who became seniors or graduated.

Arum and Shavit's sociological classification of occupations allowed them to draw conclusions about the impact of vocational education on the odds of obtaining skilled versus unskilled employment—an interesting research question asked by few other studies.²⁸⁸ However, there is some cause for concern about the accuracy of re-coding Census Bureau occupational categories into the authors' schema. Arum and Shavit themselves acknowledge that their occupation classifications do not correspond exactly to the census categories. As a result, some individuals may be assigned to the wrong category, possibly creating some inaccuracy. Arum and Shavit stated that the nature of these differences suggests that some of their estimates were conservative, but their reasoning was not completely clear, and more confidence could be placed in the results had census categories been used.

²⁸⁸See, for example, Yossi Shavit and Walter Muller, "Vocational Secondary Education, Tracking, and Social Stratification," in *Handbook of the Sociology of Education*, edited by Maureen T. Hallinan (New York: Kluwer Academic/Plenum Publishers, 2000), 437–52.

Boesel, David. 2001. "Student Attitudes toward High School and Educational Expectations." Paper presented at the annual meeting of the American Educational Research Association. Seattle. April.

Methodology. To examine student attitudes, David Boesel drew on twenty-three years of data from the Monitoring the Future survey, which has been conducted every year since 1976 by the Institute for Survey Research (ISR) at the University of Michigan. Each year ISR selects a new group of schools, using a three-state sample design. Researchers first select the geographic areas to cover and then one or more schools within each geographic area, with a total of 125 schools. Then they select a sample of students within each school, with a total of fifteen thousand seniors selected each year. Boesel used data from the common core questionnaire that all the seniors in their study complete and one of the questionnaires administered to a subsample of about three thousand seniors. He analyzed survey data for every fourth or fifth year between 1976 and 1999.

Findings. Boesel found that in 1976 there were no significant differences between academic and vocational students in the proportion who believed that doing well in school was important to getting a good job. Between 1976 and 1999, this percentage increased for academic and general students but declined slightly for vocational students so that, by 1999, vocational students were significantly less likely to believe this was the case. General track students fell in between, but Boesel does not report on the statistical significance of the difference between general students and the other groups.

In 1976, Boesel found no statistically significant differences between the percentages of academic and general students who reported thinking that their education would prevent them from getting the kind of work they wanted. By 1999, however, vocational students were significantly more likely to see their education as a handicap. Although this percentage increased for all three groups, the percentage of vocational students perceiving their education as a handicap more than doubled, from 19 percent to 44 percent, a much greater percentage point change than that of the other groups.

The percentage of students believing that the things learned in school were important in later life declined among all of the groups over the period studied, but it declined most for vocational students. (Boesel does not report on the statistical significance of the declines.) There were, however, no statistically significant differences among the groups in either the beginning or the end of the period studied. Boesel found no consistent pattern of changes over time in various measures of how students liked school and few significant differences in either 1976 or 1999.

Boesel also found that vocational students were more likely than academic students to report that their peers would approve of various anti-school behaviors such as cheating on a test or making teachers angry. There was some evidence that the differences between academic and vocational students widened on these variables, but in two out of three of them, the general track

students reported as much of an increase as the vocational students. The percentage of vocational students who reported having damaged school property in the past twelve months increased by seven percentage points, as compared with two percentage points for academic students and one percentage point for general students. But, again, Boesel did not report the statistical significance of these changes. In conclusion, Boesel suggested that vocational students were becoming more disaffected relative to academic students due to a decline in their prospects in the labor market.

Assessment. Boesel's study compared vocational track students with academic track students without any statistical controls. Thus, we do not know whether the differences found reflected the impact of vocational programs or the kinds of students who tend to take vocational education. Because vocational students were likely to be more disadvantaged to start with, their poorer attitudes toward school might have reflected this disadvantage. Moreover, because we have seen in the body of the report that vocational students have become more disadvantaged over time, the changes might have reflected this disadvantage rather than perceived changes in the relevance of vocational education for economic success.

The use of self-reported data on type of high school program might have been a particular problem because the breakdown of students by program in Boesel's study was quite different from the most recent data reported by the National Center for Educational Statistics (NCES), which was based on transcript data from 1998.²⁸⁹ NCES reported that 25 percent of high school graduates completed a vocational concentration, 39 percent completed a college preparatory curriculum, and 43 percent completed a general curriculum in 1998. Boesel's 1999 data showed 56 percent of high school graduates completing an academic program, 28 percent a general program, and only 9 percent a vocational program.²⁹⁰ These differences would accord with the generally accepted view that young people tend to understate their participation in vocational education and overstate their participation in academic education. Boesel argued that the data were acceptable sources for relative estimates of the difference between these variables across groups or over time, and that is probably true. Caution should be used, however, in reviewing the absolute proportions. If some vocational students are calling themselves academic, the differences between academic and vocational students might be understated.

It is also unfortunate that Boesel did not discuss the data on general track students, which appeared in his tables but were not analyzed in the text. For example, the increase over time in the percentage of students reporting that their classmates like their making teachers angry was greater for general than for vocational students, and the percentage point change in students saying their friends encourage behaviors that teachers do not like increased as much for general

²⁸⁹David Hurst and Lisa Hudson, *Changes in High School Vocational Coursetaking in a Larger Perspective* (Washington, D.C.: National Center for Education Statistics, 2001), available from: <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001026>, accessed February 1, 2002.

²⁹⁰NCES counts students who met the criteria for two concentrations in both categories, so 7 percent of students were counted as both academic and vocational concentrators. The Institute for Survey Research apparently required students to choose one high school program, although 7 percent answered "other" or "don't know"—the same percentage reported as dual concentrators by NCES.

as for vocational students. As other researchers have pointed out, the general track might be the more appropriate one for comparisons, because most vocational students, if not placed in the vocational track, would have been in the general rather than in the academic track. The report would have also been more complete if it had included information on the statistical significance of the changes over time.

It is not clear that Boesel's interpretation of his results is the only valid one. The changes in student attitudes might have reflected changes in public opinion and the characteristics of vocational students more than changes in vocational education or its effectiveness in preparing students for good jobs. As discussed in the body of the paper, the percentage of the public that believes that college is necessary for a good job has been increasing, and vocational education has fallen into disfavor. Moreover, the proportion of disadvantaged students in vocational education has increased as this track has become less popular among middle-class students and in response to federal legislation that required schools to target vocational programs to disadvantaged groups.

Campbell, Paul B., Karen S. Basinger, Mary Beth Dauner, and Marie A. Parks, 1986. *Outcomes of Vocational Education for Women, Minorities, the Handicapped and the Poor*. Columbus, Ohio: National Center for Research in Vocational Education.

Campbell, Paul B., Jack Elliot, Suzanne Laughlin, Ellen Seusy, George Farkas, Lawrence Hotchkiss, and Ernst Stromsdorfer. 1987. *Dynamics of Vocational Education: Effects on Labor Market Outcomes*. Columbus, Ohio: National Center for Research in Vocational Education.

Methodology. In their 1986 and 1987 papers, Campbell and his colleagues analyzed NLSY data on 7,915 young men and women who were first interviewed in 1979 when they were between the ages of fourteen and twenty-one. Only high school graduates were included. They also analyzed HSB data on 23,261 high school graduates who had been surveyed for the first time as sophomores in 1980. For the regression analysis, they divided students into five curriculum groupings, including three vocational categories as well as the academic curriculum and the general curriculum. Categories of vocational participation included (1) concentrators (those who averaged six or more Carnegie credits in one specialty area, followed the specialty throughout most of high school, and continued in it up to graduation), (2) limited concentrators (those who averaged somewhat more than three credits in a specialty and were less likely to follow it through the senior year), and (3) concentrator/explorers (who averaged two and one-half credits in a vocational area and usually ended the specialization before the senior year). The researchers used transcript data when available, otherwise using self-reported data.

For the 1986 report, the researchers ran regression equations controlling for measures of ability, grade point average, socioeconomic status, attitudes toward work and school, years of postsecondary education completed, current enrollment in postsecondary education, region of residence, and rural or urban location. Using interview data collected when the NLSY participants were on average about five years out of high school and when the HSB youths were slightly less than two years out of high school, they predicted (1) the percentage of time the respondent was in the labor force and (2) the percentage of weeks in the labor force that the respondent was actually employed. Campbell and his colleagues also estimated the effect of vocational education on hourly wage rates and monthly earnings expressed in log form, using the two databases, three differing specifications, and two different samples (those employed full-time and all workers).

When a new wave of NLSY data became available, Campbell and a different group of colleagues, using survey data from 1985, added two more years of labor market data for the NLSY youth, resulting in the 1987 paper.

Findings. In the 1986 paper, the researchers reported that high school graduates who pursued an academic curriculum were more likely than those who pursued other curricula to

continue their education beyond high school. However, vocational graduates were as likely as general graduates to continue their education.

With both databases, the researchers found that vocational concentrators and limited concentrators both spent greater percentages of time in the labor force than graduates who had followed a general curriculum. Graduates with an academic curriculum spent a *smaller* percentage of time in the labor force than their peers in the general curriculum, even though the equations controlled for participation in postsecondary education. When they estimated effects on employment, the authors found that vocational concentrators averaged about two more work weeks each year than a graduate of the general curriculum and that an academic curriculum provided neither an advantage nor a disadvantage (Campbell et al., 1986, 60). Those vocational concentrators who found training-related jobs had a greater advantage than other vocational concentrators (Campbell et al., 1986, 58–59).

When comparing vocational concentrators in training-related employment with those who followed a general curriculum, Campbell and his colleagues stated: “There is a consistent advantage in hourly wages and monthly earnings across specifications and databases” (Campbell et al., 1986, 61). The hourly wage advantage ranged from 7 percent for NLSY youth to 11 percent for HSB youth. The monthly earnings advantage ranged from 7 percent for NLSY youth to 10 percent for HSB youth. However, the authors found less evidence of such an advantage for women (Campbell et al., 1986, 101). The researchers found no significant earnings advantage or disadvantage for academic students over students in the general track. More than half of the workers whose high school transcripts indicated a vocational program were working in jobs apparently unrelated to their curriculum, and researchers found no earnings advantage for these workers. For the HSB data, but not for the NLSY data, both limited concentrators and concentrator/explorers in training-related jobs showed a monthly and hourly advantage of the same magnitude as that of concentrators.

In the 1987 paper, Campbell and his colleagues reported that the effects of vocational education seemed to dwindle over time. Although the vocational concentrators and limited concentrators still had an hourly wage advantage over academic and general track students in 1985, at ages twenty-one to twenty-eight (an average of seven years out of high school), the differences had decreased enough so as not to be statistically significant. Vocational concentrators and limited concentrators still had a significant advantage in monthly earnings, and the authors hypothesized that this reflected higher employment and hours worked in this group (Campbell et al., 1987, 26).

Assessment. The age of the data presents a problem in this study as well, because the most recent data used are from 1983 and 1984, approximately twenty years ago. Although the authors controlled for a wide variety of ability, background, and attitudinal variables, unmeasured differences were probably still present and might have biased the results. In addition, as in the other studies reviewed in this appendix, there were reasons for concern about the quality and quantity of family background information in the HSB database. In addition, like other studies using large databases, this one was unable to measure the quality or other

characteristics of vocational education programs to see whether higher quality programs or those that differ in other ways have had more impact. The use of several levels of vocational education participation reflects meaningful differences in curriculum that some other studies did not address, and the use of transcript data when available is also laudable. However, the authors indicated that “preliminary tabular analysis had documented that self-report curriculum data were only marginally reliable” (Campbell et al., 1987, 13), and they failed to report the number of cases for which they used self-report data because transcripts were not available. (As described at the beginning of this appendix, transcripts were available for less than half of the HSB sophomore cohort and for about two-thirds of the NLSY sample members.)

The 1986 study was fairly short term and included high school graduates only. The 1987 study’s addition of the somewhat longer-term findings was quite valuable, even though these were still relatively short term. By looking at high school graduates only, however, the authors may have understated the effects of vocational education, because other evidence suggests that vocational education reduces the dropout rate.

Crawford, David L., Amy W. Johnson, and Anita A. Summers. 1997. "Schools and Labor Market Outcomes." *Economics of Education Review* 16 (3): 255–69.

Methodology. Crawford, Johnson, and Summers used HSB data on a sample of 3,043 students who were sophomores in 1980 and analyzed employment and earnings data collected three years after the expected year of high school graduation. Only those students who were not full-time postsecondary students at that time were included in the sample. The authors employed a regression equation that used pupil, school, and labor market characteristics to predict labor market performance. The student characteristics included measures of socioeconomic status, gender, ethnicity, and family structure but not scholastic performance or motivation. The authors chose not to control for achievement, reasoning that it might be caused by other variables in the equation. Missing data resulted in a loss of many cases, so of the two regression models used, one was based on about twelve hundred cases and the other on about two thousand cases. The authors assessed the impact of having a vocational program, rather than an academic or general program, but they did not describe how they defined a vocational program or how they obtained the data.

Findings. The authors found that, without controlling for academic performance, participating in a vocational program lowered earnings by more than \$1,000 per year, compared with participating in an academic or general program. When they controlled for high school grade point average, they still found a negative, although reduced, impact for vocational education. They also reported, but did not show, another specification in which students pursuing an academic program averaged increased earnings of about \$1,000.

Assessment. As in most studies reviewed in this appendix, the data are quite old, reporting outcomes for the high school class of 1982. Selection bias presents a major problem. Because Crawford, Johnson, and Summers did not control for students' academic ability, achievement, or other factors such as motivation, the authors cautioned that they could not be sure whether their results were due to the different programs or to unmeasured characteristics of the students. This means that the lower earnings found for vocational students might have reflected their poorer academic abilities rather than their participation in vocational education. Controlling for grade point average did not seem to change the results much. Grade point average, however, may not be an adequate control because students may find it relatively easier to earn high grades in vocational courses, compared with academic courses. Moreover, the loss of many cases due to missing background information, and possible inaccuracies in self-reported family background information, adds to the concern about the adequacy of the controls.

The authors did not explain how they defined curriculum. It is clear that they combined all types of vocational education into one category. The fact that the effects of vocational and academic curriculum were not tested together in the same model may also be a cause for concern. The outcomes studied are also fairly short run, being measured only three years after the expected date of graduation.

Grasso, John T. and John R. Shea. 1979. *Vocational Education and Training: Impact on Youth*. Berkeley, Calif.: Carnegie Council on Policy Studies in Higher Education.

Methodology. Grasso and Shea used data from the National Longitudinal Surveys of Labor Market Experience (NLSLME), which is an even earlier survey than most of the others used in these studies. It covered the period 1966 to 1973 for young men and 1968 to 1972 for young women. Grasso and Shea used scholastic aptitude, socioeconomic origin, area of residence, and most recent high school curriculum in regression equations to predict the likelihood of dropping out of high school. The sample size for their high school completion and educational attainment analyses was 1,719 white men, 329 black men, 1,927 white women, and 447 black women. They did not provide sample sizes for their labor market analysis.

The researchers compared the impact of a general curriculum with a (1) vocational (blue-collar), (2) commercial (mainly sales or marketing, used for the male respondents only), (3) business and office (mainly clerical, used for the female subjects only), and (4) college preparatory curriculum. They controlled for scholastic aptitude; socioeconomic origins; and whether the respondent lived on a farm, in a small city, in a large city, or in a suburb. The socioeconomic status variable was a weighted average of five components: (1) father's education, (2) mother's education, (3) the level of education of the oldest older sibling if applicable; (4) father's occupation when the respondent was age fourteen, and (5) an index of the availability of reading materials in the home at the time. For scholastic aptitude, the researchers used pooled test score results reported by school officials in response to a special mail survey conducted by the Census Bureau. The reported test scores for each individual were combined into a single measure. The researchers estimated the impact of curriculum on several measures of earning and types of occupations.²⁹¹

In the base-year survey, conducted in 1966 for men and 1968 for women, respondents were ages fourteen to twenty-four and enrolled in grades nine through twelve. Researchers classified students into curricula based on self-reports. In their analysis, Grasso and Shea classified the male students' curricula as either commercial or vocational. Because the women were heavily concentrated in clerical occupations, the authors classified the female students' curricula as either business and office or vocational. Grasso and Shea seem to have used the latest data available for each student.

Findings. Grasso and Shea found positive, but not statistically significant, effects of vocational curriculum for both white and black men. Among white men, they found that a vocational curriculum was associated with a positive (but not statistically significant) difference in the probability of finishing high school. A commercial curriculum was associated with a positive and statistically significant difference of about six percentage points in the probability of finishing high school. A college preparatory curriculum had a smaller positive effect on high

²⁹¹The latter two items were measures of long-term potential earnings.

school completion. For black men, neither a vocational nor a commercial curriculum had a significant impact on high school completion, whereas a college preparatory curriculum did have a significant positive effect. For young white women, the researchers found that a vocational curriculum added eight percentage points to the probability of completing high school, a business and office curriculum added nine points, and a college preparatory curriculum added ten points. All of these effects were statistically significant. For black women the coefficients for vocational and business education were positive, but not significant, whereas a college preparatory curriculum added eleven percentage points (a statistically significant effect) to the probability of completing high school.

The researchers also found that, for white and black men, participation in a vocational program reduced the probability of completing one or more years of college by at least ten percentage points, relative to being in a general program. Participation in a college preparatory program increased the probability of college attendance by at least twenty percentage points. For black and white women, a business and office curriculum significantly reduced the probability of college attendance. A vocational curriculum also significantly reduced college attendance for black women, whereas it had no significant effect for white women.

When they looked at wages and earnings, Grasso and Shea found that a vocational curriculum had no statistically significant effect (as compared with a general curriculum) on male high school graduates, high school dropouts, and college dropouts in 1977—between two and five years after expected high school graduation. A commercial curriculum had no significant effects on current earnings for those with twelve years of education,²⁹² but it did have a positive effect on an occupational index (102). College preparatory curriculum also had no statistically significant effects on labor market outcomes.

Among women, however, “the data point consistently to a beneficial effect of having been a business or office student. The coefficient for [business and office] in both the hourly-wage-rate and earnings regressions is positive and significant for both whites (\$.27 per hour, \$665 per year) and blacks (\$.26 and \$683).” The business and office curriculum had positive impacts on their economic outcomes as well. There were not enough women in the sample to derive a coefficient for a vocational curriculum. The college preparatory curriculum had a similar effect on women’s hourly earnings as did the business and office curriculum but did not have significant effects on the three other indicators.

Assessment. The data analyzed by Grasso and Shea were older than those from any other study reviewed here, having been collected in the late 1960s and early 1970s. Both vocational education and the labor market have changed considerably since that time.

The study has a number of methodological problems. As in most of the studies reviewed here, this one had a difficult time determining the effect of curriculum on educational outcomes and labor market success, because individual characteristics can contribute both to curriculum

²⁹²There were not enough cases to perform this analysis for high school or college dropouts.

choice and to outcomes such as high school completion and later earnings. Although Grasso and Shea controlled for several factors that might affect both curriculum choice and educational and labor market variables, they failed to use a large number of controls, and, perhaps most strikingly, did not control for attitudes. Moreover, even the best controls cannot capture the subtle or unmeasurable differences in home environments or ability that can be critical in influencing later outcomes. There also may be a problem with the timing of the measurement of ability. It is not clear *when* ability was measured. If measured at the end of high school, ability scores might reflect the curriculum as much as the student's prior ability. If, for example, an academic curriculum had a positive effect on these scores, then the effect of that curriculum might be understated by controlling for scores.

Moreover, the use of self-reports to categorize each student's curriculum likely exaggerated the number of students completing academic programs and understated the number completing vocational programs. For this reason, the estimated effects might be inaccurate. Another problem stems from the authors' use of the most recent curriculum data available for each student. The authors reported that as students (especially young men) move through high school, "*net* movement occurs from year to year *toward* occupational curricula" (46; italics in the original). The net result of all the shifts that students made between curricula was a net gain to occupational curricula. In other words, the higher the grade level, the higher the proportion of students in a vocational curriculum. As a result, the authors suggested that any positive effect of occupational curriculum may have reflected this net movement toward vocational curricula, rather than any apparent positive effect of vocational education on staying in school. Thus, even the modest positive effects of vocational education on high school completion may have been overstated.

By distinguishing between different types of curricula (basically white collar versus blue collar, as described earlier), the authors made some attempt to assess the differential impact of different types of vocational studies. But like other research reviewed here, this study did not categorize vocational programs based on their quality, setting, specific occupational field, or any other program characteristic. Some effective programs might have been swamped in a sea of mediocre offerings, but this analysis cannot tell us.

Attrition is also an issue in the NLSLME. Of 5,225 young men interviewed in the fall of 1966, only 76 percent were interviewed in 1971, and only 77 percent were interviewed in 1973, the last year of data that the authors analyzed. A decision by the Census Bureau not to interview respondents in the armed forces accounted for much of this attrition. Nearly half the attrition occurred between the first and second interviews. Women were less likely to enter the armed forces and therefore experienced less attrition. Fully 90 percent participated in the fourth follow-up in 1972. The direction of the bias introduced by this attrition is unclear, because we do not know how participation in the armed forces correlated with either occupational studies or educational or labor market outcomes.

Gray, Kenneth, Neng-Tang Huang, and Li Jie* . 1993. “The Gender Gap in Yearly Earnings: Is It Lack of Education or Occupational Segregation?” *Journal of Vocational Education Research* 18 (3): 1–14.

Methodology. Gray, Huang, and Li used data from NLS-72 to predict yearly earnings for men and women in 1986, when the average respondent was thirty-two years old. The researchers restricted their sample to individuals with complete high school transcript and postsecondary attainment data, as well as information about their labor force status in 1986. These restrictions reduced the sample size to 3,309 out of the 12,481 respondents to the NLS-72 fifth-year follow-up.²¹

Gray, Huang, and Li used an ordinary least squares regression equation that predicted annual earnings based on high school curriculum, postsecondary educational attainment, and a variety of control variables including race, marital status, aptitude, family socioeconomic status, occupation, and industrial sector of employment. Researchers used professional school counselors to encode the transcript data to determine whether students had taken a vocational, academic, or general curriculum. Equations were estimated separately for males and females.

Findings. The researchers found that vocational education had a positive effect on earnings for men and women. For both, the effect of vocational education was about the same as the effect of academic secondary education and quite similar to the effect of graduating from college. However, the effects of vocational and academic education were both about twice as high for men as for women. In addition, the effects for women were significant only at the 0.1 level, whereas those for men were significant at the 0.01 level.

Assessment. As with many of the analyses reviewed here, the data in this study are quite old, consisting of 1986 data on students who graduated from high school in 1972. Moreover, one cannot help being concerned about the drastic reduction in sample size when those who were lacking the requisite information, such as employment status, were omitted. The fact that 97 percent of the sample reported having some postsecondary education experience raises some concern about possible bias. In addition, the authors do not mention controlling for attitudes, and the possibility exists of other unmeasured differences biasing the results. Moreover, Gray, Huang, and Li used aptitude test scores from the high school senior year (all that was available in the NLS-72) as a measure of aptitude. Unfortunately, these scores may have been influenced by academic courses and thus may have absorbed some of the effects of academic education, thus artificially lowering these effects.

*Author’s note: The author’s name is actually Jie Li.

²¹Kenneth Gray, Neng-Tang Huang, and Li Jie, “The Gender Gap in Yearly Earnings: Is It Lack of Education or Occupational Segregation?” *Journal of Vocational Education Research* 18 (3) (1993): 5. On page 7, however, the authors give the sample size as 5,457.

Using a concentration-based definition of vocational education is a positive feature of the study, as is the use of professionals to encode transcripts. However, like other studies using large databases, this study grouped all vocational education together, failing to distinguish between programs by quality or field. This study uses longer-term data than many studies of the economic impact of vocational education. However, like many of these studies, this one examines only those students who remained in high school until their senior year, thus perhaps understating the effect of vocational education in preventing dropping out.

Huang, Neng-Tang, and Kenneth Gray. 1992. "Sub-Baccalaureate Post Secondary Education: Does It Pay Off for Vocational Education Graduates?" *Journal of Industrial Teacher Education* 29 (3): 9–20.

Methodology. Huang and Gray used the NLS-72 database to test for the effect of completing a vocational education curriculum in high school and attending a two-year postsecondary institution. They assessed these effects in 1986, fourteen years after graduation, when members of the class were thirty-two years old. When the researchers limited their sample to those respondents who had completed the base-year aptitude test battery and had complete high school transcript data, postsecondary attainment data, and labor force data at the time of the 1986 follow-up, the sample size was reduced to 3,309 of the 12,481 people who completed the 1986 follow-up. The authors controlled for a variety of variables, including race, gender, marital status, aptitude test scores, family socioeconomic status, occupation, and industrial sector of employment. To identify high school program of study (academic, vocational, or general), the authors had professional school counselors encode the transcript data. Students following the general curriculum were used as the reference group, with coefficients calculated for the effect of choosing a vocational or academic curriculum instead of a general curriculum. This model also included coefficients for the combination of graduating from a high school vocational education program and attending either a postsecondary vocational technical or community college, as well as the combination of graduating from an academic program in high school and then attending a four-year college.

Findings. The results suggested that participating in high school vocational education instead of a general curriculum was positively related to yearly earnings. A vocational curriculum was associated with higher levels of yearly earnings than was a general curriculum. In contrast, graduation with an academic curriculum lost its significance when the combined academic track/college degree variable was added, suggesting that those who pursued an academic program in high school were rewarded in the labor market only if they obtained a four-year college degree. The authors concluded that those students who did not obtain a four-year college degree "would be better off in the only curriculum found to be positively related to earnings by itself, namely high school vocational education" (16).

Assessment. Many of the concerns mentioned above for the Gray, Huang, and Jie study are also of concern here. The data used in this study are quite old, consisting of 1986 data on students who graduated from high school in 1972. The authors controlled for a number of background variables; however, values may be missing or wrong for some variables obtained by student self-reports. Moreover, the authors did not control for attitudes, and some other unmeasured differences between vocational and academic students may remain. Moreover, as in the Gray, Huang, and Jie study, Huang and Gray had to use aptitude test scores from the high school senior year as a measure of aptitude because other scores were not available. As with the earlier study, these scores may have been influenced by academic courses and thus may have absorbed some of the effects of academic education, artificially lowering these effects. In addition, there is reason for concern about the drastic reduction in sample size (from 12,481

individuals completing the 1986 survey to 3,309), with the omission of those who are lacking the requisite information, such as employment status. The question is whether the reduction in sample size introduces any biases. One reason for concern is that 97 percent of the sample reported having some postsecondary experience.

Defining vocational education as concentration, rather than taking one course, seems reasonable, and the use of professionals to encode transcripts seems to be a fairly accurate way to measure this concept. However, like other studies reviewed in this appendix, this study considered all vocational education together and did not distinguish by quality or field. The study is notable for its use of very long-term data. However, like most other researchers, Huang and Gray used high school graduates only, which may have understated the effects of vocational education.

Kang, Suk, and John Bishop. 1986. "Effects of Curriculum on Labor Market Success Immediately after High School." *Journal of Industrial Teacher Education* 23 (4): 15–29.

Methodology. Kang and Bishop studied members of the HSB senior cohort who graduated or left high school in May or June of 1980 and did not attend school or college full time, marry, or enter the military between June 1980 and February 1982. The selection criteria and the elimination of cases with missing values on key variables resulted in a sample size of between 2,058 and 2,576 out of 12,000, depending on the dependent variable used. As independent variables in their regression equations, Kang and Bishop used years of academic and vocational course work in various subjects (English, math, foreign language, history/social science, science, business and sales, trade and technical, and other vocational areas). Because transcripts were not available for the HSB seniors, the researchers used self-reports to determine the number of full-time academic and vocational courses taken, a procedure that may have introduced inaccuracy into the model. Kang and Bishop used a large number of control variables (including standardized test scores; region; urban, suburban, or rural residence; demographic characteristics; physical disabilities; family background; school attendance; church attendance; reading for pleasure; and extracurricular activities) and a variety of attitudinal variables. The authors examined the following labor market outcomes: 1981 earnings, the number of months in which the individual worked between June 1980 and February 1982, and the average hourly wage during that period.

Findings. Kang and Bishop found that all vocational fields had a positive impact on wages and earnings immediately after graduation and that this impact was often statistically significant. On the basis of their regression coefficients, they estimated that a student who substitutes two years of trade and technical course work for two years of academic course work will obtain a 4 percent higher hourly wage, will work about 5 percent more, and will earn an additional 13 percent per year. (Students in school or college full time were not included in the analysis.) The overall numbers masked different patterns of gains for men and women, with overall gains being larger for men. During the first calendar year following graduation, men who had taken four vocational courses by cutting back on academic courses received a 7 to 8 percent higher wage, worked 10 to 12 percent more, and earned 21 to 35 percent more. Women who had substituted four courses in office or distributive education for four academic courses received an 8 percent higher wage, worked 18 percent more, and earned 40 percent more during 1981. Men who had taken commercial courses did not receive higher earnings or wage rates, and women who had taken trade and technical courses did not receive higher wage rates and earned only slightly more than those who pursued an academic curriculum.²²

²²The discussion of the results for men and women is based on a summary of this study in Suk Kang and John Bishop, "Vocational and Academic Education in High School: Complements or Substitutes?" *Economics of Education Review* 8 (2) (1989): 133–48.

Assessment. As in many of the studies reviewed in this appendix, the age of the data in this study casts some doubt on their relevance for today—particularly the different results for men and women—given labor market changes such as declining demand for secretaries, a traditionally female occupation, and the increasing presence of women in jobs formerly dominated by men.²³ The large number of control variables means that selection bias may have been less of a problem than in some other studies. However, HSB background data are based mainly on student self-reports, resulting in loss of sample members due to missing data, as well as possible inaccuracies, and some differences always remain unmeasured. In addition, the drastic reduction in sample size after the application of selection criteria (from 12,000 seniors about whom longitudinal data are available to between 2,058 and 2,576) may introduce other biases. Moreover, using senior year achievement tests (all that was available for this cohort) as controls is problematic because, as mentioned earlier, these scores may have absorbed most of the effects of academic course taking and thus biased the results in favor of vocational education.²⁴

There were some issues concerning the way that the authors defined and measured vocational education participation. The use of self-reports to estimate the number of courses taken in different fields is the major weakness of the study. Self-reports are probably even more inaccurate measures of the number of courses taken in specific areas than they are when used as a measure of concentration. In addition, the model assumed that each vocational course taken had an additive effect, rather than assuming that there might have been a threshold accumulation or a critical mass of courses needed to produce an effect. The authors distinguished between industrial, business, and other vocational fields, but not within these fields. Like other studies reviewed here, they did not assess quality or other characteristics of the courses taken.

The failure to include those who dropped out before senior year and the use of short-term data are also limitations of this study. The use of the HSB senior cohort may understate the effects of vocational education because there is some evidence that it reduces dropping out. It should also be noted that the authors examined only short-term economic outcomes, spanning less than two years from high school graduation, raising the concern that the long-term results might have been different.

²³Boesel et al., 139–40.

²⁴Boesel et al., 157.

Kang, Suk, and John Bishop. 1989. "Vocational and Academic Education in High School: Complements or Substitutes?" *Economics of Education Review* 8 (2): 133–48.

Methodology. In this 1989 study, Kang and Bishop again examined data on the seniors completing the HSB survey in 1980, this time with a different model that allowed for decreasing returns from academic and vocational course work as the number of courses increased. Out of the 12,000 seniors for whom data were available, they selected the 4,327 members of the class who graduated in May or June of 1980 and did not attend school or college full time between June 1980 and February 1982. Eliminating cases with missing values on key variables reduced the sample size to 2,576 for earning, 2,483 for number of months worked, and 2,058 for wage rates. Again, self-reports were used to determine how many academic and vocational courses the respondents had taken. The researchers again controlled for a large number of control variables, including test scores, high school grade point average, grades in vocational courses, geographic region, sex, race, ethnicity, age, parental education, family income, a variety of attitudinal measures, and a large number of other personal characteristics.

The researchers performed a simple regression analysis, using the number of vocational courses and the number of academic courses as independent variables. Then they carried out a more sophisticated analysis in which the independent variables were the number of full-year courses in five academic subject areas and, within vocational education, business and sales, trade and technical, and other vocational courses. In order to account for decreasing returns to academic or vocational subjects, the authors included in their regression analysis squared terms for total academic and total vocational courses and an interaction term between the two. They estimated separate equations for men and women, using earnings, employment, and wage rates as the dependent variable.

Findings. Using the simple regression model and using only the number of vocational and academic courses to measure curriculum choices, Kang and Bishop estimated that substituting four vocational courses for four academic courses raised wages by 7 percent, months of employment by 8 percent, and total 1981 earnings by 17 percent for male 1980 graduates during the first calendar year following graduation. For women, the gains were 5 percent for wage rates, 22 percent for months worked, and 36 percent for earnings.²⁵ In the second model, Kang and Bishop found almost no statistically significant impacts of different vocational education subjects on the three economic outcomes for men, except an increase in employment for each course taken in business and sales. However, the authors did not discuss this finding of few significant impacts for vocational education. Academic courses also generally had no significant impacts, except that science and social science classes had small negative effects on wage rates. For women, all the vocational fields had similar, significant positive effects on earnings and employment, although not on wage rates, whereas few academic courses produced significant positive effects.

²⁵Hours worked and average hourly wage were for June 1980 through February 1982.

Kang and Bishop found some evidence that the impact of vocational education on earnings and employment decreased as students took more courses in vocational education if the level of academic course work was kept constant, and vice versa. The marginal effect of both academic and vocational course work increased if the level of the other also increased. But none of these effects were statistically significant for men, a fact that the authors did not mention. The authors concluded that “students who choose to take some modest level of vocational course work benefit greatly relative to those who specialize totally in academic courses, but once three or four are taken, the benefits of additional vocational courses sharply diminish” (143).

Assessment. Again, the age of the results casts some doubt on their relevance for today. As in Kang and Bishop, 1986, the large number of control variables means that selection bias may be less of a problem than in some other studies. Nevertheless, many observations were eliminated due to missing values on key variables, which may have introduced some bias, and other self-reported family background data may be inaccurate. Moreover, some differences always remain unmeasured. In addition, Kang and Bishop again used senior year achievement tests (the only ones available for this cohort) as controls, thus raising the concern that this control may have absorbed much of the effect of academic courses.

By defining vocational participation as course taking rather than concentration, the model ignores the possibility that concentrating in vocational education, or in a specific occupational area, may have a greater effect than taking one or more isolated courses. Kang and Bishop again distinguish between industrial, business, and other vocational fields but not within these fields, and they did not assess quality or other characteristics of the courses taken. For lack of transcript data, they again used self-reports to estimate the number of courses taken in different fields, casting serious doubt on the validity of their results.

Kang and Bishop examined only high school graduates, which may have understated the effects of vocational education to the extent that it prevents dropping out. The authors also acknowledged that they examined only short-run earnings, during the first eighteen months after leaving high school, and that the combination of courses that maximizes earnings in the short run may not be one that maximizes long-term earnings.

Finally, there is some reason for concern about the authors’ interpretation of their findings. One wonders why they chose to use their simpler model to derive estimates of the value of substituting vocational for academic courses rather than using the second, quadratic model. They did not discuss the fact that any significant impact of vocational education on men disappeared in the second model, except for the impact of business and sales courses on employment. There is also reason to ask whether the authors exaggerated the significance of their results for public policy. In the quadratic model, few of the effects they found were statistically significant, especially for men, and those that were significant were often so small so as not to be relevant for policy. For example, for women, they found that “each additional year of vocational education lowers the return to the next year of vocational education by \$70 in the earnings model and by 1/5 month in the employment model” (142).

Kulik, James A. 1998. "Curricular Tracks and High School Vocational Education." In *The Quality of Vocational Education: Background Papers from the 1994 National Assessment of Vocational Education*. Edited by Adam Gamoran. Washington, D.C.: U.S. Department of Education: 65–131.

As mentioned earlier, we used James Kulik's comprehensive literature review to summarize the literature published before 1994 on the effects of CTE on academic achievement and educational attainment.

Methodology. Through an exhaustive review of studies published between 1982 and September of 1993, Kulik found six studies that used regression analysis to determine whether differences between vocational and other students in academic achievement were due to the effects of the curriculum or to other factors. Each study covered either a national or a statewide population of young people and reported on student achievement as measured by broad tests administered near the end of high school. One used cross-sectional data; the others used longitudinal data. Most relied on student self-categorizations into vocational or other tracks, and two used student transcripts to determine the nature of each student's curriculum. Some researchers used student self-categorizations made at the beginning of high school, others used self-categorizations made at the end of high school, and still others used self-categorizations made both early and late in high school. Some studies reported test scores separately for academic, general, and vocational groups, whereas others reported on academic versus nonacademic or vocational versus nonvocational.

Kulik located seven studies that used regression analysis to estimate the impact of vocational education on educational attainment. Almost all of the studies used data collected longitudinally from national studies of young people. One used cross-sectional data from a statewide study, and another used longitudinal data from a statewide study.

Findings. On the basis of these studies, Kulik concluded that "the most important cause of the achievement gap [between academic and vocational students] is student self-selection into academic and vocational programs" (104). After analyzing the various regression studies, Kulik attributed 80 percent of the difference in test scores of academic and vocational students at the end of high school to the difference in aptitude of the students entering the programs, 10 percent to the different number of advanced academic courses taken by academic and vocational students, and the remaining 10 percent of the gap to curricular and program factors. Thus, academic programs may have provided slightly better academic preparation than vocational programs. However, his statistical analysis suggested that general and vocational programs had roughly the same effect on student achievement. Kulik also concluded that the effect of academic programs stemmed mainly from the higher-level courses that their students pursued. He cited two studies that suggested that the effect of following an academic curriculum was lower when academic students were compared with vocational students who had taken the same number of advanced academic courses.

Even when researchers controlled for factors such as ability, background, and student aspirations, according to Kulik, they found little change in the differences in educational attainment between vocational and academic students that were observed in the raw data. The typical student would have completed about fourteen years of schooling if enrolled in an academic program and about twelve and one-half years if enrolled in a nonacademic program. Kulik argues, however, that these results did not mean that vocational education itself was responsible for the lower postsecondary education participation of its students. Rather, students in vocational education were mostly those who had not planned to enter college. Kulik argued that surveys did not accurately measure educational aspirations and thus could not accurately control for the differences between these two groups. He argued that it would have been more relevant to compare vocational students with those in the general track. When this has been done, researchers have found only a small difference between these groups in the likelihood of attending some form of postsecondary education—and this difference was due mostly to pre-existing differences in background, aspirations, or attitude.

Assessment. Not applicable.

Mane, Ferran. 1999. "Trends in the Payoff to Academic and Occupation-Specific Skills: The Short and Medium Run Returns to Academic and Vocational High School Courses for Non-College-Bound Students." *Economics of Education Review* 18: 417–37.

Methodology. Mane used the NLS-72, HSB, and NELS:88 surveys to estimate the effect of vocational education on labor market success. He based his analysis on a subsample of high school seniors who graduated in the expected year and did not attend school or college full time for more than six months during the twenty-one months following graduation. After applying his selection criteria, he was left with sample sizes of 9,400 from NLS-72, 5,998 from HSB, and 4,839 from NELS:88. Short-run labor market outcomes (measured six to twenty-one months after high school graduation) were available for the 1972, 1980, and 1992 graduates. Medium-run outcomes (measured two to seven years after graduation) were available only for the NLS-72 and HSB participants. For NLS-72 participants, medium-run outcomes were available through the seventh year following high school graduation; for HSB seniors, they were available through the fifth year after graduation.

Mane used the sum of all courses taken in trade and industry, business and sales, technical, and "other vocational fields" as the measure of vocational education. Transcript data were not available for NLS-72 and HSB seniors, so he used self-reported data on courses taken throughout the study. Using regression equations, Mane controlled for a large number of personal characteristics, all measured in the twelfth grade, including test scores, grades, race, ethnicity, socioeconomic status, attitudes, values, and many more, as well as school characteristics. Mane used three measures of labor market success: annual earnings, number of months worked during the year, and the hourly wage of the last job held during the year.

Findings. Mane found that vocational courses did not improve the labor market outcomes of non-college-bound male students who graduated in 1972, but they did generate "large" benefits for those who graduated in 1980 and 1982. He found that all cohorts of non-college-bound female students benefitted from substituting vocational courses for academic courses, but the payoff to vocational education increased sharply from 1972 to 1980 and remained "high" for the 1992 graduates. The dollar impact of vocational education for women remained fairly stable throughout the five- to seven-year follow-up period, whereas the impact on men who graduated in the class of 1980 fell to half its initial level by the end of the five-year follow-up period. Specifically, non-college-bound men from the class of 1980 who had taken four vocational courses earned \$1,500 more in 1981, \$1,100 more in 1983, and \$670 more in 1985 than similar young men who had taken four academic courses instead of the vocational courses. Non-college-bound women who had exchanged four vocational courses for four academic courses increased their earnings by \$1,232 in 1982, by \$1,396 in 1983, and by \$1,324 in 1985.

Assessment. This study used all three major NCES databases, enabling Mane to look at the impact of vocational education over time. Although the author used a great many control variables, selection bias remains a concern. However, there are reasons for concern about the quality of some of the family background data and the loss of some cases due to missing values

on such variables, especially in HSB and NLS-72. At least one of the controls introduced a new problem as well; Mane controlled for test scores measured in twelfth grade, but this control may have absorbed much of the effect of academic course taking.

There are several problems with Mane's method of defining and measuring vocational education. A major problem is the use of self-reported data on courses taken, which was probably not as accurate as transcript data would have been. The author combined all vocational education courses together without distinguishing between different fields, types, or qualities of programs. In addition, this model, which assumes that four courses would have had four times the effect of one course, may be less accurate than a model that takes into account the possible effect of concentrating in vocational education or a single vocational field.

Like most studies of economic outcomes reviewed here, this one only looked at the early years of a graduate's career. Only short-run data were available for the NLS participants, and even the medium-run returns were measured at most seven years after graduation. Moreover, looking at high school graduates only may underestimate the labor market effects of vocational education.

Mertens, Donna M., Patricia Sitz, and Sterling Cox. 1982. *Vocational Education and the High School Dropout*. Columbus, Ohio: National Center for Research in Vocational Education. The Ohio State University. September.

Methodology. Mertens, Sitz, and Cox analyzed data on NLSY respondents who were age sixteen or older in 1980 and had course or credit information on their transcripts for ninth or tenth grades, yielding a sample size of 7,416. The researchers performed a regression analysis in order to select those variables that were associated with dropping out of high school and then divided the sample into groups based on their high or low probability of dropping out.

In order to determine the effect of participation in vocational education on high school completion, the authors performed a series of ordinary least squares and probity analyses on each of the two groups of students, controlling for many student background, geographic, and school variables. Vocational education participation was defined as “the number of vocational credits that appeared on the high school transcript at each grade level” (34). Separate equations were estimated to determine the “retentive” effect of vocational education in the tenth, eleventh, and twelfth grade. Mertens, Sitz, and Cox also ran ordinary least squares and probity analyses to determine the effects of vocational education participation on various labor market outcomes, including labor force participation, employment, weeks of unemployment, occupational prestige, training-related placement, job satisfaction, and hourly and weekly wage rates.

Findings. In the regression results for the group with a high probability of dropping out, the authors found that vocational education had a negative effect on the likelihood of dropping out. This relationship was statistically significant, but the coefficients were small: One vocational credit in ninth grade, for example, reduced the probability of dropping out by one-tenth of 1 percent. The authors did not report on the effect of academic course taking. For male students, “vocational education was significantly related to higher occupational prestige, higher job satisfaction, greater training-related placement, more hours worked per week, and higher weekly wages” but not to labor force participation or unemployment (86). For female students, vocational education was significantly associated with higher occupational prestige, lower unemployment at the time of the interview, higher rates of training-related placement, and fewer weeks of unemployment in the year between interviews. However, the effects were generally quite small.

Assessment. Like the other studies examined in this appendix, this one is quite dated, analyzing data collected in 1979 and 1980. In addition, there are a number of methodological problems. Like all studies using large databases, this one may have failed to control for unmeasurable dimensions of ability or motivation, differences that may be related to decisions about what curriculum to take. In addition, this study raises questions by its method of attempting to control for some differences. The researchers included variables such as absenteeism in tenth

and eleventh grade, educational aspirations, and grade point average as controls, despite the fact that vocational education might itself affect these outcomes.²⁶

There are also problems with the researchers' definition of vocational education and method of measuring participation in it. By using the number of vocational credits as the predictor variable, the authors assumed that each credit of vocational education had an equal effect. Alternatively, it could be that a concentration or critical mass of courses in vocational education is needed to have an impact. As a result, studies using this definition may underestimate the results of vocational education. Like all the studies reviewed in this appendix, this one failed to distinguish between different types of vocational education as defined by quality, subject matter, or other factors. However, the number of vocational credits was at least an objective measure of vocational education participation, as opposed to a self-report. Moreover, vocational education participation was measured at each grade level and separate equations estimated at each level, thus eliminating the timing problems of some studies.

²⁶Kulik, 91.

Pittman, Robert B. 1991. "Social Factors, Enrollment in Vocational/Technical Courses, and High School Dropout Rates." *Journal of Educational Research* 84 (5) (May/June): 288–95.

Methodology. Pittman used data from the HSB sophomore cohort to assess the level of participation in vocational education and selected social factors for a sample of 1,114 students who had dropped out of high school and a matched group of 1,114 students who had completed high school. Pittman restricted the study to public school students. He matched students on region, community size, gender, tenth-grade reading comprehension (within 0.25 standard deviations), and socioeconomic status (within 0.25 standard deviations). The author used path analysis to test the effects of a vocationally oriented curriculum, as well as other factors, on dropout rates. He used a model that predicted dropout status from twelve other student- and school-level variables, including the student's vocational education participation, grades, and interest in school; peers' interest in school and participation in sports; and the general school climate.

Pittman defined vocational education participation as the "sum of items concerning the high school program track, number of vocational courses completed, the maximum number of vocational courses completed in one subject area, and whether the student had participated in a cooperative education program or work study" (295). Only certain variables were allowed to affect others. Pittman assumed that vocational education "would influence the students' level of interest in school and the perceived utility of education for those students rather than directly influence the dropout decision" (290). Vocational education was not allowed to influence the dropout decision through any other pathway, such as relationship with school staff or peers' interest in school. The author estimated the value of the coefficients for each variable using the entire five-variable matched sample and the sample matched by school.

Findings. Using both samples, Pittman found that participation in vocational courses had a very small effect on dropout status. Instead, the variables with the largest association with dropout rates were interest in school, academic performance, and the frequency of changing schools (which the author saw as a proxy for various family background variables). The variable with the largest direct influence on dropout status was interest in school, and the variable that had the largest association with interest in school was peers' interest in school. When he estimated the model separately for boys and girls, he found similar effects of vocational education, except that the effect was "slightly greater" for girls than for boys (292).

Assessment. Like other studies reviewed in this appendix, this one is dated, analyzing information on students who were sophomores in 1982. This study also failed to control adequately for pre-existing differences between vocational and other students. Students were matched on only five variables, which did not include race or any measure of attitudes, and HSB's self-reported data on socioeconomic status may not have been reliable. And of course many background and motivational factors are unmeasurable. Moreover, Pittman did not specify the time when the various measurements were taken, so it is not clear whether there might have been some confounding between predictor and outcome variables. The measure used for

vocational education is a composite of several measures and is thus more comprehensive than that used by most studies reviewed here. Like the other studies using large databases, this one did not distinguish between different vocational fields and levels of quality of vocational education programs.

Pittman's path analysis model also has some particular weaknesses. In this model, vocational education was "allowed" to have an effect only by influencing the perceived utility of education and the student's interest in school. The model did not allow vocational education to have a direct effect or an indirect effect through another variable, such as grades or peer interest. Yet, it seems plausible that a vocational education program could influence peers' interest in school and thereby a student's interest in school or influence grades by being easier or more interesting. In addition, the model did not allow variables such as race, sex, aptitude, and grade point average to influence vocational course taking.²⁷

²⁷Boesel et al., 121.

Pittman, Robert B., and Donald M. Chalker. 1994. "Potential Influence of Participation in Vocational Courses on Dropout Rates in Rural Schools." *High School Journal* 84 (5) (October/November): 19–27.

Methodology. A few years after the Pittman study just discussed, Pittman and Chalker used the HSB data set to investigate the possible link between participation in vocational courses in *rural* schools and dropping out of high school. The authors matched a sample of 442 graduates with 442 dropouts on gender, region, reading comprehension (within 0.25 standard deviations), and socioeconomic status (within 0.25 standard deviations)—as well as matching 117 dropouts and 117 graduates based on attendance at the same high school as well as the other variables.

The authors constructed a variable representing the degree of participation in vocational education on the basis of: (1) whether the student was in a vocational program, (2) the amount of vocational course work taken in the tenth grade, (3) the maximum amount of vocational work taken in a single area, and (4) whether the student had participated in either cooperative education or work/study programs. The authors used analysis of variance to compare the level of vocational education participation among graduates with that of the dropouts. They also used an alternative statistical procedure in which they grouped students into the categories of high, medium, and low vocational participation and then asked whether the graduates and the dropouts differed in their distribution between these categories. In addition, they performed this same analysis using individual components of vocational education participation (such as participation in business/office/sales courses). They performed the same procedures for the two matched samples.

Findings. Pittman and Chalker found that “up through the end of the tenth grade there was no difference in participation in vocational education between students who ultimately graduated from high school and similar students who dropped out” (22). Using their alternative procedure of assessing how many graduates and dropouts fell into the three categories of high, low, and medium vocational education participation, the authors reported a “very small” relationship between the level of participation in vocational education and high school completion in rural schools (23). In attempting to discern which aspects of vocational education produced this difference, the authors found that the “observed higher incidence of graduates in the greater vocational participation categories was due primarily to their presence in business, office or sales courses” (23). The authors concluded that “the level of participation in vocational education seemed to have little, if any, relationship with whether a rural high school student decided to remain in or drop out of high school” (19). The authors also found that graduates and dropouts did not differ in terms of access to vocational education, as measured by the number of vocational courses offered at each student’s high school.

In their second analysis, when they used the larger sample of students who were not matched on attendance at the same school, they found that 37 percent of graduates but only 29 percent of dropouts had a high level of participation in vocational education. Moreover, 31 percent of graduates and 36 percent of dropouts had a low level of vocational education participation. The authors reported that this association had a *p* value of less than 5 percent, and

characterized the relationship between vocational education participation and dropping out as “very small.”

Assessment. As in the earlier Pittman study, Pittman and Chalker used data on students who were high school sophomores in 1982, more than twenty years ago. Moreover, Pittman and Chalker may not have adequately controlled for all pre-existing differences between vocational and nonvocational students. Students were matched on only four or five variables, which made it uncertain whether the matching process controlled for all the factors, such as attitudes toward school, that might affect dropping out. In addition, the socioeconomic status data, derived from student self-reports, may not have been fully accurate.

Pittman and Chalker’s method of measuring vocational education may also have been problematic. As in the Pittman study, the authors examined vocational education through tenth grade only. The authors claim that they compared the level of participation in vocational courses across years and found that it was approximately the same in tenth grade as the average across all three years. However, they did not explore the possibility that the eleventh and twelfth grade classes, being perhaps more specifically labor-market oriented, might have had a more powerful retentive effect on students. Moreover, students may have changed their emphasis between tenth and twelfth grade. In their main analysis, which produced their major conclusion, Pittman and Chalker combined all vocational education courses together. In the secondary analysis, which tried to explain the impact they found, they attempted to distinguish at least between different fields of vocational education, although they could not discern differences in program quality.

This study was confined to rural schools. The authors noted that rural schools have a more restricted set of vocational course offerings than nonrural schools. They did not claim that their results could be generalized to urban or suburban areas.

Plank, Stephen. 2001. *Career and Technical Education in the Balance: An Analysis of High School Persistence, Academic Achievement, and Postsecondary Destinations*. St. Paul, Minn.: National Research Center for Career and Technical Education. Available from: http://www.nccte.org/publications/infosynthesis/r&dreport/CTE%20in%20Blnce_Plank.pdf. Accessed April 18, 2002.

Methodology. Plank analyzed data from the NELS:88 sample of more than twenty-five thousand students who were in the eighth grade in more than one thousand schools in 1988, most of whom graduated from high school in 1992. He limited his analyses to public school students, measuring the effect of different curricula on twelfth-grade academic achievement using tests in reading comprehension, mathematics, science, and history/citizenship/geography developed by the Educational Testing Service for the NELS.

Plank used ordinary least squares regression to predict cognitive achievement in each of the four subject areas. He controlled for gender, race/ethnicity, socioeconomic status, and eighth-grade academic achievement in the relevant subject area. Plank used logistic regression to predict the “log-odds” of dropping out of high school before graduation, controlling for gender, race/ethnicity, socioeconomic status, a composite of eighth-grade test scores, and high school grade point average. He also used logistic regression to predict postsecondary destinations (employment and postsecondary enrollment) during 1993, which was the first full calendar year after high school graduation for most sample members, controlling for gender, race/ethnicity, socioeconomic status, and pre-high school test scores.

In the academic achievement equations, Plank defined a CTE concentration as having earned at least three credits (Carnegie units) in a specific vocational area, such as agriculture or health care. An academic concentration was defined as “having fulfilled a somewhat lenient version of the *New Basics* (four Carnegie units of English and three Carnegie units each of mathematics, science, and social studies)” (12). In the equations predicting academic achievement and postsecondary destinations, Plank calculated regression coefficients for three possible concentrations: (1) CTE and not academic, (2) neither academic nor CTE, and (2) dual concentrators in CTE and academics. The omitted “reference category” represented purely academic concentrators, so the coefficients represented the impact of these other concentrations relative to a purely academic concentration. In the dropout equations, Plank used as a predictor the ratio of CTE credits to academic credits earned. He did this because a student could not complete the CTE or academic concentration as defined without completing four years of high school, so all dropouts would otherwise fall into the general category. He based all curricular information on transcripts.

Findings. In his equation predicting scores on tests of mathematics, science, reading, and history, Plank found that—controlling for gender, socioeconomic status, race/ethnicity, and eighth-grade achievement—the purely academic concentrators showed the highest achievement. The dual concentrators ranked second, the group that fulfilled neither concentration ranked third, and the CTE concentrators ranked fourth. All of these effects were statistically significant. When

the author used an equation that posited a linear relationship between the CTE/academic course-taking ratio and the log-odds of dropping out, he found a negative and significant relationship between these variables, suggesting that a “greater representation of CTE courses in an individual’s high school experience reduces the likelihood of dropping out” (25). However, when Plank added a squared version of this term as a predictor, he found that this term had a significant, positive coefficient. This result suggested that “indeed there is a significant curvilinear relationship between the probability of dropping out and the ratio of CTE credits to academic credits. Specifically, controlling for prior achievement, grades, and student background characteristics, a student’s probability of dropping out appears to be lowest when approximately 3 Carnegie units of CTE is completed for every 4 Carnegie units of academic subjects” (25).

In the equations for postsecondary destinations, Plank found that “controlling for gender, race, SES, and pre-high school achievement, purely academic concentrators were most likely to become purely or primarily students during 1993. Conversely, . . . purely CTE concentrators were most likely to become purely or primarily workers in 1993” (viii). However, Plank also pointed out that substantial proportions of all groups were in postsecondary education. For example, the predicted probability that a white male CTE concentrator would be primarily a student in 1993 is 37 percent, as compared with a 72 percent probability for a purely academic concentrator and a 60 percent probability for a dual concentrator. Thus, concentrating purely in CTE reduced, but did not preclude, the possibility of attending postsecondary education.

Assessment. This study avoided many of the methodological problems presented by the other studies reviewed in this appendix. It used the NELS database, which is much more recent than the other surveys, including students who graduated from high school in 1992. Nevertheless, at the time of this writing, it has been more than ten years since these students graduated, and as the author points out, the early 1990s were the beginning of the current wave of CTE reforms.

Plank’s study does not, however, avoid the problem of selection bias. Unlike some earlier researchers, Plank does not use a large array of control variables and includes no attitudinal controls at all. The lack of controls make his study vulnerable to selection bias because vocational students often have different attitudes and aspirations. However, by controlling for eighth-grade academic achievement rather than twelfth-grade achievement, Plank avoided the problem of introducing a control variable that could have absorbed some of the impact of the curriculum but was still able to control for pre-existing differences.

Regarding the definition of vocational education, Plank’s use of the CTE/academic ratio in the dropout equations is a creative solution to the problem (seen in some of the other studies) of students who dropped out before they had taken a certain number of vocational courses being relegated to the general category. On the other hand, his approach did not capture the possible effect of concentration, or a critical mass, of vocational courses. And, like other researchers, Plank did not distinguish between different fields of study or CTE programs that differ in quality, substance, or delivery method. Plank made use, however, of the more accurate transcript data rather than self-reports.

Rasinski, Kenneth A., and Steven Pedlow. 1998. "The Effect of High School Vocational Education on Academic Achievement Gain and High School Persistence: Evidence from NELS:88." In *The Quality of Vocational Education: Background Papers from the 1994 National Assessment of Vocational Education*. Edited by Adam Gamoran. Washington D.C.: U.S. Department of Education: 177–207.

Methodology. Rasinski and Pedlow analyzed transcript and test score data from the NELS:88 to assess the influence of vocational programs and courses on high school dropout rates. They used data from the second follow-up, which took place early in 1992, when most sample members were in the second semester of their senior year. There were over eighteen thousand students in the sample.

Rasinski and Pedlow used transcripts to classify students as vocational, academic, or general concentrators and then—controlling for student and school background characteristics and prior achievement—used logistic regression to analyze the effect of curricular program type on dropout status. Tenth-grade achievement scores and class rank were used to control for prior achievement. The authors noted, however, that students who dropped out too early to qualify as vocational or academic concentrators were by default assigned to the general curriculum, which artificially inflated the dropout rate for this curriculum. They attempted to eliminate this problem by using the number of vocational courses taken in ninth and tenth grade (instead of transcript-defined track participation using the entire high school transcript) to explain the dropout rate in eleventh and twelfth grade. They also repeated the analysis after removing class rank, number of classes skipped or cut, and special-program participation as control variables, because vocational education could have reduced the incidence of dropping out by affecting these variables. Rasinski and Pedlow also used linear regression to examine the effect of vocational course taking on achievement gain between tenth and twelfth grades, independent of academic course taking and school and student background characteristics.

Findings. In their initial analysis using the entire high school experience to define vocational concentration, the authors estimated that students in vocational programs were eight to ten times less likely to drop out of high school in their third and fourth years if they were in a vocational program than if they were in a general high school program. But they argued that this result was in large part due to the fact that students who dropped out early automatically fell into the general category, as described earlier.

When they used ninth- and tenth-grade vocational courses to predict the incidence of dropping out in the eleventh and twelfth grades, they found that vocational course taking had no effect on the dropout rate. Although they concluded that vocational education had no “direct” effect on dropout rates, the authors did find evidence that it may have had an “indirect” effect (189). Their reasoning was as follows. When the researchers removed class rank, number of classes skipped or cut, and special-program participation as control variables, they found that vocational course taking did have a significant effect. Each additional Carnegie unit of vocational

education taken in the first two years of high school reduced the dropout rate 1.14 times. This is a substantial effect. It would mean, for example, that one Carnegie unit of vocational education would reduce a dropout rate of 24.6 percent to 21.6 percent. By comparing the results obtained with different combinations of variables, the authors concluded that “the variable most responsible for reducing the effect of vocational education was class rank” (189). According to the authors, this suggested that vocational education had an indirect effect on dropping out by increasing class rank, which in turn reduced the dropout rate. In this model, each academic credit decreased the dropout rate by a much greater amount than each vocational credit, but the authors did not discuss this finding.

Examining the types of vocational courses taken, Rasinski and Pedlow found that courses in agriculture and technical/communications fields in the ninth and tenth grades significantly reduced the likelihood of dropping out in the eleventh and twelfth grades, even with class rank included in the equation. Courses in consumer economics significantly increased the likelihood of dropping out. The authors found no significant effect of vocational course taking on math, science, or reading achievement gains. Academic courses, particularly in relevant areas, were found to affect math, science, and reading achievement.

Assessment. Although the NELS:88 sample has the most recent data of all of the samples discussed in this appendix, it is still made up of students who were in eighth grade in 1988—quite a long time ago. In addition, the study has a number of methodological problems.

Like other researchers reviewed in this appendix, Rasinski and Pedlow could not control for all pre-existing differences in motivation and ability among students—differences that may have been related to decisions about what curriculum to take. Moreover, they did not control for attitudinal variables as many other researchers have done. In addition, tenth-grade class rank, which they used as a control variable in one of their models, is not an appropriate control, because it could have been affected by vocational education courses taken in the ninth and tenth grades.

Rasinski and Pedlow’s way of measuring vocational education participation is also problematic. As the authors stated, their original analysis was biased because students who dropped out too early to qualify for the vocational or academic categories were by default assigned to the general curriculum category, thus artificially inflating the dropout rate for this curriculum. The researchers’ solution, however, using only ninth- and tenth-grade vocational courses, is also imperfect because most vocational education classes are taken in the eleventh and twelfth grades. Moreover, by measuring the effect of each vocational credit, the authors posited a model where each credit had an equal effect, rather than an alternative model where they might have ascertained whether a certain number or critical mass of courses had a measurable effect. Finally, like other researchers reviewed in this appendix, Rasinski and Pedlow treated vocational education as one undifferentiated mass, without being able to categorize it by quality, field, or other attributes.

Shavit, Yossi, and Walter Muller. 2000. "Vocational Secondary Education, Tracking, and Social Stratification." In *Handbook of the Sociology of Education*. Edited by Maureen T. Hallinan. New York: Kluwer Academic/Plenum Publishers: 437–52.

Methodology. Shavit and Muller used research teams from thirteen countries to study the relationship between educational qualifications and occupational attainment, labor force participation, and unemployment of young men and women in their respective nations.²⁸ The countries were Australia, Great Britain, France, Germany, Ireland, Israel, Italy, Japan, the Netherlands, Sweden, Switzerland, Taiwan, and the United States. The thirteen studies used a common research design, similar definitions of variables, similar data sets, and similar statistical methods, and Shavit and Muller described them as “quite comparable” (445).

For each country, the researchers estimated the effects of educational qualifications (particularly vocational secondary qualifications, academic secondary qualifications that did not qualify for university admission, and academic secondary qualifications that granted access to universities) on occupational prestige scales and the odds of entering the labor force as a skilled rather than an unskilled worker. They then related differences between countries in these effects to differences in the institutional characteristics of their educational systems. They rated the countries on four such institutional characteristics: (1) the extent to which vocational students are taught specific skills, as opposed to general ones; (2) the extent to which curricula and certificates awarded are standardized; (3) the degree of “stratification” of secondary education; and (4) the “proportion of recent cohorts who attained postsecondary qualifications” (446).

Findings. The authors found that, in nine out of the ten countries for which data were available,²⁹ the chances of entering the labor market as an unskilled worker were greater for those young people with academic secondary qualifications who did not qualify for university admission than for those with vocational qualifications. The authors were not able to identify any consistent relationships between the size of the contrast between vocational and academic qualifications and characteristics of the nations’ educational systems. They also found that in all but two of the ten countries for which data were available,³⁰ vocational education returned less prestigious jobs than a matriculation diploma (one that qualifies the recipient for further education), but the magnitude of this negative effect varied between countries. The disadvantage in occupational prestige associated with vocational education tended to be larger in those countries where vocational education provided the most effective safety net. They concluded:

²⁸Arum and Shavit (described earlier) is one of these studies.

²⁹The exception was Taiwan. These data were not available for Germany, Ireland, and Japan.

³⁰The exceptions were Australia and Taiwan.

It is striking that in 9 out of the 10 countries for which data is available, vocational education is a more effective safety net than academic education of a comparable level. . . . This pattern is consistent with the rationale of vocational education, which is to improve the occupational prospects of those who are not likely to continue past the secondary level. It also underscores the risk involved in attending the academic track for students who, for various reasons such as low scholastic aptitude or motivation, are not likely to obtain a diploma of matriculation (or in the American case, to graduate from the college track). In virtually all countries, academic education without a diploma is associated with a greater risk of entering the labor force through the least desirable jobs (447).

Assessment. Shavit and Muller provided very little description of their methodology; however, the researchers stated that the methodologies of the different studies were quite similar. We therefore assume that they all resembled the Arum and Shavit study. Shavit and Muller did not discuss whether the other studies used data as old as that used in Arum and Shavit. We also assume that the individual country studies used extensive controls for pre-existing differences between students entering vocational education and those entering other programs but that there may have been unmeasured differences that might have biased the results. It also seems that the studies grouped together all vocational education, thus failing to account for any differences in quality or field, when results might have been different if separate qualities and fields could have been studied. All of the studies looked at occupational attainment only in the short term; we do not know whether the results would have been different later. Shavit and Muller did not report on whether they had to reclassify jobs in other countries from the original data set into the four-class typology this study used, but it would seem likely. In this case, re-coding problems might have existed, as with Arum and Shavit.

Wagner, Mary. 1991. "The Benefits of Secondary Vocational Education for Young People with Disabilities: Findings from the National Longitudinal Transition Study of Special Education Students." Paper presented at the American Educational Research Association annual meeting. Chicago. April. (ED334739.)

Methodology. Wagner analyzed data from the National Longitudinal Transition Study of Special Education Students to predict the impact of vocational education on absenteeism, course failure, school dropout rates, attendance at postsecondary vocational school, and employment. The data that Wagner used were collected in 1987 for a sample of more than eight thousand young people, selected to represent the population of secondary special-education students who were ages thirteen to twenty-one in the 1985–1986 school year. Data sources included a parent/guardian survey, school records, and a survey of schools attended by the students.

Wagner used a dichotomous variable, measuring whether or not a student had “been enrolled in occupationally oriented vocational education” (21). She categorized the students on the basis of students’ school records for their most recent year in secondary school and parent interviews. Essentially, she coded students as having taken occupationally specific vocational education if (1) they had taken at least one course in the most recent school year that the coder could classify into one of a list of specific vocational areas or (2) the parent indicated in the interview that the youth had received training in specific job skills in the previous year and that this training took place at the youth’s school. Wagner used ordinary least squares regression (with the number of days absent from school as the dependent variable) and logit analysis to determine the impact of vocational education on course failure and dropping out. She also controlled for many individual, household, and school characteristics.

Findings. Wagner found that students who had occupational training were absent from school 1.5 fewer days (which was statistically significant at the 5 percent level) and were about three percentage points less likely to have failed a course than students who did not have occupational training (although this difference was not statistically significant). Using absenteeism and course failure for the most recent year in secondary school as control variables, she found that the likelihood of dropping out of school was 2.7 percentage points lower for vocational students, a statistically significant but small effect. Because vocational students were less likely to be absent and to fail a course, Wagner decided to see what happened when she removed absenteeism and course failure as control variables in the equation predicting dropping out. When absenteeism and course failure were no longer in the equation, she found that a typical seventeen-year-old male student with a learning disability from a low-income household in an urban area would have an 8 percent chance of dropping out in a vocational program (given the lower absenteeism and course failure rate associated with vocational education), as opposed to a 15 percent chance of dropping out in a nonvocational program.

Wagner also assessed the impact of vocational education on two postschool outcomes: attendance at postsecondary school and employment for youth who were at least sixteen years old, noninstitutionalized, and who had been out of secondary school up to two years. She found no significant impact of vocational education in secondary school on attendance at a two-year or four-year college. She did find, however, that those students who had received secondary vocational education were “8 percentage points more likely to have attended a postsecondary vocational school in the previous year than were non-vocational students, controlling for other factors in the analysis” (27). She also found that students who had taken vocational education in their last year in high school were “9 percentage points more likely to be competitively employed than youths who had not taken vocational education, other factors being equal” (27). Moreover, students whose vocational education included work experience were 14 percentage points more likely to be employed than those who were not in vocational education at all.

Wagner pointed out that the post-high school analysis understates the impact of vocational education because vocational education reduces the probability of dropping out. Therefore, she analyzed the effect of vocational education, taking account of its effect on dropping out, on the postschool outcomes of male learning-disabled students from low-income households in urban areas. She found that among this group of students:

youth who had taken vocational education in their most recent school year, and who had the associated higher likelihood of graduating from high school, would have an estimated probability of finding paid employment shortly after high school of 78 percent. This compares to only a 55 percent probability for similar students who had not had vocational education or work experience in their most recent year in high school and who had the associated lower probability of graduation from high school (27).

The author concluded that her findings “suggest that secondary school vocational education is one educational intervention that appears to hold potential for positive school performance as well as positive post-school outcomes [for students with disabilities]” (28). She speculated that:

perhaps occupational vocational training was perceived as more relevant than academic programs to the interests of students with disabilities, the large majority of whom did not go on to college. . . . Perhaps different standards for student performance in occupationally oriented vocational classes enabled students to feel they could succeed and to persist in school. Perhaps occupational vocational students acquired better work skills and behaviors through their training that enabled them to compete more effectively in the labor market (29).

Assessment. As with the other studies summarized in this appendix, this one is somewhat dated, analyzing information on students in the mid-1980s. There are also a number of methodological problems. Like all of the studies using large databases, this one also may have ignored unmeasured differences in students’ backgrounds, ability, and attitudes. On the other hand, by controlling for absenteeism and course failure during the same period as participation in

vocational education, the author underestimated the impact of vocational education on such outcomes as dropping out of school, as she herself points out. These variables would have been appropriate controls only if they referred to the period before a student entered a vocational program. Wagner's effort to run the analysis without those control variables suggests a greater impact of vocational education, but because she did this calculation for one subgroup only (seventeen-year-old male students with learning disabilities from poor urban households), this analysis is less conclusive than it would have been had she performed it on the entire sample. On the positive side, by using absenteeism and course failure as independent variables, the author provides some indication of the pathways by which vocational education might have produced its favorable effects on dropping out.

There are also some problems with Wagner's definition and measurement of vocational education. It is not clear that having taken one occupationally specific course in the most recent school year reflects a meaningful level of participation in vocational education. If she included many students whose only exposure to vocational education was one course, then the impact of vocational education might have been diluted. Like other studies reviewed in this appendix, this one combined all vocational education offerings, failing to distinguish among programs based on quality, content, nature of school, or other factors. Finally, although the results represented an interesting suggestion that vocational education may be particularly helpful for disabled students, Wagner's results are not generalizable to nondisabled students.

Studies Not Reviewed

Studies of educational and economic outcomes of CTE that were not summarized in this appendix are listed here. Essentially, we excluded studies that examined outcomes for CTE students only (lacking a comparison group); studies that failed to explain how they obtained their results; and some studies that relied on data from before 1980. We also excluded some studies published before 1994 that focused on the impact of CTE on academic achievement and educational attainment, relying instead on James Kulik's review of these studies for the 1994 National Assessment of Vocational Education.

Alexander, K. L., and M. A. Cook. 1982. "Curricula and Coursework: A Surprise Ending to a Familiar Story." *American Sociological Review* 47: 626–40.

Alexander, K. L., M. A. Cook, and E. L. McDill. 1978. "Curriculum Tracking and Educational Stratification." *American Sociological Review* 43: 47–66.

Alexander, K. L., and E. L. McDill. 1976. "Selection and Allocation within School: Some Causes and Consequences of Curriculum Placement." *American Sociological Review* 41: 963–80.

Bishop, John. 1991. "Impact of Previous Training in Schools and on Job Productivity." Working Paper 91-27, Cornell University, Center for Advanced Human Resource Studies, Ithaca, N.Y.

Campbell, Paul B., and Karen S. Basinger. 1985. *Economic and Noneconomic Effects of Alternative Transitions through School to Work*. Columbus, Ohio: Ohio State University, National Center for Research in Vocational Education. (ERIC Document Reproduction Service No. ED 254638.)

Catterall, James, and David Stern. 1986. "The Effects of Alternative School Programs on High School Completion and Labor Market Outcomes." *Educational Evaluation and Policy Analysis* 8 (1): 77–86. *Note*: Catterall and Stern reported doing a logistical regression equation in which they found "no consistent, significant association between dropping out (or staying in) and participation in concentrated vocational education or alternative programs" (80). They provided no details, however, or even tables of the analysis, so it is difficult to comment on it. The researchers used an alternative procedure in which they divided schools into categories depending on how many dropouts they contributed to the HSB sample. Within each category, they calculated the percentage of dropouts and non-dropouts who had taken concentrated vocational education or alternative programs. They found that in each category of schools, dropouts were less likely than non-dropouts to have taken concentrated vocational education. However, this procedure did not control at all for pre-existing differences between students.

- Conroy, W. G., and D. E. Diamond. 1976. *The Impact of Secondary School Occupational Education in Massachusetts*. Lowell, Mass.: University of Lowell College of Management Sciences. (ERIC Document Reproduction Service No. ED122095.)
- Creech, F. R., N. E. Freedberg, D. A. Rock, K. M. Wilson, and K. H. Young. 1977. *Comparative Analysis of Postsecondary Occupational and Educational Outcomes for the High School Class of 1972*. Princeton, N.J.: Educational Testing Service. (ERIC Document Reproduction Service No. ED139845.)
- Daymont, T. N., and R. W. Rumberger. 1987. "The Impact of High School Curriculum on the Earnings and Employability of Youth." In *Job Training for Youth*. Edited by R. Taylor, H. Rosen, and F. Pratzner. Columbus, Ohio: The National Center for Research in Vocational Education, The Ohio State University. September.
- Echternacht, G. 1975. *Vocational Re-evaluation of the Base Year Survey of the High School Class of 1972: Part II: Characteristics Distinguishing Vocational Students from General and Academic Students. Final Report*. Princeton, N.J.: Educational Testing Service. (ERIC Document Reproduction Service No. ED115692.)
- Evans, R. N., and J. D. Galloway. 1973. "Verbal Ability and Socioeconomic Status of 9th and 12th Grade College Preparatory, General and Vocational Students." *Journal of Human Resources* 8: 24–36.
- Gamoran, A. 1987. "The Stratification of High School Learning Opportunities." *Sociology of Education* 60: 135–55.
- Gustman, A. L., and T. L. Steinmeyer. 1981. *The Relation between Vocational Training in High School and Economic Outcomes*. Paper prepared for the Division of Technical Systems in the Office of Technical and Analytic Systems, Office of the Assistant Secretary for Planning and Budget, U.S. Department of Education. Hanover, N.H.: Dartmouth College.
- Hauser, R. M., W. H. Sewell, and D. F. Alwin. 1976. "High School Effect on Achievement." In *Schooling and Achievement in American Society*. Edited by W. H. Sewell, R. M. Hauser, and D. Featherman. New York: Academic Press.
- Hilton, T. L., 1971. *A Study of Intellectual Growth and Vocational Development. Final Report*. Princeton, N.J.: Educational Testing Service. (ERIC Document Reproduction Service No. ED056063.)
- Hotchkiss, Lawrence, and Linda Dorsten. 1987. "Curriculum Effects on Early Post-High School Outcomes." *Research in the Sociology of Education and Socialization* 7: 191–219.
- Jencks, C. L., and M. D. Brown. 1975. "The Effects of High Schools on Their Students." *Harvard Educational Review* 45: 273–324.

- Meyer, Robert. 1982. "Job Training in the Schools." In *Job Training for Youth*. Edited by R. Taylor, H. Rosen, and F. Pratzner. Columbus, Ohio: The National Center for Research in Vocational Education, The Ohio State University. September.
- Meyer, Robert, and David Wise. 1982. "High School Preparation and Early Labor Force Experience" In *The Youth Labor Market Problem: Its Nature, Causes, and Consequences*, 277–339. Edited by Richard Freeman and David Wise. Chicago: University of Chicago Press.
- Rumberger, Russell, and Thomas Daymont. 1984. "The Economic Value of Academic and Vocational Training Acquired in High School." In *Youth and the Labor Market: Analysis of the National Longitudinal Survey*. Edited by M. E. Borus. Kalamazoo, Mich.: W. E. Upjohn Institute for Employment Research.
- Stevens, D. 1993. *The School-to-Work Transition of High School and Community College Vocational and Non-Vocational Program Completers: 1990–1992*. Report prepared for the National Assessment of Vocational Education. National Center on the Educational Quality of the Workforce, Philadelphia, PA.
- Trent, E. R. 1982. *Interim Report One: Ohio Department of Education Basic Skills Study*. Columbus, Ohio: Ohio Department of Education.
- Vanfossen, B. E., J. D. Jones, and J. Z. Spade. 1987. "Curriculum Tracking and Status Maintenance." *Sociology of Education* 60: 104–22.

Appendix B

CTE Demonstrations and Evaluations: Summary and Assessments

This appendix summarizes a number of evaluations of individual career and technical education (CTE) programs or groups of programs. We identified these studies by several means. We used one recent literature review of school-to-work programs to identify some studies.³¹ We also searched the ERIC Clearinghouse on Adult, Career and Vocational Education (ERIC) (<http://www.eric.ed.gov/>) for documents on “vocational” and “career and technical” education. We reviewed materials available on several Web sites, including the National Centers for Career and Technical Education (NCCTE) (www.nccte.com), the National Center for Research in Vocational Education (NCRVE), ERIC (<http://ericacve.org>), and the school-to-work Web site of the U.S. Department of Education (no longer in operation).

We included studies that assessed the impact of CTE programs on outcomes such as dropping out, academic achievement, postsecondary education, and labor market success and that compared students in the program with a control or comparison group. We did not review studies that assessed only program implementation, that had outcome data on CTE students only, or that were conducted before 1980 (one such study is listed at the end of this appendix).

The summaries in this appendix describe each program being evaluated, detail the methodology of the evaluation, discuss the findings, and provide an analysis of the evaluation. The summaries cover the effects of the programs on outcomes such as high school completion, academic achievement, postsecondary enrollment and attainment, and employment. Although we did not review studies that discussed only program implementation, we sometimes briefly summarized implementation findings. The studies are arranged in alphabetical order by the name of the program. Publications reporting on the evaluations are cited in a note at the beginning of each summary.

³¹Katherine L. Hughes, Thomas R. Bailey, and Melinda J. Mechur, *School-to-Work: Making a Difference in Education* (New York: Institute on Education and the Economy, Teachers College, Columbia University, 2001).

California Peninsular Academies

Program description. David Stern and other researchers from the University of California evaluated eleven California Peninsular Academies, which were designed to reduce dropout rates.³² Each academy was a school within a school for students from grades 10 through 12, concentrated in a particular occupational sector. Five of the academies concentrated in computer-related occupations, three in electronics, two in health services, one in financial services, and one in food services. Academy students took some or most of their classes together. Academy teachers worked together to coordinate curriculum; local employers helped design the vocational portions of the curriculum, donated equipment, and provided mentors and summer jobs. The academies were located in a diverse set of schools, mostly urban and suburban. The percentages of students on welfare ranged from less than 1 percent to 41 percent, and the percentages of white students ranged from less than 1 percent to 97 percent.

Methodology. At most sites, the evaluation covered three years of operations. The evaluators generally estimated impacts for the cohorts entering in each of three school years in the 1980s: 1985–1986, 1986–1987, and 1987–1988.³³ At each academy site, a comparison group was selected that matched the academy students on race, sex, and the criteria used to select students for the academy: poor attendance, low grades, and insufficient course credits, but with standardized test scores that were not more than two years below grade levels. The researchers used a statistical regression model to test whether academy students in each cohort and grade at each site performed better in school than students in the nonrandomly selected, matched comparison group. They used five measures of performance: attendance, credits earned, grade point average (GPA), number of courses failed, and the probability that the student left high school during the given year. An individual regression was conducted for each outcome, site, cohort, and year.³⁴ The regression model controlled for prior year performance using the same performance measures listed above, plus sex, race, and age. The researchers used the ordinary

³²David Stern et al., “Benefits and Costs of Dropout Prevention in a High School Program Combining Academic and Vocational Education: Third-Year Results from Replications of the California Peninsula Academies,” *Educational Evaluation and Policy Analysis* 11 (4) (Winter 1989): 405–16; David Stern et al., “Combining Academic and Vocational Courses in an Integrated Program to Reduce High School Dropout Rates: Second-Year Results from Replications of the California Peninsula Academies,” *Educational Evaluation and Policy Analysis* 10 (2) (Summer 1988): 161–70; Charles Dayton, Alan Weisberg, and David Stern, *California Partnership Academies: 1987–88 Evaluation Report* (Berkeley, Calif.: Policy Analysis for California Education, September 1989). There was a twelfth academy, but it “botched the replication effort to such an extent that the state cut off its funding and sufficient data were not collected for evaluation.” See Stern et al., 1988, 16.

³³Three of the academies, however, did not begin until the third year, one academy closed in the third year, and two academies enrolled freshmen rather than sophomores in the first year and did not enroll a cohort in the second year.

³⁴Because not all of the academies were open and enrolling students in all three academic years, there were a total of 270 statistical tests.

least squares estimation method for all outcomes except the probability of dropping out, for which they did a logit analysis.

Findings. Of the 270 tests reported (one for each outcome, cohort, grade, and site), 61 showed significantly better performance by academy students, and 11 showed significantly better performance by comparison group students. Using the 0.05 significance level, fewer than 14 of the tests would be expected to give significantly positive or negative results if the 270 tests were statistically independent.

The large variation in effectiveness between different academies is a major finding of the evaluation. The researchers reported that “the number of statistically significant positive results varied markedly from one program to another.”³⁵ Three academies produced particularly positive results; counting the individual tests shows that thirty-eight of the sixty-one favorable outcomes came from these three. One academy had a large share of the negative results.

The authors concluded that the most effective programs were those that had implemented the academy model most faithfully.

In addition to a positive judgment of the economic value of the academy replication effort as a whole, the main lesson that can be derived from this evaluation is that individual academies vary greatly in their measured effectiveness. Replication is risky. Success cannot be taken for granted. Continual monitoring, technical assistance, and discontinuation of ineffective programs are necessary if scarce resources are to be used efficiently.³⁶

The results also “differ systematically between years for each cohort. Results are substantially more positive for each of the first two academy cohorts in its first year than in subsequent years.”³⁷ The evaluators concluded,

Evidently, 1st-year participation in the academy is associated with widespread improvement among academy students, compared to similar students at the same high school. These 1st-year gains are generally maintained in subsequent years: they are not usually augmented, but even less often are they significantly eroded. . . . Academy students continue to perform at a higher level in subsequent years although the difference between their performance and that of comparison students does not widen as much in subsequent years as in the 1st year.³⁸

³⁵Stern et al., 1989, 407.

³⁶Stern et al., 1989, 415.

³⁷Stern et al., 1989, 407.

³⁸Stern et al., 1989, 407.

The results also differed substantially with the performance measure. GPA showed the largest number of favorable outcomes, both in absolute terms and relative to unfavorable outcomes, with fourteen school/cohort/year groups showing improvement and only one showing a reduction. Credits earned showed thirteen favorable outcomes and only two unfavorable ones. The academies seemed to have the smallest impact on dropout probability: a favorable effect was observed for only one cohort at one school in one year, and an unfavorable effect was also observed for one cohort at one school in one year. But the evaluators cast doubt on the dropout results, stating that their sample size was too small to obtain valid results using logit analysis (which is appropriate to assess a binary outcome such as dropping out) and that their dropout results should be regarded with “more skepticism” than their results on the other four measures.³⁹

Because the small sample sizes make regression difficult, the researchers used the raw (unadjusted) differences in dropout rates between students at all the academies combined and the combined comparison groups to estimate academy effects on dropping out. They counted both “known dropouts” (students who were known to have left high school) and “probable dropouts” (students for whom no spring semester records existed, but no transcript had been requested by another school). They found that generally dropout rates were lower for academy students than for the comparison group. When they compared the dropout figures for the first cohort at all the sites, they found that

among academy students the attrition [dropouts, probable dropouts, plus transfers] figure over three years for the first cohort is 32.9 percent, and for comparison group students it is 47.7 percent. However, the known plus the probable dropout totals across the three years are 7.3 percent for academy students and 14.6 percent for the comparison group. This suggests that the academies, on average and across three years, are reducing the dropout rate by about half, and the attrition rate by about one-third.⁴⁰

In order to estimate the number of potential dropouts prevented among academy students, the authors examined the cohort of 327 students at eight academies who were sophomores in 1985–1986 for whom they had graduation data.⁴¹ They “compared the actual number of academy students counted as known or probable drop-outs with the number that would have occurred if academy students dropped out at the same rate as students in the comparison group at the same school.” On the basis of this comparison, they estimated that for the eight academy programs that graduated students in 1988, there were only thirty-one actual dropouts, as compared with sixty predicted dropouts, for a total of approximately twenty-nine dropouts “saved.” Surprisingly,

³⁹Stern et al., 1989, 411.

⁴⁰Dayton, Weisberg, and Stern, 143.

⁴¹Evaluators did not include the two academies that enrolled freshmen rather than sophomores in 1985 or one academy that did not open until 1987.

between twenty-one and twenty-two of the dropouts “saved” attended the same academy.⁴² The researchers also used these calculations to estimate the costs and benefits of the academies, concluding that the net benefit to society for the cohort of 327 students in the eight academies was between \$1.0 and \$1.3 million.⁴³

Analysis. As already mentioned, the evaluation used matched, nonrandom comparison groups. Because students were not randomly assigned to the academy and comparison groups, the researchers acknowledged that unmeasured differences may have biased the results. For example, if those students who applied for the academies were more motivated, then the evaluation might overstate the effect of the academies. On the other hand, if the academies attracted students with particular interest and aptitude in vocational subjects but with lack of interest and aptitude in other subjects, academy students might have done worse than the comparison group in an academic program, and thus the evaluation might have understated the effects of the academies.⁴⁴

The evaluators used statistical controls in regression analysis to attempt to correct for selection bias. However, the statistical controls used could not correct for unmeasured differences in motivation and ability. Moreover, the sample sizes were too small to obtain accurate dropout results from regression analysis, so the researchers used unadjusted data. They justified this decision by saying that the comparison groups seemed not to have been very different from the academy students on the characteristics measured.⁴⁵

Small sample sizes make it difficult to find statistically significant results. For example, to obtain a statistically significant result from the evaluation’s regression analyses in the 1985–1986 academic year, the researchers reported that they would have had to find at minimum a 29 percent increase in the probability of dropping out of school within one year for a cohort at one site.⁴⁶ Thus, it is possible that more sites would have shown statistically significant improvements in dropout rates had the sample sizes been larger. Moreover, as mentioned earlier, there was no appropriate method of regression analysis for the small sample sizes in the dropout analysis, so the authors were forced to rely on unadjusted data.

The evaluation grouped together eleven programs that, according to the evaluators, varied greatly in quality. The disparity of the results—where more than two-thirds of the estimated dropouts prevented attended one school and where three other academies produced the bulk of the improvements in other outcomes—may reflect this disparity in program quality. This suggests

⁴²The predicted number of dropouts at this academy was 27.5; the actual number was 6, so the number “saved” was 21.5.

⁴³Stern et al., 1989, 411–15.

⁴⁴Stern et al., 1989, 406.

⁴⁵Stern et al., 1989, 411.

⁴⁶Stern et al., 1988, 166.

that this study did not really test the same program in multiple locations. The disparity among programs also raises questions about the generalizability of the results because the same model was not applied at the various sites.

Career Academies

Project description. In a series of reports, James J. Kemple and colleagues at the Manpower Demonstration Research Corporation (MDRC) described the results of their evaluation of nine career academies around the country.⁴⁷ MDRC is a nonprofit social policy research organization with offices in New York City and Oakland, California.

Each academy was a school within a school, which used an integrated academic/vocational curriculum and employer partnerships in an effort to motivate students to stay in school. Whereas the original career academies were designed to keep at-risk students in school and prepare them for work, the newer academies evaluated here had a broader target population and purpose. They were designed to serve both at-risk students and those who were engaged in school and to prepare students both for work and for college. Thus, each tried to enroll a mix of students, including those who seemed at high risk of dropping out and those who were highly engaged in school and performing well academically. All of the academies were located “in or near a large urban school district that serves a substantially higher percentage of African-American and Hispanic students than school districts nationally.”⁴⁸ These school districts, on average, also had higher dropout rates, unemployment rates, and percentages of low-income families than the average school district.

Methodology. The MDRC career academy study is one of the few that has used random assignment to assess the effectiveness of CTE programs. Of a sample of 1,764 applicants, 959 students were randomly chosen to attend one of the career academies, and 805 were randomly assigned to the control group.

Outcome data were collected from school transcripts, student surveys, and standardized tests administered to a subsample of students at the end of their scheduled twelfth grade year. The latest report presents data from a survey that students completed slightly more than one year after their scheduled graduation. Evaluators “strategically selected” the nine sites to reflect the diversity of conditions (including urban/nonurban school districts, members of a career academy “network” or independent programs, and whether they were a single center or one of many within

⁴⁷James J. Kemple, *Career Academies: Impacts on Students' Initial Transitions to Post-Secondary Education and Employment* (New York: Manpower Demonstration Research Corporation, December 2001), available from: http://www.mdrc.aa.psiweb.com/Reports2002/CA_StudentsImpacts/CA_StudentImpactwTech.pdf, accessed April 19, 2002; James J. Kemple and Jason C. Snipes, *Career Academies: Impacts on Students' Engagement and Performance in High School* (New York: Manpower Demonstration Research Corporation, 2000), available from: <http://www.mdrc.aa.psiweb.com/Reports2000/CareerAcademies/CA-Impacts.pdf>, accessed April 19, 2002; James J. Kemple, *Career Academies: Communities of Support for Students and Teachers: Emerging Findings from a 10-Site Evaluation* (New York: Manpower Demonstration Research Corporation, December 1997); James J. Kemple and JoAnn Leah Rock, *Career Academies: Early Implementation Lessons from a 10-Site Evaluation* (New York: Manpower Demonstration Research Corporation, July 1996), ES-12.

⁴⁸Kemple, 2001, 7.

a district) under which career academies have been implemented around the country.⁴⁹ The research team divided the students into three subgroups: those at high, medium, and low risk of dropping out, based on the “background characteristics and prior school experiences associated with dropping out of high school” measured at the time of application.⁵⁰ The evaluators looked at a number of outcomes, including test scores; high school completion status; and postsecondary education enrollment, completion, and continuation status, as well as employment experiences and job characteristics. About 85 percent of the academy group and 83 percent of the nonacademy group completed the post–high school survey. Evaluators reported no significant differences in background characteristics between the academy and nonacademy group members who responded to the survey.

Findings. In reports published in the late 1990s, MDRC evaluators found that career academies succeeded in changing the high school environment and experiences of students and teachers in ways that were consistent with the goals of the model. For example, compared with teachers who did not teach academy classes, academy teachers reported that they had more opportunities to collaborate with each other and “were more likely to develop personalized relationships with their students.”⁵¹ Students were more likely to report that their teachers gave them personalized attention and that they worked together with their peers.⁵²

In the first report on outcomes (2000), completed at the time that the students were scheduled to graduate, Kemple and Snipes found that the academies had significantly increased attendance for high-risk students and doubled the percentage of high-risk students who completed a “basic core academic curriculum” while producing no statistically significant impacts on these outcomes for the other groups.⁵³ Evaluators also found a significant reduction in the dropout rate for the high-risk academy students, compared with the high-risk nonacademy students. Career academies did not improve standardized measures of reading and math achievement, either on average or for any of the risk groups. Academies also had no impact on risk-taking behaviors (including taking drugs, becoming a parent, being expelled from school, or being arrested) or “positive youth development activities” (including volunteer work or receiving recognition for academic or extracurricular activities) for any of the risk groups.

In the second outcome report (2001), Kemple found that the promising early changes had not translated into impacts on high school graduation rates or initial postsecondary outcomes—including employment and enrollment in postsecondary education—measured

⁴⁹Kemple and Rock, 207.

⁵⁰Kemple, 2001, 9.

⁵¹Kemple and Rock, ES-12.

⁵²Kemple, 1997.

⁵³A basic core academic curriculum is defined as four English courses, three social studies courses, two math courses, and two science courses.

slightly more than a year after scheduled graduation. Even among the high-risk group, despite the considerable difference in dropout rates during the period up to scheduled graduation, there was no statistically significant difference a year after projected graduation in high school completion status, suggesting that the control group “caught up” with the program group by graduating late.⁵⁴ Nor were there differences in the amount of time spent attending postsecondary education, working, or combining the two. However, the academies did produce a statistically significant increase in the proportion of high-risk students who earned a one-year postsecondary license or certificate. Kemple found no systematic pattern of variation between the sites.

Kemple speculated that the lack of impact on high school completion, postsecondary education, and labor market outcomes may have been in part due to the fact that

the non-Academy students—whose outcomes set the standard against which the Academy students were compared—achieved relatively high graduation rates and postsecondary education outcomes. The level of performance among the non-Academy students, who applied for the Academies but were not randomly selected to enroll in one, suggests that the Academies attracted students who were likely to graduate and move onto postsecondary education and employment regardless of whether they gained access to an Academy.⁵⁵

Analysis. The use of random assignment in this study makes its results highly credible compared with most of the other studies reviewed in this appendix. Moreover, the study was conducted under the auspices of MDRC, an institution known for high-quality evaluations. If perfectly implemented, random assignment allows evaluators to conclude with confidence that differences in outcomes between the program and control groups were due to the program. However, random assignment is rarely implemented perfectly, nor was it in this case. Approximately 12 percent of the academy group admitted never attended an academy, and 7 percent of the nonacademy group were “inadvertently allowed to enroll in an academy.”⁵⁶ These students could not be removed from the sample or switched to the other group without violating the integrity of the random assignment process, but such crossovers are likely to reduce the apparent impact of the program. When Kemple attempted to adjust for the students in the academy group who never enrolled and the students in the nonacademy group who did, he found that this adjustment “does not substantially change the overall pattern of impacts discussed in this report.”⁵⁷

Attrition is also an issue. One-third of those students who initially enrolled in an academy left before their scheduled high school graduation but were kept as members of the academy

⁵⁴Kemple, 2001, ES-6.

⁵⁵Kemple, 2001, 42.

⁵⁶Kemple, 2001, 17–18.

⁵⁷Kemple, 2001, 18.

group. As Kemple pointed out, including the students who leave “takes the reality of attrition squarely into account by including in the analysis all students who were randomly assigned to academies, whether they remained enrolled or not.”⁵⁸ Because the background characteristics of academy students who left after enrolling are different from those who stayed until graduation, the researchers chose not to compute impacts separately for those who stayed until graduation. Nevertheless, it would have been interesting to see the results of such a computation and whether the students who stayed did better than the others.

The high response rate (by survey research standards) and the comparability between the academy and nonacademy students who responded gives reason for confidence in the validity of the results. But the evaluator warned that “because the participating sites were chosen strategically rather than randomly, the findings from this study cannot necessarily be generalized to all schools and school districts. Nevertheless, as a group these sites typify urban schools and school districts of moderate size, reflecting much of the diversity of such places.”⁵⁹ Kemple also mentioned that most of the schools have modified the model in response to changing conditions. Many have moved toward “more complete” versions of the model, and other programs were weakened by funding losses, staff turnover, or other causes.⁶⁰ It would have been interesting if such implementation differences had been associated with differences in outcomes, but Kemple reported no pattern of outcome differences between sites.

It should also be noted that the evaluation followed up students only in the short term. Although one year after expected graduation is an appropriate time to look at high school completion status, it is quite early to assess economic outcomes. MDRC plans to issue more reports in the future, with the goal of determining “whether the Academies enable students to make better choices about postsecondary education and employment and, if so, whether their choices lead to higher educational attainment and entry into higher-wage, more career-oriented jobs.”⁶¹

Finally, the evaluators’ explanation for the apparent lack of program impact—that the academies attracted students who were more likely to graduate from high school, attend postsecondary education, and find jobs, even without attending a career academy—raises a question. Would the program have shown stronger impacts with a more disadvantaged population? If this logic were correct, however, one might expect that the high-risk subgroup in this evaluation study would have shown greater impacts, and this was not the case.

⁵⁸Kemple, 2001, 12.

⁵⁹Kemple, 2001, 8.

⁶⁰Kemple, 2001, 8.

⁶¹Kemple, 2001, ES-8.

Career Magnets (New York City)

Program description. Robert Crain and his colleagues at Teachers College, Columbia University, studied New York City's career magnet schools.⁶² These fifty-nine programs, located in thirty-one different high schools, attempted to prepare students for college and simultaneously for careers. Most operated as a school within a school, offering a number of career-oriented classes separate from the rest of the curriculum. Out of thirty-one career magnet schools, eight were devoted entirely to career magnet programs, and the remaining twenty-three were located within comprehensive high schools. A typical career magnet school taught ten to twelve career-focused classes over a four-year period. Six out of every seven career magnet students were African American or Hispanic.

Methodology. Crain and his colleagues attempted to take advantage of the fact that half of the students in the career magnet programs were selected by lottery, recognizing that this situation could provide a natural experiment. Separate lotteries were performed for students with high, average, and low reading test scores to decide admission to 137 programs.

Evaluators eliminated every program with fewer than nine students admitted randomly and fewer than nine rejected or placed on the waiting list. They also eliminated programs where fewer than 60 percent of those randomly admitted actually attended the magnet school, as well as those where more than 40 percent of those randomly rejected were later admitted by the school. After these deletions, the researchers had 112 separate experiments in fifty-nine programs involving 9,174 students who entered as ninth graders in 1988. Of these students, 2,373 were admitted by lottery to their first-choice program. Only 63 percent of these, however, actually entered the program to which they were admitted, and 18 percent of the lottery losers were actually accepted for their first-choice program as part of the group not subject to lottery.

In addition to the school records data, the researchers conducted interviews of two and one-half hours in length with a subsample, consisting of high school graduates who had either (1) attended one of four schools that were completely dedicated to career magnet programs, or (2) had applied to the same programs but were randomly rejected and later graduated from a comprehensive high school. To obtain students for this part of the study, the researchers drew a random sample of lottery winners and losers from those schools and then deleted all who had not graduated from high school within five years. They then selected pairs of lottery winners and lottery losers and matched them on the basis of ethnicity, sex, achievement test scores, and neighborhood. Because of difficulties in locating and contacting interview respondents, the researchers interviewed only 110 out of 483 graduates. Of these, fifty-one had won the lottery, attended, and graduated from their first-choice career magnet; the other fifty-nine had lost the lottery and attended a comprehensive high school. In the course of the interviews, however, the

⁶²Robert L. Crain et al., *The Effects of Academic Career Magnet Education on High Schools and Their Graduates* (Berkeley, Calif.: National Center for Research in Vocational Education, 1999), available from: <http://vocserve.berkeley.edu/AllInOne/MDS-779.bhtml>, accessed April 22, 2002.

researchers discovered that eleven of the students who entered comprehensive schools were later placed in career magnet programs within these schools. These students were kept in the comparison group.

The authors also selected a subsample of matched pairs from the 110 graduates for a four-hour life history interview. They were able to interview only thirteen matched pairs, but do not say how many matched pairs were in the original subsample. In addition, they interviewed four nonmatching respondents, bringing the number of interviews up to thirty.

Findings. Examining the full sample, the researchers found that career magnet students had a higher dropout rate than students at comprehensive high schools. Whereas only 26 percent of those who gained admission to magnet schools through lottery graduated at the end of the fourth year, 31 percent of the lottery losers did so. Moreover, because some lottery winners did not enter career magnets and some losers did, the evaluators stated that their findings understated the true difference between the two sets of schools. The authors attributed the lower graduation rate of lottery winners to the fact that the career magnet high schools were academically more demanding than the comprehensive high schools. The authors reported that the career magnets—which were concerned with placing their students directly in jobs and therefore needed to vouch for the quality of the students they sent to employers—were the most academically demanding. These schools were especially concerned about the quality of the students they sent to employers. Many programs, moreover, maintained their academic rigor by dropping a large fraction of poorly performing students once the actual career preparation began in the junior year.

The researchers also found that, “compared to the comprehensive high schools, students in academic career magnet programs do not have higher or lower reading scores, do not take advanced graduation tests more or less often, and do not have higher or lower absenteeism. In fact, the career magnet students have slightly lower math scores.”⁶³ The authors attributed this lack of impact on achievement to the tendency of career magnets to ignore many of their weaker students—a practice that they also blame for their lower graduation rates described earlier. They also pointed out that, unlike comprehensive schools, career magnets experienced less pressure to keep their test scores up, because only their average test scores and graduation rates were being reported. Because the career magnets may handpick half of their students, test scores and graduation rates remain at acceptable levels. The authors also found that the career magnet schools that gave students more time on computers actually seemed to raise students’ math scores. The evaluators found no difference in the rates of college attendance between career magnet and comprehensive schools.

Using the subsample of 110 students, the evaluators found that the career magnet graduates earned more credits in college (37.7 versus 30.9 for comprehensive school graduates, a difference that is significant at the 0.07 level). Career magnet graduates were also more likely (78

⁶³Robert L. Crain et al., “Executive Summary,” in *The Effects of Academic Career Magnet Education on High Schools and Their Graduates* (Berkeley, Calif.: National Center for Research in Vocational Education, 1999), available from: <http://vocserve.berkeley.edu/AllInOneMDS-779.bhtml>, accessed April 22, 2002.

percent versus 58 percent) to have declared a major at the time of the interview, a difference that had only a 2 percent likelihood of occurring by chance. The evaluators also found that career magnet graduates reported a starting hourly wage (averaging \$7.27 per hour) that was about \$1.00 higher than that of comprehensive students (averaging \$6.28 per hour). Moreover, current wages varied in a similar way for the sixty-one members of the sample who were working when they were interviewed, with career magnet graduates earning \$8.00 per hour and comprehensive graduates earning \$7.01 per hour. The authors do not report on the statistical significance of the wage findings.

Also using the subsample of 110, the evaluators found that career magnet graduates reported engaging in significantly fewer high-risk behaviors than comprehensive school students, with less smoking, fighting, drinking alcohol, becoming pregnant, or causing pregnancy. In total, 41 percent of career magnet graduates reported no risky behaviors, whereas only 19 percent of comprehensive school graduates did so. The career magnet students were more likely to “have developed a career identity and to report that their high school education enabled them to become ‘really good at something.’”⁶⁴ Magnet graduates reported that their parents volunteered to help with college costs twice as often as comprehensive graduates, and the researchers suggest that this implies the career magnets have an indirect positive effect on the families of their students. Perhaps, for example, the greater commitment shown by the students toward school and college might have inspired their parents to be more supportive as well.

Analysis. The researchers refer to their study as an “experiment-based study rather than a classical laboratory experiment” because they could not include every student who participated in the lottery.⁶⁵ They were not able to follow up with students who transferred to private school or left the school district. Nor could they study further outcomes for students who dropped out. Although they never stated directly how many students were unreachable for these reasons, the text implies that of the 9,174 students selected to take part in the experiment, they obtained outcome data on only 5,038. Apparently, the other four thousand-plus students were those who transferred to private schools or left the school district. However, the authors did not specify how many did leave or explain the 5,038 figure. This lack of clarity is in itself a serious problem with the study.

Another problem is that many lottery losers attended magnet schools whereas many lottery winners did not, a problem that is difficult to assess because the authors gave several versions of the percentages that fall into these categories. Of the 9,174 students selected for the experiment, the authors stated that 18 percent of lottery losers attended magnet schools and that 37 percent of lottery winners did not. In an appendix on methodology, the authors gave a different set of numbers and percentages, reporting that 30 percent of lottery losers enrolled in a career

⁶⁴Crain et al., “Executive Summary.”

⁶⁵Robert L. Crain, “Introduction,” in *The Effects of Academic Career Magnet Education on High Schools and Their Graduates* (Berkeley, Calif.: National Center for Research in Vocational Education, 1999), available from: <http://vocserve.berkeley.edu/AllInOneMDS-779.bhtml>, accessed April 22, 2002.

magnet and that 19 percent of lottery winners did not do so. These latter percentages apparently applied to the students for whom outcome data were available, as described earlier.⁶⁶ In any case, this is a high rate of crossover between groups. According to the researchers, this high crossover rate was likely to understate differences between the groups, but they argued that it was not likely to change the direction of the difference. The authors also reported finding some statistically significant differences between lottery winners and lottery losers in the 1988 class; they described these differences as small but did not say what they were.

All of the findings of favorable outcomes of attending career magnets relied on data from the interviews rather than the review of school records. Yet, this portion of the study seems more flawed than the school records analysis. In the analysis of wages, the authors did not report on whether their results were statistically significant. Moreover, the researchers' inability to interview most members of the original sample raises questions about possible bias. Researchers found no significant difference between lottery winners and lottery losers in the final sample on sex, ethnicity, eighth-grade reading scores, parental education, or socioeconomic status, but the career magnet graduates did significantly better on seventh-grade math, suggesting the possibility of some bias, and unmeasured differences may have existed as well. The evaluators also found, after interviewing the students, that eleven of the "lottery losers" had nonetheless been admitted to career magnet programs within their comprehensive schools. These admissions may have reduced the differences between the groups. Moreover, the sample size was small, making the estimates less precise and increasing the difficulty of obtaining statistically significant results.

Another problem is that interviews were conducted with high school graduates only. Thus, as the authors acknowledge in the case of the wage results, the reduced risky behaviors and higher wage rates among magnet graduates might have been due to the fact that career magnets may have lost more of their at-risk students through dropping out, as their higher dropout rates suggest. The same logic would apply to the college findings and other results that were based on the interviews. The authors, however, argued that the bias could not have been strong enough to invalidate the differences in parental support between the magnet school graduates and other students because those differences are so much stronger than differences in graduation rate.

The evaluators left unanswered some questions about the survey portion of the study. They did not explain whether the matching was done as part of the sample selection process or after the sample was selected. Did they draw a sample and then match as well as possible within that sample? Or did they make the best matches they could and then discard some? The authors also did not specify whether the matching occurred within the original sample of 483 or among the 110 students whom they were able to locate. The order of the write-up implied that they matched from the original 483 students. If so, that would mean the samples were no longer matched after the students were located. Nor did they describe the closeness of the matching. Moreover, their results on the number of college credits earned were based on only ninety-two students and results on whether students declared a college major on ninety-one students. The

⁶⁶A third set of percentages was given elsewhere, but it was almost the same as the second set.

authors did not explain whether the reduced sample size was due to missing data or some other factor. Furthermore, they did not provide tables with sample sizes for their other analyses using the 110-student sample, so we do not know whether these samples were reduced as well.

The authors also pointed out that the career magnet model as defined in the literature was not always fully implemented, at least not for all students or in all of the schools they studied. For example, integration of academics with vocational course work was almost never observed. Furthermore, on the basis of interviews with the sample of fifty-one magnet graduates and fifty-nine comprehensive school graduates, the researchers found that comprehensive high school students were significantly more likely to report having spent time in high school talking with a counselor about work or careers and to have gotten to know an adult on a personal level in high school—features that one would expect to be more prominent in the academies. Thus, some career academy students received a high school program that was not very different from what their peers attended in a comprehensive high school.

Finally, there are some reasons for concern about the authors' interpretation of their findings. They make much of their finding that career magnet parents volunteered help with college twice as often as the parents of comprehensive school graduates, stating, "The . . . finding about parental support for college is one of the most important findings in recent research on high schools."⁶⁷ This conclusion does not seem justified in light of the weaknesses of the supporting data. Moreover, the authors go on from this finding to conclude that career magnets have an indirect effect on students' families. This interpretation seems overly optimistic in light of the many problems with the very small sample the authors used to obtain this result. It might be instead that the increased help from families reflects unmeasured differences between the two sets of families.

⁶⁷Robert L. Crain, "Career Magnet Schools: Effects on Student Behavior and Perceived Parental Support: Part Two," in *The Effects of Academic Career Magnet Education on High Schools and Their Graduates* (Berkeley, Calif.: National Center for Research in Vocational Education, 1999), available from: <http://vocserve.berkeley.edu/AllInOneMDS-779.bhtml>, accessed April 22, 2002.

Career and Technology Education, Montgomery County, Maryland, Public Schools

Program description. James Griffith and Julie Wade, two researchers from the Montgomery County Public Schools, evaluated the county's CTE program.⁶⁸ Montgomery County's CTE program involves a prescribed sequence of courses leading to state-certified diplomas in CTE. Areas of study include business education (marketing, hospitality, and food production), business operations (secretarial, typing, data processing, accounting, and so on), health, trades, automotive, and horticulture. CTE participants may take several semester-long job placements that combine classroom instruction and work experiences. In 1993, 10 percent of graduates completed the CTE program.

Methodology. The researchers examined the postsecondary school and employment experiences of graduates from 1993 through 1999. They compared graduates of the CTE program with other graduates. The researchers analyzed data from surveys completed by all 6,284 students who graduated in 1993. The students were asked for their social security numbers, but of the initial sample, only 71 percent provided a usable number. Researchers then matched this subsample with employment data from the state department of labor and from in-state, public college enrollment data supplied by Maryland's higher education commission. This procedure yielded two separate samples for analysis: one sample of student data matched with employment outcomes and another sample of student data matched with college enrollment data. The data did not include information on (1) enrollment in private colleges and universities within Maryland, (2) enrollment in colleges and universities outside the state, or (3) employment outside the state.

Findings. The authors found that the CTE graduates in the sample were more likely to come from disadvantaged backgrounds and had weaker high school college preparation than non-CTE graduates. CTE graduates were more likely to be African American or Hispanic, to have received free or reduced-price meals, and to have attended English for Speakers of Other Languages (ESOL) programs. They were less likely to have completed Algebra I or taken honors courses and had lower GPAs and SAT scores.

Not surprisingly, during high school, CTE graduates were much less likely than others to plan to attend four-year college (30 percent versus 71 percent) and much more likely to plan to attend two-year college (52 percent versus 21 percent) or to work right after high school (11 percent versus 3 percent). Because the evaluators reported that most students behaved consistently with their plans, we can deduce that CTE graduates indeed were less likely to attend

⁶⁸Montgomery County Public Schools, Applied Research Unit, Office of Shared Accountability, Division of Career and Technology Education, *Post-secondary Employment and College Enrollment among Montgomery County Public Schools (MCPS) Graduates: The Role of Career-Focused Programs* (Rockville, Md.: Montgomery County Public Schools, January 12, 2001), available from: http://www.mcps.k12.md.us/departments/accountability/pdf/surveys/Career_Ed_report.pdf, accessed April 23, 2002; James Griffith and Julie Wade, "The Relation of High School Career and Technology Education to Postsecondary Employment and College Performance: A Six-Year Longitudinal Study of Public High School Graduates" (unpublished paper, February 7, 2001).

four-year colleges and more likely to attend two-year colleges or work. However, the evaluators also found that CTE and non-CTE graduates who went to college had quite similar college performances. By 1999, about 60 percent of both groups of 1993 graduates enrolled in four-year colleges had received four-year college degrees, and about 6 percent of those enrolled in two-year colleges had received two-year college degrees. First-year GPAs were about the same in both groups within two- and four-year colleges, and percentages that took remedial education classes were about the same.⁶⁹

When they compared CTE and non-CTE graduates who were in four-year college, two-year college, or working only, evaluators found that, within each group, CTE graduates worked more, had longer periods of employment, and earned more over the six-year study period. Through 1997, all of the differences were significant at the 0.05 level or higher, except for the differences among the group in four-year college in 1996 and 1997. These differences were particularly large for the working-only group (the group that worked without having attended colleges and universities in the state during the six-year follow-up period). For example, total earnings for the entire period averaged \$81,455 for the working-only CTE graduates, compared with only \$61,237 for the non-CTE working-only group. Outside the working-only group, the differences between CTE and non-CTE graduates became smaller or disappeared, losing their statistical significance by 1998. The differences remained large and statistically significant, however, for the working-only group in 1999, with CTE graduates earning \$8,946 more than non-CTE graduates that year, a difference that was statistically significant at the 0.05 level. (These values were adjusted for differences in the number of quarters worked.) The evaluators also found that earnings results did not change much when they controlled for receipt of free and reduced meals in high school—an indicator that, in high school, the student’s family income had been below poverty levels.⁷⁰

As would be expected, completion of a CTE program was also associated with the type of job held by the graduate. A smaller proportion of CTE graduates than non-CTE graduates were employed in restaurants, hotels, and entertainment—jobs that are often short term or temporary. This difference, however, was more evident in their first jobs than in their more recent jobs, suggesting that the CTE advantage may fade out over time. More CTE graduates—12 percent in their most recent job compared with 8 percent for non-CTE graduates—were employed in trades such as construction, transportation, and auto repair, which are often well paid and stable. CTE graduates were also significantly more likely than non-CTE graduates to report that their high school program provided excellent or good preparation on five out of seven items on a list of work skills, including: act appropriately, come to work daily, report to work on time, make good decisions, and provide guidance to others.

⁶⁹CTE graduates were more likely to be in remedial education, but the differences were not statistically significant.

⁷⁰James Griffith, personal communication, January 2001.

Analysis. The strengths of this study include a large sample size and the six-year follow-up period. There is reason for concern, however, that the evaluators' reliance on data provided by the state—requiring valid social security numbers (which were lacking for 29 percent of the graduates)—may have been a source of bias. Also, researchers could not capture data on work outside Maryland or college attendance outside Maryland or at a private institution. When the evaluators compared the total 1993 sample of 6,284 graduates to the 4,476 who had valid social security numbers, they found no statistically significant differences in the percentages who were African American or Hispanic or had received free or reduced-price meals. They found statistically significant but very small differences in other background and school performance variables. However, 80.5 percent of those with valid social security numbers, as compared with 76.3 percent of all graduates, had completed Algebra I, and it is possible that this reflects a real difference between the two populations.

Another matter of concern is the loss from the study samples of students who lacked state employment and college data. The researchers compared the full sample with the 71 percent of students who had employment data and the 42 percent who had college data. They found that both subgroups were very similar to the entire class in their background and high school curriculum characteristics. Although researchers found some statistically significant differences between the groups, these differences were extremely small, and the fact that they reached statistical significance reflected the large sample sizes. However, although the divergence of outcomes of the CTE and non-CTE groups may accurately reflect reality, we must keep in mind that evaluators had access only to data on work and public college attendance within Maryland. We cannot assume that these differences apply to those who worked or attended college outside the state or attended a private college in Maryland. If, for example, the non-CTE graduates were more likely to work outside of Maryland, then the apparent advantage in work among non-CTE graduates might shrink.

Another limitation of the study is that the published results did not contain controls for differences between CTE and other students. The authors reported that CTE graduates were more likely than non-CTE graduates to be African American or Hispanic and to participate in the free and reduced-price meals and ESOL programs. They also found that CTE graduates were less likely to have completed Algebra 1 or taken honors courses and earned lower GPAs and SATs than other students. All these findings indicate that CTE graduates were more disadvantaged than other students, and one might expect them to have had poorer outcomes. As a result, the differences between the two groups that are favorable to the CTE graduates might be understated, and there might be other differences that the authors did not pick up. However, the authors stated that CTE graduates had higher earnings even when considering the receipt of free and reduced-price meals, but they did not explain how this was done or show the results.⁷¹

⁷¹Montgomery County Public Schools, 4.

Dropout Prevention and Re-entry Projects in Vocational Education

Program description. Becky Jon Hayward, of the Research Triangle Institute, and G. Kasten Tallmadge, of the American Institutes for Research, evaluated twelve projects around the country that were designed to demonstrate the efficacy of using vocational education as a key component in encouraging at-risk youth to remain in or return to school.⁷² Seven of the twelve sites evaluated used the Project COFFEE model, which includes an “abbreviated-day alternative school that integrates academic and vocational instruction” and provides “small class sizes, a highly structured and nurturing environment, a strong personal counseling component, career awareness counseling, student participation in entrepreneurial businesses that generate income, a physical education program that stresses recreational and leisure activities rather than competitive sports, and intense monitoring and evaluation of student progress.”⁷³ Two of the sites used the California Peninsular Academy model, described earlier. The remaining sites each used a different model. All of the programs were in communities with high dropout rates.

Methodology. Students in ten of the sites were represented in Cohort 1, which began receiving services in the 1989–1990 school year. All twelve sites had students in Cohort 2, which began receiving services in the 1990–1991 school year. Outcomes were given separately for each academic year in which the cohort received services. The 1991–1992 (final) outcome data reflect the status of students after three years of dropout prevention services for Cohort 1 and two years for Cohort 2. Of the twelve project sites participating in the evaluation, nine used random assignment and three used a matched comparison group design. A total of 2,492 students were included in the outcome evaluation: about 27 percent were in treatment groups, 32 percent were in statistical control or comparison groups, and 41 percent were in “typical student groups.” The latter groups were created to “protect against the degradation of the experimental and quasi-experimental designs that might result from differential attrition” serving “as a comparison group used to assess the reduction in the size of the gap between treatment students and ‘typical’ students from before to after treatment on key variables of interest.”⁷⁴ The authors analyzed the effects of the programs on dropping out and a variety of other outcomes, including school performance, attendance, attitudes toward self and school, and educational and employment aspirations. The researchers admitted that

although the comparison groups were designed to be matched to the treatment groups, the match was imperfect, and differences in attrition between treatment and comparison groups increased the discrepancy. To eliminate this variation from the comparisons

⁷²Becky Jon Hayward and G. Kasten Tallmadge, *Strategies for Keeping Kids in School: Evaluation of Dropout Prevention and Reentry Projects in Vocational Education* (Washington, D.C.: U.S. Department of Education, June 1995).

⁷³Hayward and Tallmadge, 3-7.

⁷⁴Hayward and Tallmadge, 2-6.

between groups, all treatment/control comparisons were conducted within demographic categories and the results were pooled across the categories to obtain an overall result for each site.⁷⁵

Thus, evaluators calculated all the comparisons within groups defined by gender, race or ethnicity (white or nonwhite), and relative age (old for grade or appropriate).

In the dropout analysis, the researchers used an extension of the chi-square test, where they calculated a separate statistic for each demographic group and then combined these separate statistics across demographic categories at each site. They also measured other outcomes (such as attendance, grades, and attitudes) before students entered the programs. The evaluators used different methods to analyze program impacts while taking into account students' prior scores on these outcomes: "gain score analysis," "probabilistic gain score analysis," and analyses of covariance. The authors used three different types of analysis of covariance: regular analysis of covariance, "reliability-corrected covariance analysis" (appropriate when random equivalence has been destroyed by differential attrition), and a "gap reduction evaluation design" (that attempted to assess the reduction in the size of the gap between the treatment groups and "average" students from the same schools).⁷⁶

In the report, the researchers used a definition of dropout that included both individuals formally classified as dropouts and those who were formally expelled. The category did not include young people who were "classified as 'moved,' with no additional information about graduation or transfer into another school."⁷⁷

Findings. The researchers found that only one-third (four) of the twelve projects achieved statistically significant reductions in the number of students dropping out. And in only one of these projects, STARS, in Detroit, was the improvement seen in every year for every cohort. The Detroit program, with only one cohort, provided support services to at-risk students enrolled in the city's vocational-technical centers. Several other sites showed some reduction in dropout rates: (1) GRADS, a Cushing, Oklahoma, project that used special teachers to adapt instructional materials for students with special learning needs and to train regular vocational instructors in appropriate instructional methods; and (2) two sites at North Dakota high schools near Indian reservations that used the Project COFFEE model, providing academic tutoring, career guidance, employability skills instruction, work experience, and payment for school attendance. The Detroit program showed a reduction in dropout rates for its single cohort from 14 percent to 3 percent in 1990–1991 and from 26 percent to 11 percent in 1991–1992—an impressive result. The Cushing GRADS program's combined cohort treatment group had a second-year dropout rate of 10 percent, compared with 22 percent for the control group. The

⁷⁵Hayward and Tallmadge, 2-9.

⁷⁶For more information on the methodology, see Hayward and Tallmadge, chapter 2.

⁷⁷Hayward and Tallmadge, 2-8

combined cohort at the Turtle Mountain COFFEE had a dropout rate of 20 percent in the treatment group compared with 50 percent for the control group in the first year. Apparently, however, the treatment group's 40 percent dropout rate in year two was not statistically different from the 63 percent dropout rate for the control group. The Fort Totten COFFEE had statistically significant results only for the second cohort in the second year, in which 18 percent of the control group but only 7 percent of the treatment group dropped out.

The projects overall did better at improving participants' academic achievement than they did at reducing dropout rates. Ten of the programs showed statistically significant increases in participants' grade point averages, and seven showed statistically significant reductions in the number of courses failed, relative to the comparison group, for at least one cohort in one year.

The authors documented several problems that prevented many of the grantees from implementing the model as planned. For example, none of the grantees implementing Project COFFEE received sufficient funding to replicate the model completely. Only one site, Oconee, Colorado, was able to obtain enough additional funding to replicate the Project COFFEE model faithfully.⁷⁸ In some sites, vocational education components were minimal or nonexistent. The authors concluded that "the relatively modest student-related outcomes demonstrated by many of the projects over the course of the evaluation reflect the difficulty of overcoming the myriad political, logistical, and environmental factors that require attention as grantees attempt to implement even well-conceived and tested strategies for improving the educational experiences and outcomes of at-risk adolescents."⁷⁹ Moreover, the evaluators concluded that

most of these projects did not really *establish* vocational education as an intervention, since most participants had already arranged to enroll in vocational education and received project services to supplement their vocational courses. . . . A fairer test of vocational programs as a drop-out prevention strategy might be examination of the extent to which selection of a vocational program in an area vocational-technical school instead of an academic program in a "regular" high school affects youths' likelihood to remain in school.⁸⁰

Interestingly, the one program (Detroit) that apparently did recruit students to vocational education and compared these students with a control group not enrolled in vocational education did achieve a fairly impressive reduction in dropout rates, as described earlier.

On the basis of their analysis, the authors concluded that "some level of integration, or at least coordination, of academic and vocational course work appeared important in engaging

⁷⁸Hayward and Tallmadge, 5-8. This site, Oconee County, did have some improvements in academic achievement but not in dropout rates.

⁷⁹Hayward and Tallmadge, 5-1.

⁸⁰Hayward and Tallmadge, 5-13–5-14, emphasis in the original.

students and leading to improvement in their overall performance.”⁸¹ They also concluded that “projects that changed the structure of the school, particularly those that created a smaller, more nurturing environment, achieved positive effects in school performance and affiliation, though not in retention.”⁸²

Analysis. Three-fourths of the sites used a random assignment research design—by far the best way to assure comparability between treatment and comparison groups.⁸³ However, one-fourth of the sites did not use such a design, making their results more questionable. Furthermore, the sample sizes were quite small, making it difficult to obtain statistical significance. The combined cohorts in the program groups ranged from twenty-five to ninety-four students, and the combined comparison groups ranged from thirty-two to ninety-six students. The single-cohort treatment groups ranged from ten to eighty-seven members, with most being under fifty. The sample sizes were even smaller for some specific outcomes. Moreover, the evaluators did not explain the implications for statistical significance of their decision to conduct all the comparisons within groups defined by gender, race or ethnicity (white or nonwhite), and relative age (old for grade or appropriate). With larger sample sizes, the authors might have been able to find smaller differences significant. In the existing study, some very large differences, such as the Turtle Mountain results described earlier, were not found to be statistically significant.

That few if any of the studies implemented the models as planned is a major concern with this evaluation. The study did not evaluate the actual CTE models but rather imperfectly implemented versions of them. Results might have been more promising if the implementation had been stronger, although the evaluators explained this shortcoming quite clearly. Nonetheless, this weakness of implementation is to be regretted, because evaluations of poorly implemented programs are often taken as suggesting that the models themselves are ineffective.

The authors also made only a minimal effort to synthesize the results across projects, cohorts, and years. The only summary table lists each program separately and provides separate results for each cohort and each year. For each of these cohort/year combinations, the authors list the outcomes achieved, such as higher GPA. A cohort/year combination is listed only if there is at least one significant favorable outcome for that cohort in that year. But not every site had the same number of cohorts or operated in every year, so if a certain cohort is missing for that year, one cannot tell whether that cohort/year combination did not exist at this site or whether it existed but had no favorable outcomes. It would have been helpful to know how many effects were observed as a proportion of the number of possible effects. Not only are all these separate effects difficult to synthesize, but the table in the body of the report fails to provide the sizes of the

⁸¹Hayward and Tallmadge, v.

⁸²Hayward and Tallmadge, v.

⁸³The sites not using random assignment were Woodside, Carlmont, and Portland. See Hayward and Tallmadge, 2-6.

effects, whereas even a few examples would have been useful. Effect sizes are given only in the appendix tables on each program.

Another problem is that the appendix tables that provided dropout rates among the different cohorts did not indicate statistical significance. Because the summary table listed only positive effects, and because statistical significance was not given in the dropout tables in the appendix, the reader has no way of knowing whether an unfavorable effect listed in the appendix is statistically significant. For example, the appendix reported that the Fort Totten Project COFFEE had a dropout rate of 43 percent among its first cohort in its first year, as compared with 14 percent for the control group, with no indication of this finding's statistical significance.

High Schools That Work (HSTW)

Program description. Researchers from MPR Associates, Inc., an education research, policy analysis, and evaluation consulting firm, studied the High Schools That Work (HSTW) program, a high school reform initiative in southern states.⁸⁴ HSTW, promoted by the Southern Regional Education Board (SREB), incorporates CTE as part of a broader school reform framework. According to the SREB Web site, HSTW is:

the nation’s first large-scale effort to engage state, district and school leaders and teachers in partnerships with students, parents and the community to improve the way all high school students are prepared for work and further education. HSTW provides a framework of goals, key practices and key conditions for accelerating learning and setting higher standards. It recommends actions that provide direction to schools as they work to improve academic and vocational-technical instruction at school and the work site. These recommendations meet the criteria for comprehensive school reform. The HSTW effort is based upon the belief that, in the right school environment, most students can learn complex academic and technical concepts. The initiative targets high school students who seldom are challenged to meet higher academic standards.⁸⁵

The centerpiece of *High Schools that Work* is raising the expectations of students by replacing the general track—a system that has traditionally allowed students to graduate from high school without completing a rigorous academic core—with a curriculum that blends the essential content of college preparatory science, mathematics and language arts courses with challenging vocational/technical studies in grades 9 through 12.⁸⁶

The HSTW-recommended curriculum includes at least three credits each in mathematics and science, with two of the credits in each subject coming from courses on the college-preparatory level.

⁸⁴Philip Kaufman, Denise Bradby, and Peter Teitelbaum, *High Schools That Work and Whole School Reform: Raising Academic Achievement of Vocational Completers through the Reform of School Practice* (Berkeley, Calif.: National Center for Research in Vocational Education, February 2000), available from: <http://www.sreb.org/programs/hstw/publications/special/ncrreport.asp>, accessed April 25, 2002.

⁸⁵Southern Regional Education Board, *High Schools That Work: New Partnerships and a National Network to Improve High School Education* (Atlanta, Ga.: Southern Regional Education Board, revised October 1999), 1, available from: <http://www.sreb.org/programs/hstw/background/99%20HSTW%20Brochure.pdf>, accessed April 25, 2002. According to the organization’s Web site: “The Southern Regional Education Board works with those who are seeking to improve education from prekindergarten through graduate programs. The organization links leaders and agencies that are working on similar issues throughout the 16 member states.”

⁸⁶Kaufman, Bradby, and Teitelbaum, 8.

Methodology. Unlike the other studies reviewed here, this one uses school-level data only. Examining data from 424 schools, evaluators used test scores from 1996 and 1998, demographic variables to control for changes in the student body, and variables that correspond to the key practices of HSTW. The evaluators measured each school’s practices within six “clusters”: curriculum standards, instructional goals, academic/vocational integration, guidance counseling, teacher practices, and work-based learning. Each cluster was represented by a set of variables, including such measures as the percentage of students meeting the HSTW mathematics standard, teacher responses to questions asking the importance (on a scale of 1 to 4) of a series of goals, and the proportion of students responding “yes” to questions about whether academic and vocational teachers worked together to improve students’ reading, writing, and math skills.

Using regression analysis, the evaluators attempted to measure the impact of each cluster individually on achievement gains for vocational completers between 1996 and 1998, while controlling for student demographic characteristics over the same period. Initially, they computed a separate regression analysis for each cluster of variables. Later, they computed the model with all the variables included. The authors argued that this combined model was not as useful as the separate models because of the many interrelationships between the variables, which produced some inexplicable results.

Findings. The evaluators found that the median change in achievement for vocational graduates in the 424 schools between 1996 and 1998 ranged from an increase of six points in reading (about half a standard deviation) to an increase of twelve points in mathematics (almost a full standard deviation). However, there were large differences between schools, with some schools actually seeing a large drop in achievement (as much as sixty points) and some seeing gains as large as fifty points. The evaluators found that increases in the proportion of students meeting HSTW curriculum standards, in the proportion of students perceiving that their academic and vocational teachers were working together, and in the amount of time that students spent talking to their guidance counselors and teachers about their school program were all “directly associated with increases in the schools’ mean assessment scores.”⁸⁷

These effects were quite large, according to the researchers. For example, a one-percentage-point change in the percentage of students completing the recommended mathematics curriculum was associated with a one- to two-point increase in science, mathematics, and reading test scores. A one-percentage-point increase in the proportion of a school’s students reporting that their academic and vocational teachers worked together to help improve math/reading skills resulted in a greater than one-point increase in math or reading achievement. A one-point change in the average amount of time spent talking with a guidance counselor or teacher (from “not at all” to “somewhat” or from “somewhat” to “a great deal”) was associated with an increase in test scores of eight to eleven percentage points. The other clusters (including the use of work-based

⁸⁷Kaufman, Bradby, and Teitelbaum, vi.

learning), however, seemed to “have little or no explanatory power for predicting school changes in student academic achievement.”⁸⁸

Analysis. This study makes a valuable contribution to the field of CTE evaluation through the use of school-level variables. The main shortcoming is that the reader cannot be sure that there are not unmeasured factors, such as changes in unmeasured student characteristics, that might have influenced the changes in achievement. Another issue, which the authors themselves raised, is that their model is very simple, with all relationships deemed to be linear and no provision for interactions between the variables. If this is not an accurate reflection of reality, then the models may produce biased results. Moreover, although the authors downplayed the usefulness of their regression analysis that included all the variables in question, they failed to mention that the separate regressions for each cluster of school characteristics may also have been inaccurate because if the different clusters of school characteristics are correlated with each other, then the effects of each might be artificially inflated by leaving out the others.

⁸⁸Kaufman, Bradby, and Teitelbaum, vi.

ProTech

Program description. Jobs for the Future, a Boston-based effort to help states reform their education and workforce systems, evaluated ProTech, a CTE program in Boston.⁸⁹ A multiyear program, ProTech combined “rigorous academic instruction, a sequence of work site learning experiences in the eleventh and twelfth grades, and additional supports after high school.”⁹⁰ ProTech was a collaboration of the Boston Public Schools, seventy-five employers, and the Boston Private Industry Council. The program combined academic and technical subjects that were related to the students’ career interests. Students were expected to develop eleven “competencies,” including “the abilities to use technology, understand and work within complex systems, and communicate and understand ideas and information.”⁹¹ Students were placed in “high quality internships in seven major industry clusters.”⁹²

Methodology. In June 1997, evaluators from Jobs for the Future sent surveys to 163 high school graduates who had completed the program (completing forty-two months, thirty months, or eighteen months earlier); 107 responded. Surveys were also sent to 460 young people who had graduated high school in 1993, 1994, or 1995 and who would have met ProTech eligibility standards in the spring of their sophomore year; 124 of these young people responded and became the comparison group.

Findings. The evaluators found that 80 percent of African American graduates of ProTech enrolled in college the year after graduating, compared with only half the black students in the comparison group. Differences in college enrollment are not as great for students taken as a whole: 78 percent of all ProTech graduates, compared with 72 percent of the comparison group, enrolled in college. Evaluators found almost no difference in the proportion of the full ProTech and comparison groups that were either enrolled in college or had completed a postsecondary certificate or degree at the time of the survey. Differences were greater among African American students: 74 percent of the ProTech graduates were enrolled or had completed a postsecondary program, compared with 65 percent of the comparison group. Differences were also greater for the 1993 class, which had been out of high school the longest (four years). The authors found that 64 percent of ProTech graduates had completed a postsecondary degree or certificate, compared with only 44 percent of the comparison group.

The authors also found that ProTech students were more likely than their peers to be working (87 percent versus 75 percent) and less likely to be neither employed nor in school (3

⁸⁹Jobs for the Future, *School-to-Career Initiative Demonstrates Significant Impact on Young People* (Boston, Mass.: Jobs for the Future, May 1988), 1.

⁹⁰Jobs for the Future, 1.

⁹¹Jobs for the Future, 2.

⁹²Jobs for the Future, 1.

percent versus 5 percent overall; 3 percent versus 8 percent for the African Americans). ProTech graduates had a higher hourly wage (\$8.92 versus \$8.10 for the comparison group; \$8.17 versus \$6.77 among African Americans). For the 1993 ProTech graduates, the mean hourly wage was \$10.10, over a dollar and a half more than those of the comparison group. More than 89 percent of the ProTech respondents reported that the program was “somewhat to greatly influential” on their enrollment in postsecondary training.⁹³ They also rated their ProTech coordinators and their private sector work site supervisors as the most influential people in their lives after their mothers.

Analysis. A major weakness of the study is the possibility that there were differences between the ProTech group and the comparison group that may have biased the results. The authors did not explain how they identified the comparison group, but clearly there was no random selection, matching, or controlling for differences between the group. We cannot know, therefore, the extent to which differences between the survey results for the two groups reflected the true impact of the program as opposed to pre-existing differences between the groups. The evaluators claimed that, because the comparison group had better grades and attendance than the ProTech group and the ProTech group had almost twice the proportion of African American students, the positive results were probably underestimated. They also contended that positive impacts were biased downward because the comparison group had a much lower response rate than the program group, and the respondents were probably the ones who were doing the best. Low response rates are also a major flaw of the study; the response rate was only 66 percent for Pro Tech graduates and 27 percent for the comparison group. The authors do not report on the statistical significance of their results, and, in view of the small sample sizes, it is likely that few of the differences are statistically significant.

⁹³Jobs for the Future, 4.

Tech Prep

Program description. In 2001, the National Research Career and Technical Education (NRCTE), a Minnesota-based project funded by the Office of Vocational and Adult Education of the U.S. Department of Education, released an early report from an ongoing study of the Tech Prep initiative. The Carl D. Perkins Act of 1990 awarded grants to states to establish local consortia to create Tech Prep programs.⁹⁴ Debra D. Bragg of the University of Illinois at Urbana-Champaign produced the report under contract to NRCTE.

As described in the body of the present report, Tech Prep is a model of CTE that involves a formal agreement between high schools and postsecondary institutions that provides a pathway from high school to college, usually community college. The model includes an integrated curriculum spanning the last two years of high school and two years or more of college and also emphasizes the integration of academic and vocational content.

Methodology. A national panel of experts selected a total of eight consortia for the study, in the states of California, Florida, Illinois, North Carolina, Ohio, Oregon, Texas, and another state not specified. Among other selection criteria, evaluation sites were all deemed to be strongly committed to the Tech Prep model and to be “mature implementers” of the model, having begun enrolling students by the mid to late 1990s.⁹⁵ Rural, suburban, and urban schools were all represented, often within a single consortium. Within each consortium, the research team selected a sample of Tech Prep and non-Tech Prep participants for the outcome analysis. They used “systematic random sampling” to ensure that the groups were similar in terms of academic performance as measured by grade point average and/or class rank percentile at the time of graduation.⁹⁶ This sample included almost forty-six hundred students from the 1995, 1996, and 1997 high school graduating classes, with roughly equivalent numbers of Tech Prep and non-Tech Prep participants in each group.

The evaluation acquired high school transcripts for 98 percent and college transcripts for about 40 percent of the sample and also surveyed the students between the summer of 1998 and the winter of 1999 (between one or three years after high school graduation), receiving usable data from about 47 percent overall (ranging from 38 percent to 62 percent for individual consortia).

⁹⁴Debra D. Bragg, *Promising Outcomes for Tech Prep Participants in Eight Local Consortia: A Summary of Initial Results* (St. Paul, Minn.: National Research Center for Career and Technical Education, 2001), available from: <http://www.nccte.org/publications/infosynthesis/r&dreport/Promising%20Outcomes.pdf>, accessed April 24, 2002.

⁹⁵Bragg, 9.

⁹⁶Bragg, 22.

Findings. Bragg found considerable variation in the Tech Prep model across consortia. Whereas half of the consortia started Tech Prep curricula in the ninth grade, the other half started in the eleventh grade. Three of the consortia emphasized programs that provided a sequence of integrated CTE and academic courses to a defined group of students: as in a career academy. In two of these consortia, Tech Prep took the form of what Bragg described as a “work-based” youth apprenticeship model in which workplace experiences were linked with high school–based and college-based curricula.

By contrast, four used a different model that employed Tech Prep as basically an enhancement to the current CTE program. In this model, students already taking CTE classes were encouraged to take applied or other appropriate academic courses in order to complete a specified core curriculum. Students were not grouped into special classes, but were instead advised to take courses that were otherwise open to all students who met the requirements. One consortium offered an “integrated” model that brought together academic and CTE curricula around “career clusters” that began in high school and ended at the two-year or four-year college level.⁹⁷ And one consortium emphasized the College Tech Prep model, which stressed preparation for four-year college. In addition, some consortia used more than one model. The consortia also varied greatly in the amount of academic course taking among Tech Prep students. For example, the percentage of students completing Algebra II or above ranged from 23 percent to 90 percent (the latter being in the consortium emphasizing College Tech Prep).

The consortia also differed in whom they targeted. Most consortia attempted to attract all students, especially those who seemed unlikely to graduate from a four-year college. However, the Tech Prep youth apprenticeship programs had specific admission requirements designed to meet the needs of the cooperating businesses that were providing the apprenticeship slots. These requirements were fairly modest, such as “a C average in basic math or Algebra I, good attendance, and lack of discipline problems.”⁹⁸ Five consortia had similar proportions of male and female students, but male students predominated in the other three. The latter were the consortia with admissions requirements to some programs, which Bragg suggests may be due to a biased selection process. The percentage of minority and low-income students also varied across consortia, but was similar for Tech Prep and non–Tech Prep participants within consortia, suggesting that the programs’ participants reflected the demographics of the local communities where the programs were located.

According to the author, the outcome results

suggest that, across all eight consortia, at least 65 percent of Tech Prep participants enrolled in some form of postsecondary education within one and three years of high school graduation. . . . In all but one consortium a higher percentage of Tech Prep

⁹⁷Bragg, 31

⁹⁸Bragg, 25.

participants enrolled in two-year college than their non-Tech Prep peers, though the difference was usually modest.⁹⁹

Tech Prep students in five consortia were less likely than others to attend four-year college. In one consortium, by contrast, Tech Prep students were more likely to attend a four-year institution, whereas in two others they were as likely as others to attend a four-year college. Not surprisingly, the author found that the consortium that used a model that sought to prepare students for four-year college had the highest rate of matriculation to four-year college of all the consortia.

Tech Prep participants were also more likely to be working than their non-Tech Prep peers, and, of those working, Tech Prep participants were more likely to be working full time. However, this evaluation noted some major differences between consortia. About 30 percent of Tech Prep participants in three consortia went directly to work without attending postsecondary education. Among this group of three, Tech Prep participants were much more likely than non-Tech Prep participants to be working without attending school. In the other five consortia, an equal or greater percentage of non-Tech Prep participants were working only than the Tech Prep group. Only 15 percent or less of Tech Prep participants fell into this category, however.

Analysis. The usefulness of this study is limited by several factors. The evaluator chose to select Tech Prep and non-Tech Prep groups that were similar in academic performance in order to improve the accuracy of the analysis of educational and employment outcomes. As Bragg acknowledges, however, this procedure limited the evaluation’s ability to assess the impact of Tech Prep on secondary-level outcomes, such as high school dropout, graduation, and academic attainment. Response rates were quite low in some consortia, as described earlier. The author acknowledged that the low response rates limited the generalizability of the results, but argued that “this limitation is off-set to some extent by the exceptionally high response to our collection of transcripts by the participating secondary schools and colleges.”¹⁰⁰

The author’s practice of displaying the results separately for each consortium makes it difficult to compare Tech Prep to non-Tech Prep outcomes overall. On the other hand, the differences between programs in the different consortia may have been so great that it is difficult to draw conclusions about the “Tech Prep model.” This report represents midpoint findings of this study. Information on longer-term outcomes will be available later.

⁹⁹Bragg, ix.

¹⁰⁰Bragg, 11.

Wisconsin Youth Apprenticeship Program in Printing

Program description. Margaret Terry Orr of Teachers College, Columbia University, evaluated the Wisconsin Youth Apprenticeship Program in Printing (YAP).¹⁰¹ YAP was based on the German youth apprenticeship model, with some adaptations based on U.S. labor market conditions and Americans' concern about limiting students' future options early. The program attracted national and international attention when it began in 1992. At that time, the federal government and many state governments were considering the youth apprenticeship model for widespread implementation. Later, federal interest resulted in the School to Work Opportunities Act of 1994.

YAP enrolled students during their junior and senior years of high school. Program elements included: (1) a competency-based curriculum and assessment system, (2) two years of paid training and work experience at a printing company for twenty hours per week, (3) a work-based mentor for each student, (4) technical college instruction in printing technology and some academic courses, (5) integrated academic and vocational instruction, and (6) collaborative school and industry oversight. Students earned technical college course credit for their work. The program offered a much longer and more highly structured training experience than a typical co-op education program, which was the most common work experience model. Unlike most co-op programs, YAP coordinated each student's school-based and work-based printing instruction. The only enrollment requirements were interest and being on track to graduate on time. In addition, applicants had to be interviewed by employers and selected for an apprenticeship. Program staff tended to exclude the most severely at-risk students from the program and include those who were doing at least adequate academic work. YAP students had average sophomore grades, low absenteeism, and few discipline referrals and were on track in their credit accumulation.

Methodology. Orr's report focused on the five program sites (out of a total of eleven) that had the largest number of students and had been in operation the longest.¹⁰² At each of these sites, all YAP seniors graduating in 1995—the second YAP cohort—constituted the program group. The evaluator constituted three comparison groups: (1) all seniors who had taken or were taking at least one printing-related course, (2) all seniors in printing co-op programs, and (3) one subject class of seniors (such as English or social studies) at each site who were in neither a college preparation nor a vocational program. The program coordinators, who chose the classes, “were advised to select an average class of students, excluding advanced classes or special needs classes.”¹⁰³ Program and comparison group seniors were interviewed shortly before graduation the late spring of 1995. The evaluator attempted to collect school records for all the students, and a survey was also administered at the end of the program. To obtain post-program data, six to

¹⁰¹Margaret Terry Orr, *Wisconsin Youth Apprenticeship Program in Printing: Evaluation 1993–1995* (Boston, Mass: Jobs for the Future, 1996).

¹⁰²Orr.

¹⁰³Orr, 10.

eight months after graduation the evaluator interviewed a subgroup of members of the first YAP cohort, who graduated in 1994, at two sites. Because there were only four co-op students in the 1995 survey and only five responding to the follow-up survey, data on the co-op students was cited only occasionally.

Findings. Orr concluded that YAP seemed to have somewhat positive effects on school performance based on the improved attendance and grade point averages, as well as the maintenance of low disciplinary referral rates, of participants. She found that whereas the program and comparison groups had similar absenteeism rates during their sophomore year, YAP students had a significantly lower absenteeism rate than the comparison groups during their senior year. Between the sophomore and senior years, the YAP and the printing-class-only groups had statistically significant improvements in their grade point averages, whereas the general class group maintained their GPAs. However, the latter group's average GPA started out and remained significantly higher than that of the other groups. The YAP group maintained its low disciplinary referral rate, but lost the statistically significant advantage over the other students that it had in the sophomore year. The evaluator did not compare school completion rates for the various groups because "all sampled students completed high school at the same rate."¹⁰⁴

YAP graduates were less likely to attend college immediately after graduation than comparison students. Six to eight months after graduation, about 45 percent of the 1994 YAP graduates were enrolled in college, compared with 63 percent of the students from the printing-class-only group and 60 percent of the co-op students. These differences, however, based on information from only sixteen YAP students, eight printing students, and five co-op students, were apparently not statistically significant.¹⁰⁵ About three-fourths of YAP graduates and a similar proportion of the comparison groups planned eventually to enroll in two-year college, four-year college, graduate or professional school, or further training.

Six to eight months after graduation, almost all (94 percent) of the 1994 YAP graduates were working, all in the printing industry. By contrast, 75 percent of the printing-class-only comparison group and 60 percent of the co-op group were working. Seventy-five percent of YAP graduates were employed with their apprenticeship employer.

Of those who were working, 60 percent of the YAP group were earning \$7.00 or more per hour, compared with only a third of the other groups. In addition, the YAP graduates were more likely to be employed full time, had been more continuously employed, and had jobs that required more skills. The author also reported, based on an employer survey, that employers described the YAP students as better prepared for employment than other entry-level employees on half of the skills they were asked about, rating them comparable on the remaining skills.

¹⁰⁴Orr, 57.

¹⁰⁵The author does not state this specifically, but in other tables, statistically significant items are marked with an asterisk.

Analysis. There were several problems with the collection of student data. First, the samples were not strictly comparable, not surprising because the evaluation used no random assignment, systematic sampling, or matching. Whereas 95 percent of the 1995 YAP seniors were white and non-Hispanic, only 77 percent of the printing-class-only group and 85 percent of the general group were white and non-Hispanic. Seventy-three percent of YAP participants were male, compared with 51 percent of the printing-class-only group and 64 percent of the general group. Sixty-one percent of the YAP group had a father with a high school education or less, compared with 34 percent of the printing-class-only group and 40 percent of the general group. YAP participants were fairly similar to the other groups in their rate of absenteeism as sophomores, but they had considerably lower grade point averages than the general group and a much lower rate of disciplinary referrals than the printing-class-only group. There is no way of knowing the extent to which differences between the groups at follow-up were due to their educational programs, to these characteristics, or to other unmeasured factors.

Not only was selection bias a potential problem but also the sample size was small, including only forty students for the YAP group of 1995 seniors, forty-three for the printing-class-only group, seventy-eight for the general group, and four for the co-op group. Although response rates to the 1995 student survey were very high (93 percent for the YAP group and 100 percent for the comparison groups), the evaluator was able to obtain only 50 percent or less of the student records for the comparison groups and 83 percent of the records for the YAP group. Moreover, the data on employment and postsecondary education were based on follow-up telephone interviews with 1994 YAP graduates at only two sites. Only twenty-nine interviews were conducted, representing only sixteen YAP students, five co-op students, and eight printing-class-only students. These groups were apparently too small to obtain any statistically significant results. Moreover, no information was given on the characteristics of the YAP graduates who were interviewed for the follow-up analysis.

The evaluator's treatment of high school completion rates is rather unusual. She states that "school completion rates were not used in this comparison because all sampled students completed high school at the same rate."¹⁰⁶ If this statement means that there was no difference in school completion rates between the YAP group and the comparison groups, this should have been treated as a finding and not as an aside.

¹⁰⁶Orr, 57.

Study Not Reviewed

Perlmutter, Deborah E. 1982. *Career Training Choice: Project CATCH. A Follow-up Study of Students Denied Admission to Vocational High Schools*. Brooklyn, N.Y.: New York City Board of Education. (ERIC Document Reproduction Service No. ED 219563.)