Secondary Career and Technical Education and Comprehensive School Reform: Implications for Research and Practice

Marisa Castellano and Sam Stringfield
Johns Hopkins University
James R. Stone III
University of Minnesota

In the 1990s, federal legislation authorizing funding for secondary vocational education, increasingly called career and technical education (CTE), began to mandate accountability requirements such as improved academic achievement. These requirements have necessitated a search for ways to integrate CTE into broader school reforms that have improved student achievement as their goal. This review examines research on the effects of CTE reform efforts in general and on efforts to meld CTE with comprehensive secondary school reforms. The authors found that the intersection of CTE with comprehensive school reform is under-researched. However, the studies reviewed here reveal the potential benefit for research and practice in re-examining CTE as a means of preparing our nation's youth for the future.

KEYWORDS: career and technical education, comprehensive school reform, high school reform, vocational education.

During the last decade, federal legislation authorizing funding for secondary vocational education, increasingly known as career and technical education (CTE), has placed greater accountability requirements on local programs. The legislation mandates not only measures of gains in specific career-related competencies but also traditional measures such as academic achievement tests. Focusing CTE on both career- and academic-related measures is having the effect of encouraging new unions between CTE and academic departments in secondary schools. This review examines the research base for such an intersection.

CTE reform efforts are seriously under-researched. School and district personnel are forced to make major programmatic decisions in the absence of replicating studies or, often, any process or outcome studies to inform their thinking. As an example of the shortage of research, the last article in Review of Educational Research to use "vocational education" as a descriptor was one in 1997 that had special education as its primary focus (Phelps & Hanley-Maxwell, 1997). To find another article about vocational education, RER readers must search back to 1968. In that year, the journal published a special issue focused on vocational education, edited by J. Moss. The last volume in the National Society for the Study of Education did not feature a study on vocational education until 1997. The shortage of research on vocational education is even more pronounced in the secondary education literature, as the last article in Review of Educational Research to use "vocational education" as a descriptor was one in 1997 that had special education as its primary focus (Phelps & Hanley-Maxwell, 1997). To find another article about vocational education, RER readers must search back to 1968. In that year, the journal published a special issue focused on vocational education, edited by J. Moss. The last volume in the National Society for the Study of Education did not feature a study on vocational education until 1997.
of Education series to be devoted to the topic was published in 1965. It is ironic that, at the very time that national policy is calling for a more integrated and outward-looking version of CTE, there have been few scholarly attempts to build bridges from CTE to research on academic components of U.S. schooling.

In this article we provide some historical perspective on CTE but emphasize recent research on CTE reforms and on the intersection of CTE research with research on broader secondary school reform. The focus on comprehensive school reform (CSR) derives from federally mandated accountability requirements for CTE programs that go substantially beyond traditional vocational content, effectively requiring the integration of academic content with CTE. We take a broad perspective on the integration of CTE and CSR, examining outcomes for all secondary students. At the same time, we recognize that students considered to be at risk of dropping out of high school historically have been, and continue to be, heavily enrolled in vocational education. We identify approaches that have tended to work well with at-risk students.

Method

Each of the three authors of this article contributed a particular area of expertise and was able to construct an up-to-date review of that area by virtue of other professional activities. For the CTE literature, although we note earlier key references, we focused on materials published since 1992. Before that time, there were few manifestations and even fewer studies of the kinds of CTE designs and practices that incorporate rigorous academics and integrate well with broader reform efforts. Our preliminary sample contained 48 studies, position papers, or articles.

The types of reform models known as CSR are relatively new on the educational landscape. Most research on CSR designs has been conducted since the early 1990s. They constitute a large body of literature that we delimited in several ways. First, we eliminated all reform designs for elementary and middle schools. Second, we focused largely on the period 1992-2002, although we point readers toward large, seminal works on school change that came out before that period. Our focus was on outcome-based studies of some of the high school CSR designs that seem well matched with CTE efforts. Our preliminary sample of CSR studies that fit these criteria contained 37 studies, position papers, or articles.

We augmented the preliminary samples with library searches derived from the references in the two sets of literature that we had already collected. We conducted searches of the ERIC database. For the CTE literature, we used search strings such as "vocational education" or "career and technical education" or "Tech Prep" and "student outcomes." We included "student outcomes" in our search to eliminate program descriptions and focus on studies that had achievement or other results. The search process yielded more than 80 studies. Many of the studies were precursors to the more authoritative work that we had already included by the same authors, so those earlier works were eliminated. Given the constraints of article length, we preferred, where possible, to review 1 or 2 nationwide or longitudinal studies of each CTE reform effort (e.g., Tech Prep) rather than include the many instances of single-program evaluations. This search and sift process yielded 11 more studies.
For the section on CSR, we used descriptors such as "comprehensive school reform" or "whole school reform" and "student outcomes." This netted more than 100 studies, program descriptions, and position papers. Again, most of these articles focused on elementary school reforms, and they were eliminated. Of the rest, many had already been reviewed for the sample. Some CSR designs are more conducive than others to integrating CTE themes or structures such as career academies. It was not our intention that the section on high school CSR designs be exhaustive; we hoped only to give several examples of how such designs have integrated CTE and to provide the outcomes in those cases of integration. More comprehensive reviews of CSR designs have been conducted elsewhere (Borman, Hewes, Overman, & Brown, 2002; Herman et al., 1999; Northwest Regional Educational Laboratory (NWREL), 1999; Slavin & Fashola, 1998; for a review of reviews, see Stringfield, 2000a). This search yielded 3 additional studies.

In addition to the library and ERIC searches, each of the authors continued to monitor the CTE and CSR fields, checking new publications and journals, attending professional meetings, and monitoring the Internet. Many reform design organizations, education research organizations, policy and evaluation organizations, and the federal-government post publications online. Over the 18-month period of preparing this literature review, new studies were published, many of which were accessed online. We monitored a total of 28 websites known to publish in the areas of interest. These monitoring activities yielded 29 recent studies, dated from 2000 to 2002.

This review covered 128 works, only a few of which include student outcomes. There is limited statistical evidence for the effectiveness of CTE reform efforts, and this paucity is reflected in some of our conclusions—most obviously, the need for expanded research. Table 1 contains the 18 studies of CTE-based reform efforts that included student outcomes. In cases where a study contained multiple research questions and findings, we include in the table only those related to student outcomes.

The studies in Table 1 display methodological variation and, in some cases, a lack of rigor that reflects the difficulty of doing random assignment research, even in schools that are oversubscribed and conduct a lottery to determine student admission. In fact, the act of conducting a lottery can sometimes bias the sample, as students who are not accepted might leave the school system or seek out curricular programs similar to the one to which they were not admitted. Additionally, an applicant pool is by definition no longer a random sample of all students, and the results of such a study can be generalizable only to the universe of students who might apply to a special high school structure. Students and parents have free will. Their actions cannot be controlled as tightly as dosages in a medical trial—the usual model for random assignment studies.

Therefore, although the methodological limitations of each of the studies in Table 1 are noted, these observations are not meant as "fatal" criticisms. On the contrary, the studies form the knowledge base about CTE in the time period under consideration and are valuable. Although all researchers are aware of the benefits of a random assignment research design, the constraints of time and funding usually lead to pragmatic tradeoffs. As long as the limitations are acknowledged and the generalizability of the findings bounded properly, these studies still can be quite
<table>
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<tr>
<th>Reform studied, author, and year</th>
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<th>Limitations of the study</th>
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<td>Tech Prep Bragg (2000, 2001)</td>
<td>Are Tech Prep students' educational or employment outcomes different from those of non-Tech Prep students?</td>
<td>Analysis of high school and community college transcripts, interviews, and follow-up surveys from eight Tech Prep consortia</td>
<td>Little overall difference was found in math course taking between Tech Prep and non-Tech Prep students. More Tech Prep than non-Tech Prep students enrolled in 2-year colleges. After graduation, Tech Prep students were more likely to be working and working full time.</td>
<td>Student follow-up survey response rates from two of the consortia were low (38%), limiting generalizability beyond the participating consortia.</td>
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<td>School to Work Griffith &amp; Wade (2002)</td>
<td>What is the impact of career- and work-related education (CWE) programs on students' college enrollment and employment trajectories in one district?</td>
<td>Analysis of high school transcript data, state higher education commission data, and state employment data</td>
<td>CWE students worked more continuously during the 6-year follow-up period, with higher earnings, than did the non-CWE students. CWE students had about the same college outcomes as the non-CWE students, in terms of receiving college degrees, 1st-year grade point averages, and percentage of students needing remediation.</td>
<td>Some analytic groups were small, limiting generalizability. College and work information included only in-state data. The outcomes might be explained by systematic differences among student groups not known to the researchers.</td>
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<td>Career Academies</td>
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<td><strong>Questions</strong></td>
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<td>What are the effects of career academies on education and work-related student outcomes?</td>
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<td>Large-scale, multi-site, random assignment research design, analyzing student surveys, transcript records, achievement data, and site visit data</td>
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<td>Academy students received enhanced interpersonal supports. Among students at high risk of dropping out, academy students were more likely to complete a basic academic core curriculum. But there was no improvement for any academic subgroup on achievement, high school graduation rate, or initial postsecondary outcomes in comparison with the control group.</td>
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<td>Although the students were randomly assigned to an academy (or not), all had self-selected by applying to the academy, limiting generalizability. Also, the participating career academies were not randomly selected, limiting generalizability.</td>
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<th>Maxwell (2001)</th>
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<td><strong>Questions</strong></td>
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<td>Do career academies facilitate postsecondary education?</td>
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<td>Analysis of career academy enrollment and performance data from one district, and local state university application data from graduates of that district</td>
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<td>Career academy graduates needed less remediation in English at the university and were more likely to graduate from the university than the non-academy comparison group; but the rates of remediation were still high, and the rates of graduation were still low.</td>
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<td>Findings from one district and the subset of students who applied to one university are not generalizable to the entire population. Students were not randomly assigned to career academies.</td>
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<th>Orr, Hughes, &amp; Karp (2002)</th>
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<td><strong>Questions</strong></td>
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<td>How do career academies foster improved preparation and successful transition to postsecondary education?</td>
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<tr>
<td>Analysis of achievement and survey data of academy seniors compared with those of non-academy seniors; comparison of alumni data with relevant national data</td>
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<td>Academy seniors reported taking more college-level courses than the control group; alumni reported less remediation in college than the national average.</td>
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<td>The student sample was restricted to program completers. Nonrandom selection of career academies and low alumni survey response rates limit generalizability. (continued)</td>
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<td><strong>Stern, Raby, &amp; Dayton</strong> (1992)</td>
<td>What are the effects of career academies on education and post-high school student outcomes?</td>
<td>Analysis of achievement and survey data of academy graduates compared with those of non-academy graduates</td>
<td>Academy students performed better than a comparison group on attendance, grades, and graduation rates; but there were no significant differences in post-high school wages earned or in likelihood of enrolling in postsecondary education.</td>
<td>The student sample size was relatively small and not randomly assigned, limiting generalizability.</td>
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<td><strong>Career magnets</strong></td>
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<td>Crain et al. (1999); Crain, Heebner, &amp; Si (1992)</td>
<td>What are the effects of career magnet schools on student performance and postsecondary outcomes?</td>
<td>Large-scale, multi-site, random assignment research design, analyzing (a) student achievement, attendance, and graduation records; and (b) surveys and interviews with career magnet graduates and non-accepted applicants</td>
<td>Low- and average-level readers in the magnets performed better on the state math achievement test than did similar students in the control group. The low- and average-level readers in the magnets had higher 9th-grade dropout rates than the control group. Among graduates, magnet students showed better postsecondary performance, earning more credits and choosing a major sooner.</td>
<td>While the students were randomly assigned to a magnet or not, they had all self-selected by applying to the magnet, limiting generalizability.</td>
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<td><strong>High Schools That Work</strong></td>
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<td>Frome (2001)</td>
<td>What was the level of student achievement in HSTW schools in 1996, and did it change in 1998?</td>
<td>Analysis of HSTW assessment data from 1996 and 1998</td>
<td>In 1996, about half of the students who were tested met the HSTW achievement goals in math, science, and reading. A significantly higher percentage met the goals in 1998.</td>
<td>There was no control group.</td>
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What is the impact of the TDHS 9th-grade instructional program on student achievement? 

Analysis of longitudinal pretest and posttest data with matched treatment/control school design 

TDHS students had substantially greater gains in math and reading achievement in comparison with the control groups. 

Students were not randomly assigned. Third-party research needs to replicate these findings. 

What is the impact of the TDHS reforms on student achievement at the pilot site? 

Analysis of core-subject Maryland State Functional Tests 

The pilot TDHS site showed improved student performance on the state tests in comparison with previous years and in comparison with the control group. 

Students were not randomly assigned. Third-party research needs to replicate these findings. 

What is the impact of TDHS on the climate, attendance, and promotion rates at the pilot Talent Development site? 

Analysis of student transcripts, attendance records, and teacher surveys 

The pilot TDHS site showed improved attendance in comparison with previous years and in comparison with a control group. Using first-semester data, higher promotion rates than in previous years were predicted. 

Students were not randomly assigned. These were very preliminary data, so no definitive conclusions about promotion rates, but attendance rates increased. 

What is the impact of the TDHS reforms on 9th-grade student outcomes? 

Analysis of longitudinal pretest and posttest SAT-9 data with matched treatment/control school design 

TDHS 9th graders showed substantially greater gains in math and smaller gains in reading achievement than the control groups. 

Students were not randomly assigned. Third-party research needs to replicate these findings. 

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<td>Philadelphia Education Fund (2002)</td>
<td>What is the impact of the TDHS reforms on student outcomes?</td>
<td>Analysis of pretest and posttest data of 9th graders; analysis of 11th-grade state-mandated achievement tests; analysis of senior transcript records compared with those of demographically similar schools</td>
<td>Ninth graders showed strong achievement gains in math and smaller gains in reading. Eleventh graders showed achievement gains in math and reading. A higher percentage of seniors completed the minimum college prep course sequence than in similar schools.</td>
<td>Students were not randomly assigned. There was no comparison group on the 9th-grade test scores. State achievement test scores for the comparison group of juniors was not available. No statistical controls were included in the analysis of senior curriculum completion.</td>
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informative. By pointing out their limitations, we hope to delineate the direction that future research must take if the field is to advance. We believe that there is much to be learned from the studies reviewed here. In this regard, we agree with Herman's remarks on CSR models (2002):

The quality of the research base overall matters. It's not just the methodology used in the independent studies, but it's a replication of findings. It's that all of the research converges in a certain direction and points a way to a finding that can be useful to schools. . . . It's important to look at the replication of findings, especially . . . when you don't have a lot of random assignment studies, because if you have hundreds of studies that are quasi-experimental studies and no random assignment study, you might want to put some weight to those findings. (Unpaginated website)

Finally, because of the shortage of studies containing student outcomes, and as a way to familiarize readers with the various reform efforts and their goals, we have included in the review some program descriptions and position papers. Most of the studies reviewed here were conducted since 1990. We recognize the gap in the mainstream literature between the last special issue of Review of Educational Research dedicated to vocational education (1968) and the decade of the 1990s. There was a qualitative shift in emphasis in vocational education in the 1990s, as we discuss below. This shift integrates well with contemporaneous, broader reform efforts; therefore, the review is thorough for its purpose.

The Imperative for Secondary School Reform

School reform is a perennial issue in American education. At the turn of the 20th century, John Dewey (1900, 1916) described reasons to be concerned with educational improvement, two of which continue to stand out at the dawn of the 21st century: furthering democratic ideals through a broadly educated citizenry, and obtaining a viable economic future for all of our citizens.

Formal education is society's best available route to assure citizens' participation in the world of work. The relationship between education and income has never been stronger than at present. Figure 1 presents the income advantage that young U.S. male high school and college graduates have had over high school dropouts over the past 50 years.1 For a young male, the economic advantage of a college degree in 1949 was 13% greater than that of a high school degree and 30% greater than dropping out of high school. By 1973, those differences had grown to 20% and 46%, respectively. However, the entire spectrum had risen so much that the average young high school dropout was making more than the average college graduate of only 24 years earlier, so that the effect was hardly noticeable for the individuals concerned. By 1998, the picture had changed dramatically. Not only was the real income of a young high school dropout down by 52% since 1973, but the differential in income by education level had increased from 30% to 138%. In other words, the differential economic advantage of obtaining a college education in comparison with dropping out of high school today is more than four times as great as it was 30 years ago.

In the emerging world information economy described by Friedman (1999), there is an increasing premium for obtaining further formal education. The U.S. Department of Labor (2000) notes that job prospects are expected to grow among job types that require all kinds of postsecondary degrees. By contrast, all job types
requiring less than an associate's degree are expected to have lower percentage increases in job growth. The clear conclusion of the work of the U.S. Department of Labor is this: “Education is essential in getting a high paying job” (p. 2).

The relationship between education and income is established by young adulthood for most people. As Mumane and Levy (1996) document, “The widening earnings gap between high school and college graduates stems in large part from differences in the mastery of basic skills when the two groups were high school seniors” (p. 8, italics in original). Mumane and Levy list nine “new basic skills”: reliability, positive attitude, willingness to work hard, ninth-grade-or-higher mathematics abilities, ninth-grade-or-higher reading abilities, the ability to solve semi-structured problems at levels much higher than today’s high school graduates, the ability to work in groups, the ability to make effective oral and written presentations, and the ability to use personal computers to carry out simple tasks such as word processing.

Clearly these are valuable skills, both for preparing for postsecondary education and for the world of work. Murnane and Levy (1996) argued that the majority of these skills were not being taught to most U.S. high school students. A series of commission reports during the 1980s and early 1990s concurred, warning of the economic consequences of the growing shortcomings in the education of young Americans (Commission on the Skills of the American Workforce, 1990; National Commission on Excellence in Education, 1983; William T. Grant Foundation, 1988).

We have not yet developed reliable ways of measuring student performance on many of Murnane and Levy’s (1996) “new basics.” However, we do have longitu-
dinal measures of how well we are teaching some of the more academic skills. The National Assessment of Educational Progress (NAEP) provides data in several of these areas, including reading, mathematics, and science (see Figure 2, adapted from Campbell, Hombo, & Mazzeo, 2001). The large sample sizes \((N > 10,000)\) in each cell at each time make it possible to find statistical significance among the various trends at various times. However, six of the trends (in levels of reading and math achievement at the ages of 9, 13, and 17) have in fact been quite stable over the past 30 years, with math rising somewhat during the 1990s. Among the three reading trend lines, for example, only one data point (age 13 in 1990) revealed scores significantly different in 1999 from the scores of 1980; and that difference disappeared in the next (1992) round of testing.

In mathematics and science, all six lines are up slightly from 1982, but the science score at age 17 is actually below the mean score of 1969. Mathematics would appear to be the area with clearest long-term gains, since in science none of the increases are significantly higher than in 1994. Despite these anomalous fluctuations, it is hard to look at the nine trend lines in Figure 2 without concluding that each is essentially flat.

In summary, census data and commission reports indicate that failure to get at least a high school diploma creates increasingly high hurdles for young people seeking economic sufficiency in adulthood. The Murnane and Levy (1996) analysis suggests that the income-by-education-level differentials are partially explained by achievement differences observable in the senior year of high school, and the NAEP data indicate that age-17 achievement has been largely flat over the last 30 years. The measured effectiveness of education has not significantly increased, but the economic consequences of failure to thrive educationally have become increasingly challenging for students.

On the basis of the preceding discussion, a logical goal of compulsory education would be to help the largest possible percentage of people prepare for and succeed in postsecondary education. With respect to baccalaureate institutions, however, there are not enough slots in colleges and universities for all high school graduates, nor do all students wish to attend 4-year colleges. Of those who do, many do not complete their degrees (Gray, 2002). Clearly, then, the "college-for-all" goal as expressed by bachelors' degrees is unrealistic and not even necessary for successful student transitions to adult work roles (Rosenbaum, 2002). Students can obtain a high-quality combination of general education for participation in a democratic society and the technical skills necessary to succeed economically in an information-based world economy at community and technical colleges. In fact, the education level expected to see the most rapid growth in job prospects over the next 10 years is the associate degree (U.S. Department of Labor, 2000). Studies have shown that the returns of community college credential and degree programs are significant when participants get jobs in the fields in which they studied (Grubb, 1999; Sanchez & Laanan, 1998).

Some studies provide evidence of the value of CTE in secondary school as well. Mane's analysis (1999) of national datasets showed high short- and medium-term payoffs (18 months and 5 years, respectively) of high school vocational courses for students who do not attend college. Griffith and Wade (2002) conducted a smaller-scale analysis and similarly found that CTE program participants had higher annual earnings 6 years after high school than did non-CTE program participants.
FIGURE 2. Trends in average NAEP scale scores for U.S. students in reading, mathematics, and science. Adapted from Campbell, Hombo, & Mazzeo, 2001 (data are from NCES).
Studies have shown, then, the economic value of high school CTE (Griffith & Wade, 2002; Mane, 1999; Rosenbaum, 2002). Certainly there is additional value to postsecondary education; indeed, high school should not be the end of the education trajectory for students not immediately bound for college. Ideally, they would continue their education as needed to advance in their fields and, as illustrated in Figure 1, to lessen the income differential between themselves and their peers who do complete a postsecondary degree. Nevertheless, these studies reveal the value of preparing in high school for well-paid occupations for students who do not wish to attend college upon graduation.

The goal of preparing more people for postsecondary education reflects the goals of most current secondary school reform efforts: to reduce the number of dropouts, to increase student achievement and work-related skills in high school; and to prepare all students for lifelong learning. In the following pages, we outline the direction that vocationally based reforms have taken. Then we describe the comprehensive school reform movement, focusing on high school reform designs that attempt to integrate rigorous academics and career information and preparation. We conclude with implications of that integration for research and practice.

Career and Technical Education Reform

Vocational education as a part of public schooling began in the United States in the 19th century. Previously, public secondary schools had been designed to serve a small percentage of the students who completed elementary school. Most children were expected to learn a trade in the traditional apprentice fashion, by the side of a family member, farmer, or craftsman. When compulsory schooling extended into the teen years, students began to be sorted by likely outcomes. The sorting itself tended to ensure a “practical” (i.e., local-economy-directed) education for the great majority of students and effectively ensured the marginalization of vocational education (Kincheloe, 1995).

Historically, vocational education programs tended to include the students who were at risk of not finishing high school (Thompson, 1973). They were students who, counselors and other adults assumed, would not go on to any postsecondary education. Those students were provided with vocational education so that they could earn a decent living after leaving school. Although vocational education in the United States did not enjoy high status, it prepared generations of young people for the work roles that awaited them in factories, farms, and offices. Vocational education succeeded in that mission as long as there were enough jobs in those areas. However, over the last generation, the globalization of the economy has had an increasing impact on work in the United States. Between 1970 and 1993, the proportion of U.S. workers employed in manufacturing fell 41%, down to only 16% of the total workers employed (Feuer & Shavelson, 1996). The expectation that a young person could get a well-paid job in the plant where his or her father worked was no longer a given. In fact, many fathers were unable to keep such jobs themselves.

During the 1980s and 1990s, vocational education enrollments declined in traditional vocational content areas: business, agriculture, and the trades (U.S. Department of Education, 2000). Each time that federal legislation supporting vocational education was passed (i.e., the Perkins legislation), it included an evaluation component called the National Assessment of Vocational Education (NAVE). The
NAVE for Perkins II concluded that vocational education had to become a more active part of broader secondary reform efforts (Boesel & McFarland, 1994). That NAVE, however, was conducted too early to conclude anything substantive about the effects of comprehensive school reform on vocational education (Milne, 1998). When completed, the current NAVE for Perkins III will provide more up-to-date information on vocational student outcomes and the quality of implementation in a context of accountability and reform (Silverberg, Warner, Goodwin, & Fong, 2002). Other research conducted between the two NAVE evaluations suggests that participation in CTE coursework reduces dropout rates (Plank, 2002) and effectively prepares students for work and postsecondary education (Griffith & Wade, 2002; Mane, 1999). Studies describing these and other effects of CTE in a reform context will be reviewed here under each reform effort.

During the period of enrollment decline, the vocational education community felt pressure to adapt to new demands or risk becoming irrelevant. Most of the traditional areas needed to be infused with new technologies—computerized diagnostics in auto repair, numerically controlled machines in machine shops, and sophisticated medical equipment in health occupations classes. For these changes to occur, staff needed professional development in the new technologies as well. High schools needed to provide a more expansive academic and vocational curriculum premised on broad career clusters rather than on preparation for particular jobs. Such programs needed to become better linked to postsecondary occupational education, which, in turn, could provide greater specificity and more direct application to immediate employment. These programs could also point to further postsecondary education and workplace training opportunities over a lifetime.

To reflect this change in philosophy and the kinds of programs offered, the professional vocational association in 1998 urged its members to begin to use the term career and technical education (CTE) in place of vocational education (Lynch, 2000). The most important changes were efforts to increase the academic skills of CTE students, erase the stigma sometimes attached to vocational education, and see that all students met the higher standards that had become prevalent. The goal of CTE became for all students to finish high school prepared either to enter the workplace (which had come to demand strong academic skills and other “new basic” skills) or to begin postsecondary education. This broader mission challenged vocational educators to teach beyond the confines of specific occupations and, instead, to prepare students for a more demanding world of work.

Stone (2000) summarized the expanded view of CTE in which students are prepared for the contemporary workplace through three nonexclusive approaches: education that uses work as a context for developing broader general skills; education that uses work as a context for developing more widely recognized skills required for long-term occupational and career success; and finally, education that uses work as a context for developing occupationally specific skills. These approaches can be referred to as education through work, education about work, and education for work.

Education Through Work

All students should have the opportunity to learn school subjects with work as the context of their learning. Dewey called this “education through occupations” (1916, p. 309). Work-based learning and “the new vocationalism” (Benson, 1997;
Grubb, 1995) are other descriptors. Wirth (1992) interpreted Dewey's terminology in the following way:

- Dewey perceived the occupations, then, in the broad sense as those activities that occupy men and women in coping with life. Education through occupations meant for Dewey an activity that engages the intellect in reflection upon actual practical activity—the shared practices of the community that are the roots of human learning. (p. 182)

Stone (1995) described ways in which workplace learning could be harnessed to reduce the achievement gap, especially in urban locations. He pointed to opportunities in urban communities that had work or learning potential, such as rehabilitating homes and buildings and meeting the needs of children and the elderly. Communities abound with work and learning opportunities, and these have power to transform the entire curriculum.

**Education About Work**

Education about work, like education through work, is meant to be broad. The curriculum assumes that career and technical knowledge—knowledge about the world of work—is valid school content and belongs in the common core of knowledge that all students should possess. All students need to learn about social aspects of work, such as democratic rights in the workplace, safety, and the prospect of race or gender discrimination. They need to know about career ladders, labor markets, job-seeking skills, and job-keeping skills. They need to understand how to allocate resources effectively, acquire and use information, develop solid interpersonal skills, use and troubleshoot technology, and work with and modify systems used in business and industry (Secretary's Commission on Achieving Necessary Skills [SCANS], 1991).

**Education for Work**

Education for jobs in the economy is a vital aspect of career and technical education. Although many argue that preparation for jobs should be concentrated primarily in the postsecondary phase of students' lives (e.g., in community and technical colleges), many students are developmentally ready to prepare for occupations at earlier ages. However, secondary CTE programs must provide rigorous academic development and rigorous career development if they are to prove beneficial to students. These programs must also be linked to postsecondary education and training opportunities. For most young people, secondary schools should provide high-quality career guidance and competence in communication, numeracy, literacy, and computer abilities, all of which lead to more specific preparation at the postsecondary level.

The emergent secondary CTE programs that educate through, about, and for work include a broader focus on all aspects of an industry rather than job-specific training, attention to student achievement through some form of academic and vocational curriculum integration, strong linkages to workplaces while students are still in high school, learning activities that link experiences at those workplaces with school learning, smaller learning communities with a career focus to help engage students and keep them in school until graduation, and connections to postsecondary institutions to encourage further education.
The following reforms in the field of secondary vocational education represent a gradual movement toward the framework outlined earlier. First, we describe the CTE reforms that were driven by federal legislation; then we discuss reform efforts unrelated to legislative mandates.

**Legislation-Driven Career and Technical Education Reforms**

Much of what occurs in U.S. high schools is shaped by state laws and local programs. State policy, in particular, plays a significant role in shaping the direction of high school reform, through curriculum policies that affect graduation requirements, student testing, school evaluations, materials selection, and teacher certification (MacIver & Legters, 2002; Tyree, 1993). Noncurricular state policies, such as a funding calendar that does not match the school year calendar (Tyree, 1993), also affect local efforts to reform practice. Clearly, such wide-ranging potential to control secondary schools will have a strong effect on reform efforts, be they comprehensive or CTE based. However, such control tends not to completely eliminate local influence over actual teaching and learning. Even the strongest policies may not be implemented as intended, whether because of lack of awareness of the policy, lack of consequences for failing to implement a policy, or lack of capacity at the local level to implement the policy (Marsh, 2000; Tyree, 1993).

Prior research reveals that, in some cases, state policy has blended well with other CTE reform initiatives, such as School-to-Work (Erlichson & Van Horn, 1999). In other cases, state policy can hinder or deflect CTE or other reform efforts in local schools and districts (MacIver & Legters, 2002; Marsh, 2000), leading to "policy collisions" (Darling-Hammond, cited in Bartlett, 1997). Because of the wide variation in state policies and in their effects on specific local reforms, this review does not incorporate studies of the effect of individual state policies on CTE reform efforts. Some efforts in that area have been undertaken (Bartlett, 1997; Erlichson & Van Horn, 1999); but to maintain our focus here, we leave it to other interested researchers to review that rich area of investigation.

Since the passage of the Smith-Hughes Act in 1917, the federal government has been involved in the provision of vocational education to high school youth. As the commissions cited earlier (Commission on the Skills of the American Workforce, 1990; National Commission on Excellence in Education, 1983; SCANS, 1991) issued their critiques on the state of American education in the 1980s, the U.S. Congress responded by reauthorizing vocational education laws. The reauthorizations encouraged reforms of vocational education to make a clearer transition to post-secondary education, to infuse more academic rigor, to include more work-related experiences, and to make vocational education more accountable.

**The Perkins Legislation**

The Carl D. Perkins Vocational and Applied Technology Education Act of 1990 (called "Perkins II") was the first CTE legislation to recognize the changing economic and educational landscape. The act mandated that federally funded vocational education programs institute several reforms, including the following initiatives:

1. Development of Tech Prep programs, which coordinate courses in the last 2 years of high school with the 2-year community college associate degree
2. Integration of vocational and academic curricula
3. Promotion of work-related experience
4. Accountability as a required element of funding

Continuing a trend that began in the late 1960s, the 1990 act required that resources be targeted at "special populations": the poor, the disabled, and the limited-English proficient.

These reforms were strengthened in the act’s 1998 reauthorization (Perkins III), although the emphasis on special populations was reduced. Perkins III was designed to support the alignment of vocational education with state and local efforts to reform secondary schools, so that CTE might become an integral part of those efforts. The act’s four programmatic initiatives are discussed here.

Tech Prep

Tech Prep encourages articulation agreements—formal arrangements aligning curricula—among school districts and community colleges. This vertical integration of curriculum links the final 2 years of secondary education with the first 2 years of postsecondary education (or apprenticeships), leading to a degree or certificate. A common core of required proficiency in math, science, and communications is presented in the context of technical preparation in specified occupational fields, and job placement is often included.

The goal of Tech Prep was to attract students by eliminating repetition between high school and community college courses and by showing students a clear path to postsecondary education and technical occupations. Tech Prep also allowed community colleges to teach the more advanced courses thought to be necessary for highly technical occupations, on the assumption that students had taken the foundation courses in high school.

The Perkins II Act contained vague definitions of course articulation and curriculum integration to encourage the creation of systems that responded to local needs. However, the vagueness slowed the development of Tech Prep. By the mid-1990s, Tech Prep structures had been developed in just over half of the comprehensive high schools and in the majority of community colleges in the United States (Bragg et al., 1997; U.S. Department of Education, 2000). However, an evaluation of Tech Prep implementation that surveyed state and local administrators over a 3-year period found that only 8.4% of high school students participated in Tech Prep (Hershey, Silverberg, Owens, & Hulsey, 1998).

Bragg (2000, 2001) began a longitudinal study in 1998 of eight Tech Prep consortia that were considered “mature implementers.” Because of large differences in implementation across sites, Bragg (2001) did not aggregate all results over the eight consortia but, rather, described the ranges of outcomes. Between 28% and 75% of Tech Prep participants across consortia went to 2-year colleges, as compared with a range of 18% to 58% of non-Tech Prep participants in the same consortia. Additionally, between 5% and 53% of Tech Prep participants across consortia went to 4-year colleges, as compared with a range of 17% to 55% of non-Tech Prep participants. In most consortia, Tech Prep participants were more likely to be working than their non-Tech Prep peers. Future reports based on this study will report on college completion and subsequent employment.

In a nationwide evaluation of Tech Prep implementation, Hershey et al. (1998) found that consortia often implemented various components of Tech Prep but did not
always strongly emphasize a smooth transition from high school to postsecondary education. One reason was that parents and students often balked at strictly defined sequences of courses explicitly preparing students for a postsecondary education at the local community college. Only 10% of consortia were found to follow such a strong course sequence, because the sequence appeared to dismiss the possibility of attending a 4-year college.

Once out of high school, Tech Prep students do not always take advantage of the articulated coursework by proceeding to more advanced courses at a community college. Often, students retake the articulated courses at the college level (Bragg, 2000; Urquiola et al., 1997) or do not attend community college at all (Hershey et al., 1998). Urquiola et al. (1997) concluded that the failure of secondary students to enroll in articulated courses suggested a lack of confidence on the part of community college faculty that high school courses really can substitute for courses at the community college level. Of the students who did attend community college, many were required to take additional tests or to undergo delays before being granted articulated credit (Hershey et al., 1998).

Curriculum Integration

Perkins II and III both called for the integration of vocational and academic education, defining integration only as a set of courses constituting coherent sequences through which students could achieve both academic and vocational competencies. Details were left to states and localities. The integration concept was not unknown in the vocational community; its proponents go back nearly a century to John Dewey (1916), who exhorted educators to contextualize learning in U.S. high schools. However, it took a more recent confluence of events to bring curriculum integration back into vogue. The first event was the recommendation by the business community in the aforementioned commission reports that high schools improve their preparation of students for the demands of modern work.

The SCANS report (1991) supported the teaching of the required skills "in context." That support stemmed from a second event in the ascendance of curriculum integration: the emergence of research in cognitive science suggesting that students learned better when learning was modeled after "real world" learning outside school (Brown, Collins, & Duguid, 1988; Lave, 1988; Resnick, 1987). For example, Resnick (1987) examined learning both in and outside school, noting that schools lacked the context for adequate engagement of tools, other artifacts, and people. Using calculators and conferring with friends are considered to be cheating, not learning methods. Resnick criticized conventional schooling as presenting theory almost exclusively, to the detriment of developing performance or what Resnick called higher-order cognitive abilities: thinking about the thinking and problem solving in which one is engaged. Resnick reported that, conversely, effective out-of-school learning settings involved learners in socially shared intellectual work, such as group projects. Such contexts contained elements of apprenticeship, by which she meant that learners at all levels participated and developed their range and competence gradually. For schools to fulfill their societal mission, Resnick concluded, they must focus on the aspects of learning that occur in out-of-school learning situations and must incorporate those aspects into the school curriculum.
Proponents of curriculum integration claimed that it could serve several important purposes (Grubb, 1995; Rosenstock, 1991). It could reform secondary education for at-risk students and others not in the academic track, making it more rigorous and inclusive of the kinds of competencies perceived to be lacking in traditional vocational (and general) tracks. When curriculum integration was coupled with new organizational structures (e.g., career academies, discussed later), it formed part of what became known as the new vocationalism (Benson, 1997; Grubb, 1995), which referred to a broadening of the goals of vocational education beyond job-specific training. Beyond that, curriculum integration could bring with it the opportunity to change an entire high school. Teachers could collaborate with peers outside their discipline, and students would be provided with engaging academic courses that were related to broader themes of adult life or careers. Pedagogy, too, could change, as academic courses presented students with applications of traditional bodies of knowledge and vocational teachers incorporated rigorous methods and deeper understanding of various technologies. Indeed, formal and informal tracks themselves could become obsolete, as students became oriented around career themes, regardless of their next step after high school (i.e., postsecondary education or work).

To date, it has been difficult to assess the effectiveness of curriculum integration (Johnson, Charmer, & White, 2002). However, several studies are under way that may shed light on the extent and type of integration currently being implemented in schools. In addition to the paucity of research, it is difficult to “scale up” this particular reform effort. Successfully scaling up reforms is difficult under any circumstances (Stringfield & Datnow, 1998). Given the often relatively low status that vocational education has in high schools and the fact that vocational and academic staff often do not know each other well, much less collaborate with each other (Hershey, Silverberg, & Haimson, 1999), spreading reform based on curriculum integration has proved to be very slow. By 1997, a survey of comprehensive high schools (i.e., not including vocational high schools) reported that although the faculties of 90% of the high schools surveyed had attended professional development sessions on curriculum integration, only 45% had implemented such curricula (U.S. Department of Education, 2000).

Work-Related Experience

Perkins II and III support workforce preparation in the form of work-related experience, whereby students participate in workplace learning opportunities that are coordinated and sequenced with learning at school. Like Tech Prep, work-related experience was not new, but the legislation encouraged such programs as a way of improving the transition from school to work.

Cooperative, or co-op, education (Stern, Finkelstein, Urquiola, & Cagampang, 1997), school-based enterprises (SBE; Stern, Stone, Hopkins, McMillion, & Crain, 1994), and youth apprenticeships (Hamilton, 1990) are common ways of providing work-related learning. In co-op programs, students receive training in the context of a paid job. In SBEs, students are involved in either on-site or off-site work-related experiences such as running a store, producing goods or services for sale, or even building a house. Students enroll in related classes (e.g., business management or construction) and may decide how to re-invest the income generated by the enterprise, but usually they are not paid. In comparison with outside jobs, effective SBEs often provide more opportunities for students to perform a range of tasks.
and to work in teams. Through youth apprenticeships "schools provide integrated academic and vocational education that is linked to employer-provided paid work experience and training at a work site" (Corson & Silverberg, 1994, cited in Urquiola et al., 1997, p. 120).

Work-related experience programs such as co-op education, SBEs, and youth apprenticeships are beneficial in the lives of young people because most high school students want or need to work. The effects on students of part-time work of less than 20 hours per week can be positive (Stone & Mortimer, 1998; Warren, LePore, & Mare, 2000). In addition, when work-related experiences are coordinated with school learning, students have the opportunity to learn from and contribute to authentic achievements in a work setting.

According to Pauly, Kopp, and Haimson (1994), an additional advantage of providing work-related experiences to students is that it can engage students who are at risk of dropping out. One of the most important findings of their study was that programs that begin before Grade 11 are more likely to succeed in keeping young people engaged in high school, because many students begin to disengage from school in the middle school years. Beginning a program in Grade 9 or 10 provides students with longer preparation time, so that their work-related experiences can make substantive contributions to the workplace rather than being mere busywork or observation.

Accountability

Before 1990, federal legislation authorizing vocational education expenditures at the secondary and postsecondary levels required little accountability beyond reporting program enrollment numbers. Perkins II mandated that states develop performance measures and determine standards for those measures and that recipients of Perkins funds implement the evaluations (with some allowable modifications). However, little progress was made in these areas during the tenure of Perkins II.

Perkins III attempted to address the gap. The new act set out four core indicators of performance: (a) student attainment of challenging, state-established academic, vocational, and technical skill proficiencies; (b) student attainment of a secondary school diploma or its recognized equivalent, a proficiency credential in conjunction with a secondary school diploma, or a postsecondary degree or credential; (c) student placement and retention in, and completion of, postsecondary education or advanced training, or placement and retention in military service or employment; and (d) student participation in and completion of vocational and technical education programs that lead to nontraditional training and employment. States not making satisfactory progress in meeting these negotiated accountability measures risked losing Perkins funding.

However, although the goals of the Perkins legislation are far-reaching, Perkins funding is a very small percentage of any school or district budget, typically less than 5%. Most schools use it to fund program development or equipment purchases, not as a source for general education reform. It should therefore not come as a surprise if Perkins III has not brought about fundamental change on a large scale, especially in helping students to attain academic proficiencies. Perkins III cannot be expected to accomplish in isolation what broader education reform efforts have been trying to do for decades.
The School-to-Work Opportunities Act (STWOA) was passed in 1994, with the goal of encouraging states to develop and implement comprehensive statewide systems to help all young people prepare for high-skill, high-wage careers, using workplaces as learning environments. The new systems were to provide students with career awareness and exploration activities, work-based learning opportunities, and school-based activities to connect the learning at school to that at work, all while ensuring strong academics. Many localities borrowed from traditional vocational education practices (school-based enterprise, internships, etc.) to constitute part their school-to-work (STW) programs. The reform, then, was the combination of these practices with strong academics and the marketing of STW to all students, not just vocational students.

An early evaluation of STW programs found promising practices but did not draw definitive conclusions (Stern, Finkelstein, Stone, Latting, & Dornsife, 1995). The authors noted one of the difficulties that has plagued all subsequent studies of STW: There are so many elements involved in STW that, when positive effects are found, it is difficult to know which element or set of elements is responsible.

Urquiola et al. (1997) reviewed evaluations of several STW programs. They reported that the wide range of activities that fall under the umbrella term "school-to-work" made a generic evaluation of STW impossible. The authors concluded that their findings could not be generalized to other programs. Some of the evaluations that they reviewed found slightly negative outcomes for STW students in contrast with a comparable control group (Kopp, Goldberger, & Morales, 1994, cited in Urquiola et al., 1997); others found slight positive effects (Hollenbeck, 1996, and Orr, 1996, both cited in Urquiola et al., 1997). Some of the positive outcomes included lower school absence rates, higher college attendance rates, and longer and higher-paying employment. But some of the studies cited by Urquiola et al. had control groups that were questionable in terms of their similarity to the groups participating in the STW programs.

One single-district study of the impact of STW activities on students' post-high school trajectories suggested that participants in the career- and work-oriented education program had higher post-high school earnings during the first 6 years after high school than did nonparticipants (Griffith & Wade, 2002). In addition, the program participants who attended college performed nearly the same on college outcomes as nonparticipants.

In a national evaluation of STW implementation, Hershey et al. (1999) found that equal numbers of both "low achieving" and "academically talented" seniors participated in school-to-work (STW) activities. Students who planned to attend college were somewhat more likely than others to take career-related academics. This early evidence suggested that states were including all students, an important focus of the legislation.

Of the three major elements of the STWOA—school-based learning experiences, work-based learning experiences, and connecting activities—Hershey et al. (1999) found that career exploration activities (e.g., individual career planning, part of the school-based learning component) were the most commonly observable in schools. The most common work-based activities were brief worksite visits and job shadowing. Only 3% of the students surveyed in 1998 were involved in activities
that connected all three elements. Hershey et al. (1999) concluded that the minimal participation in fairly commonplace activities did not fulfill the promise of the STWOA.

One important finding was that most students felt that their involvement in STW activities had helped them to identify career goals (Hershey et al., 1999). Even among students who changed their goals, STW was helpful in making these decisions. Other studies support the finding that STW helped students to define life goals. For instance, Hughes, Bailey, and Mechur (2001) found that STW students were more likely than other students to choose a major early in college, a sign of direction and purpose. Rather than wander aimlessly through their high school years, in school or out, STW participants were exposed to life options, weighed them, and developed career goals. They had contact with adults outside the school setting in ways that fostered further development, and they tended to follow through at the postsecondary level.

Hershey et al. (1999) concluded that STW broadened students' career options rather than narrowing them, as many parents had feared. STW partnerships seemed to be focused on career awareness rather than on forcing students into narrowly defined occupations. However, federal support for STW activities ended in 2001. Hershey et al. (1999) predicted that career exploration activities would likely continue beyond the federal funding period but that work-based learning activities would be difficult to sustain because they were labor intensive and many schools would lack the resources to sustain them. Although state and regional workforce investment systems might continue without federal funding, they might not target secondary schools to the same degree. Without continued promotion at the federal level, support for work-based learning within a school-to-work system seemed likely to "slip into the shadows of the many other competing demands on schools and teachers" (Hershey et al., 1999, p. 153).

More recent examinations of STW show that student participation in cooperative education or work experience coursework increased by 2% during the period from 1990 to 1994 (U.S. Department of Education, 2000). Between 1997 and 1999, small but steady increases in student participation in STW activities continued, averaging 1 to 2 percentage points each in job shadowing, mentoring, internships, co-op education, and school-based enterprises (Medrich, Beltranena, & White, 2001). Youth apprenticeship numbers stayed the same throughout the period. In none of these activities did the average percentage of high school students participating in local school-business partnership apprenticeships exceed 12% (Medrich et al., 2001).

Non-Legislation-Driven Career and Technical Education Reforms

Along with reform efforts driven by federal legislative mandates, there have been reform efforts that incorporate aspects of vocational education but are not connected to specific legislation. These include reform strategies that reorganize high schools around new structures such as career academies, career magnets, and career pathways. Each is discussed here.

Career Academies

Career academies have existed since the 1970s, but their focus shifted in the late 1980s from a dropout prevention strategy to a high school reorganization model
that prepares all students for both work and postsecondary education (Kemple & Snipes, 2000). In a study of career academies, Kemple and Snipes reported a 15-fold increase in the number of such academies during the decade of the 1990s, with many more planned. Most career academies incorporate the main elements of the new vocationalism: a broad career focus, links to postsecondary education and business, and curriculum integration (Benson, 1997). Kemple and Snipes defined a career academy as a program that (a) is organized as a school within a school, where students stay with a group of teachers for a period of 3 or 4 years; (b) offers students both academic and vocational curriculums, usually integrated around a career theme; and (c) has established partnerships with businesses to build connections between school and work.

Early studies of career academies include an evaluation of the California Partnership Academies (Stern, Raby, & Dayton, 1992). The findings suggested that career academy students performed better than a comparison group on school indicators such as attendance, grades, and graduation rates. Analyses of survey data collected 2 years after high school did not show any significant differences between academy and comparison graduates in wages earned or in likelihood of enrolling in postsecondary education.

Perhaps the most comprehensive study of career academies is the 10-year longitudinal evaluation by the Manpower Demonstration Research Corporation (MDRC) (Kemple, 1997, 2001; Kemple, Poglinco, & Snipes, 1999; Kemple & Rock, 1996; Kemple & Snipes, 2000). Researchers at MDRC began the longitudinal evaluation in 1993, with the goal of providing educators and policymakers with information on the effectiveness of career academies in the areas of student engagement in and completion of high school and student transitions after high school.

All of the career academies in the MDRC study received applications from more students than they could serve, so students were chosen at random. Random assignment studies are a valued method of determining cause and effect because random assignment to treatment or control groups eliminates the question of whether unmeasured differences between the groups might be responsible for any difference in outcomes. The design of the study approached a pure random assignment because of the surfeit of applicants. However, although students were randomly assigned, or not assigned, to career academies, the academies themselves were purposefully, not randomly, selected for participation in the study. The study team required academies that were willing to participate, that had stable academy structures in place, and that consisted of the three elements of career academies described earlier (Kemple & Rock, 1996).

Early reports from the study found that academy teachers had higher job satisfaction than their non-academy colleagues (Kemple, 1997). An analysis of student performance in high school found that among students at high risk of dropping out, those in career academies dropped out 11% less often than did non-academy students (Kemple & Snipes, 2000). The attendance rates of academy students were 6% higher than those of the non-academy students, and 40% of the academy students earned enough credits to meet graduation requirements, as compared with 26% of the high-risk subgroup of non-academy students. Even among students at low risk of dropping out, career academies increased their likelihood of graduating on schedule and increased their vocational course taking without reducing their completion of the academic core curriculum. Kemple and Snipes found that career
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academies did not improve student standardized test scores of any risk subgroup; however, they questioned whether such scores were the best measures of the kinds of learning that take place in career academies. Because the findings across the nine academies in the study showed a great deal of variation, we disaggregated the results to identify which types of career academies were most effective for which subgroups of students. Specifically, those career academies that provided strong interpersonal supports to students in the early years of high school appeared to be most successful in achieving the positive outcomes described earlier. The interpersonal supports identified by the study were as follows:

1. A core group of four or five teachers who taught almost exclusively within the academy
2. Students who were scheduled together for several courses, to the exclusion of non-academy students
3. Housing of the academy in a distinct area of the school building

These tight-knit, school-within-a-school features appeared to have nurtured “a more personalizing learning environment and helped students and teachers feel that they were part of something unique within the school” (p. ES-20).

Kemple and Snipes (2000) recommended that career academies continue to serve a heterogeneous population of students because it could have been the mix of engaged and at-risk students that helped to bring about the benefits for the latter group. Kemple and Snipes also stressed the importance of the interpersonal and academic supports provided by career academies, claiming that simply offering a career focus and work-based learning without such supports would not be sufficient to engage at-risk students.

Subsequent findings in the MDRC longitudinal evaluation moderated the initially dramatic conclusions. Kemple (2001) reported on career academy students’ transitions to postsecondary education and employment. In the year after scheduled high school graduation, Kemple found virtually no difference between academy and non-academy students in their rates of eventual high school graduation, college enrollment, or employment. In addition, the impact of career academies on students at high risk of dropping out of high school was less pronounced 1 year after graduation than it had been in high school: Similar students in the non-academy control group had eventually graduated from high school and enrolled in postsecondary education at about the same rates as academy students. Kemple concluded that the improvement in high school experiences for at-risk students did not translate into improved post–high school outcomes. Kemple suggested that career academies need to provide stronger counseling and guidance, and perhaps more emphasis on academic achievement, because no impact on standardized test scores was found in this large-scale study.

A study of career academies in one inner-city school district in California found that academy students were generally more successful than the non-academy students when they attended the local 4-year university (Maxwell, 2001). Academy students were found to have higher GPAs, to need less remediation in English at the university, and to graduate from the university more often than their non-academy peers. Maxwell concluded, however, that the remediation rates were still too high and the postsecondary graduation rates still too low to claim that these career academies were solidly successful in moving at-risk students through postsecondary education.
A final study of career academies found more positive post-high school outcomes for academy students. Orr, Hughes, and Karp (2002) studied academies that belonged to the National Academy Foundation (NAF), a national network of academies that include finance, travel and tourism, and information technology themes. Like the MDRC evaluation, Orr et al. found that students in career academies had higher-quality high school experiences, such as more computer courses, internships, and college-level courses. The researchers found that career academy alumni whose parents never went to college were themselves attending college at higher rates than the national average of similar students. Career academy students also reported needing less remediation than the national average of college attendees. These positive findings may be the result of self-selection bias: That is, academies may attract more able or more motivated students. The study does not adequately control for that possibility.

**Career Magnets**

Career magnets include college preparation along with career preparation. Some magnets are free standing; others are housed within a comprehensive high school. One difference between a career academy and a career magnet is size. Academies are small learning communities, usually housed within a larger school. Even if a whole school is broken up into academies, each one is relatively small. Career magnets may be housed within a larger school, but a career magnet can also be an entire high school with one particular career focus. In such a case, there is no “small learning community.” Another difference between academies and magnets is their origins. Career academies began as a dropout prevention strategy, whereas career magnets often trace their roots to desegregation efforts, in which urban districts created magnet schools that might otherwise be racially segregated.

Crain, Heebner, and Si (1992) presented findings from a longitudinal study on the effectiveness of career magnets in New York City. As in the Kemple and Snipes (2000) study, Crain et al. were able to construct an experimental design because of New York City’s random assignment of students from an oversubscribed list of students requesting admission to magnet high schools. Schools were permitted to select half of their students; however, even that half had to include students at all reading levels. Early analyses examined the effect of career magnets on lower-achieving and average-achieving ninth-grade students, finding differences between career magnets located in comprehensive high schools and those that were free standing (Crain et al., 1992). The analyses found that students of average reading ability who attended free-standing magnets earned more course credits than demographically similar students in regular comprehensive high schools. Magnet students increased their reading skills more than twice as much as comparable students in comprehensive high schools.

Low-scoring readers assigned to free-standing career magnets were more likely to attend high school and more likely to pass the state Regents math test than were similar students in regular comprehensive high schools. However, the same students did not increase their reading test scores, and they were found to be absent more frequently than their regular high school counterparts, regardless of the type of career magnet they attended. In general, however, the authors claimed that “magnet programs which isolate themselves from the rest of their school have more success educating their average readers” (Crain et al., 1992, p. 37).
magnets that provided students with a greater career focus, such as special equipment or placement services, were most effective with poor readers. The authors posited that attending a school with a special and separate career focus often meant the difference between a student’s attending high school and dropping out.

Subsequent analyses with additional data showed that student outcome measures for career magnet students were actually quite similar to those for students from traditional comprehensive high schools and were worse in some cases (Crain et al., 1999). However, the career magnet graduates earned at least a third more college credits and were more likely to have chosen a college major within their first 1 or 2 years after graduation. Crain et al. also conducted interviews with career magnet students and with students who had applied but were not chosen. They found that career magnet graduates were less likely to engage in risk-taking behaviors than were graduates of comprehensive high schools. Crain et al. noted the importance of friendships established at the career magnets. Students made friends with others who were also interested in a particular career. Such friendships fostered career-related conversations—planning and projecting—that may not have been likely or acceptable in other more traditional high school settings.

Crain et al. (1999) concluded that the success that career magnets can have rests on their ability to create a school culture that promotes hard work and a shared commitment to a particular career area, which helps to explain students’ greater success in postsecondary education. Much of the benefit of career magnets was attributed to their ability to help adolescents through the important process of identity development by providing a network of sustained, caring relationships along with instruction focused on a career. These elements enabled students to become “really good at something,” as students reported to the researchers (Crain et al., p. iv).

Career Pathways

Some high schools have reorganized their curriculum around clusters of occupations that share similar skills and knowledge, although they may differ in the length of education and training required (Pucel, 2001). These career pathways or majors replace the traditional college preparatory, vocational, and general tracks. For example, a cluster such as Engineering, Manufacturing, and Industrial Technology can provide students with a broad introduction to many occupations, such as machinist or engineer.

Career pathways form the context for integrated activities such as senior projects and other interdisciplinary activities. Career pathways are also intended to provide a rigorous, coherent program of study that includes high-level academics in addition to technology applications and work-based learning. Schools that choose to develop career pathways must have strong connections with business, industry, and institutions of postsecondary education; such connections enable the school to provide internships and other applied experiences for their students.

The Office of Vocational and Adult Education (U.S. Department of Education, 2001) has identified 16 career clusters that high schools can choose from, depending on local labor market opportunities. Some states have developed their own clusters. Many districts and a few states have mandated that high schools incorporate pathways into their curriculum. To date, no studies on the effects of career pathways have been conducted, but several are under way that will provide more information in the near future.
The evidence from these three career-themed high school organizational structures suggests that academies, magnets, and pathways are possibly productive ways for secondary vocational education to position itself for the future. The research base, while mixed, shows positive outcomes in many measures of high school achievement and in reducing the need for remediation at the postsecondary level. The elements of these structures are pedagogically and theoretically sound. One possible reason for success might be the focus on all students, not simply those not deemed "college material." Another reason is that career magnets, academies, and pathways restructure the school. In the best of cases, students feel that their teachers care, their peers care, and they all share a common interest and goal. These affective factors are likely to increase student engagement and can improve achievement as well. Such reforms may also affect students' perceptions of their life chances.

How much of the improvement in student outcomes is attributable to caring relationships and how much to CTE? This is a difficult question to answer, because the two are confounded in the best examples of these schools. The students are not the only ones involved in positive relationships. Teachers, too, have developed professional communities around career themes and have become responsible to each other. Perhaps non-career-related magnets experience the same results. However, it is useful to recall students' reports to Crain et al. (1999) that they found their high school experience useful in developing a career identity and in becoming proficient at something. Non-career-related high school reorganization along the lines of academies or magnets would be unlikely to produce this result (cf. Ready, Lee, & LoGerfo, 2000).

Summary of Career and Technical Education Reform Strategies

All of the reform efforts described earlier have expanded the traditional role of vocational education to provide not only education for and about work, but also education through work. In fact, education for work has been downplayed at the high school level so that the workplace at large can be used as a learning site. The research has not yet shown that education through work has fulfilled its promise, and there are hurdles to overcome in terms of realistic outcomes for the resources provided. But the concept is being explored in increasing numbers of schools.

Comprehensive Secondary School Reform

Given that career and technical education is becoming increasingly accountable for producing academic outcomes, we examined the research on comprehensive secondary school reform efforts to see whether connections across approaches were being made. The history of U.S. education is one of nearly continuous efforts at educational reform (Tyack, 1974). Yet careful historical scholarship (Cuban, 1993) and the best available quantitative data on secondary student achievement (Campbell et al., 2001) leave the disquieting impression that a great deal more has been tried than has succeeded. After reviewing the 5 largest U.S. school change studies of the 20th century, Nunnery (1998) found, among other things, that locally developed reform efforts rarely moved to actual classroom implementation, despite having begun with high hopes and a flurry of committee and design work.
Given the difficulty of implementing locally developed reforms, and spurred in part by increased federal funding for CSR implementation (FY2003 funding is $310 million), more schools are adopting externally developed CSR designs. One difference between CSR and previous reform waves is the relative level of institutionalization of several designs and the emergence of universities, companies, and foundations that develop, market, and deliver CSR designs to schools across the country. Schools adopt the designs more or less completely, but the school change process inevitably involves a certain amount of co-construction, in which schools adapt the designs somewhat to fit their context and mission (Datnow, Hubbard, & Mehan, 1998; Datnow & Stringfield, 2000). However, schools that modify a design excessively are considered poor implementers by the parent organizations, and extreme adaptations can cause a school to lose its affiliation. Furthermore, a variety of studies over more than half a century have noted a positive correlation between the level of reform design implementation and the improvement of student outcomes (Aiken, 1942; Stallings & Kaskowitz, 1974; Stringfield et al., 1997).

CSR designs vary in the extent of change recommended. Some designs focus exclusively on changing organizational cultures and structures and do not provide specific curriculum or instruction recommendations. However, designs that recommend examination of all aspects of a school—from governance to professional development to curriculum and instruction—have a better chance of succeeding (Nunnery, 1998). In addition, the comprehensive approach is more likely to involve the vocational departments of a high school.

There have been 5 published efforts to review the full range of CSR studies. The 4 earlier reviews (Herman et al., 1999; NWREL, 1999; Slavin & Fashola, 1998; Wang, Haertel, & Walberg, 1997) were themselves reviewed in Stringfield (2000a). The 5th and most comprehensive review of CSR-related studies was recently completed by Borman, Hewes, Overman, and Brown (2002). The Borman et al. review involved an initial identification and examination of more than 800 articles and books. Of those, 232 studies examining a total of 29 different whole school designs were found to include sufficient quantitative data to allow for inclusion into the meta-analysis. Like the predecessor reviewers, Borman et al. reached generally positive conclusions regarding CSR. Looking across all 232 studies and 29 designs, they found a mean positive effect size of +.15.

However, for purposes of the current review of research on intersections of CTE with whole-school reform, Borman et al. (2002) presents a severe limitation. Many of the reform designs focus on the elementary grades (e.g., Success for All, Slavin & Madden, 2001). Other reform designs that are implemented across the full K–12 range have been studied only in the elementary grades (e.g., ATLAS Communities, Orrell, 1996). Borman et al. found the well-known School Development Program (Comer, 1988) to be one of the more frequently studied and more consistently effective of the CSR designs; however, the School Development Program is most often implemented in the elementary grades, and Borman et al. did not break results out by level of schooling.

G. Hewes (personal communication, November 2002) reanalyzed data from the Borman et al. (2002) meta-analysis, breaking out studies conducted in high schools. The result was the identification of 54 studies of CSR effects. However, 45 of those were analyses of outcome data from High Schools That Work sites (Bottoms, 2001,
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described below). The remaining studies were divided among seven additional reform designs, with no design having data from more than 2 studies.

Borman et al. (2002) found that studies of HSTW tended to produce positive effects. However, 4 studies that made use of control schools (as opposed to control groups within schools or simple pre-post analyses) did not produce a mean positive effect. It was frustrating to note that even after contacting the developers of HSTW, Borman et al. were unable to identify any comparison studies that had been conducted by a fully disinterested third party. Thus, in the Borman et al. work, HSTW was categorized as being among the reform designs on which additional research is most clearly needed.  

With the obvious caution that HSTW was found to need additional research, and that none of the other seven designs had more than 2 high school studies, it is still relevant to note that across the total of 54 high-school-level studies of CSR designs, the mean effect size was a positive .23, with a 95% confidence interval of +.16 to +.29. Within the limited data available, CSR appears to be having a positive effect on student achievement.

Because our review is not focused on CSR in isolation but rather on the intersection of CSR and CTE, we will describe two of the secondary CSR designs that incorporate CTE into their structures or practices. After a review of secondary CSR efforts, we chose to focus on HSTW, because it is so widely implemented and studied, and on Talent Development High Schools (TDHS), because, like HSTW, TDHS has a clear focus on career education.

High Schools That Work

High Schools That Work began in 1987 as an initiative of the Southern Regional Education Board (SREB). It has since grown to include more than 1,100 schools in 27 states (Bottoms, 2001). Its goal is to “raise the academic achievement of career-bound high school students by combining the content of traditional college preparatory studies (e.g., English, mathematics, science) with vocational studies” (Herman et al., 1999, p.76). This is accomplished through a curriculum that includes rigorous vocational courses along with increased academic coursework.

HSTW calls for common planning time for teachers to collaborate on curriculum integration, and it sets higher standards and expectations for all students (Bottoms & Presson, 1995). Extra help is provided for students, along with an individualized advising system. Finally, HSTW uses assessment information to improve student learning. All high school seniors who complete a vocational or technical concentration at HSTW sites are required to participate in the ESTW Assessment, which is based on the NAEP tests of reading, mathematics, and science.

Research has shown that “HSTW students, including vocational students, take more academic courses than [other] students at the same schools did” before HSTW was implemented (Herman et al., 1999, p. 77). Schools that have implemented the design faithfully usually see improved student achievement and higher attendance, graduation, retention, and postsecondary attendance rates (NWREL, 1999). Studies also show improvement on the HSTW Assessment (Frome, 2001; NWREL, 1999); however, those data should be interpreted with caution because students who do not complete the HSTW-defined vocational concentrations do not take the tests. Such a sampling method is likely to result in improved overall test scores, regardless of the program, because noncompleters are not tested.
In addition, some of the studies showing positive results were conducted by or for SREB (Kaufman, Bradby, & Teitelbaum, 2000), as opposed to being conducted by a third-party evaluator; other studies have lacked a control group (Frome, 2001). The outcome data for these studies were provided by the reform designers, a condition that clearly calls for third-party replication studies. Internal data rarely include matched control data and are often less available than national datasets. Similar observations can be made about evaluations of other CSR designs developed by organizations (Herman et al., 1999; Borman et al., 2002); and, indeed, third-party replication of many findings from research on several CSR designs is under way. HSTW remains an appealing design because it has shown success with vocational students, many of whom are at risk of dropping out of high school.

Talent Development High Schools with Career Academies

The goal of Talent Development High Schools with Career Academies (TDHS) is to “improve achievement and other outcomes (e.g., attendance, dropout rates) for all students in large high schools by creating a personalized environment that focuses on students’ interests within an academic core of courses” (Herman et al., 1999, p. 121). In TDHS, a high school is reorganized into a Ninth Grade Success Academy and career-themed academies for sophomores, juniors, and seniors. Each academy includes its own faculty, management team, and section of the high school facilities. The Ninth Grade Success Academy includes “double doses” of math and English courses for students who are below grade level. The faculty is divided into interdisciplinary teams to create smaller learning communities, designed to increase student engagement in school.

TDHS provides common planning time for teacher teams to develop curricula and to discuss academy and individual student progress. The Ninth Grade Success Academy and the specific career academies provide college preparatory academics, and the career academies provide career experiences within a chosen career theme. TDHS offers an after-hours Twilight School for students experiencing problems with attendance, discipline, or other matters. Research on the initial TDHS site found increased student attendance in comparison with previous years at this pilot high school (McPartland, Legters, Jordan, & McDill, 1996). Research at subsequent sites found improvement in student performance on standardized tests, as well (Balfanz, in press; Legters, Balfanz, Jordan, & McPartland, 2002; McPartland, Balfanz, Jordan, & Legters, 1998; Philadelphia Education Fund, 2000, 2002). As with every other high school reform design, carefully controlled third-party research is needed to substantiate the results that TDHS appears to produce.

Discussion

The separation of vocational and academic education seems to be a natural product of the historically different goals and funding mechanisms of the two areas of high school curricula and their subsequent different trajectories. As the latest wave of reform movements entered U.S. high schools, the two areas often continued to operate separately. In some cases, the reform efforts kept academic and vocational tracks apart (Prestine, 1998). In other cases, the academic and vocational areas were both involved in the reform efforts, but those efforts were not directed at the entire school. Students and teachers could choose between the pocket of reform within the school or the traditional high school curriculum and structure (Little, Erbstein, &
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Walker, 1996). Partial attempts at reform usually do not result in the broad overhaul of structures and practices necessary for comprehensive school reform.

As change has come to the vocational areas, so must change also affect the college preparatory track. Graduates on the latter track often have to take remedial courses at the college level, and they often lack direction in their choice of a major in college (Stasz, Kaganoff, & Eden, 1998). The linkage of vocational and academic reforms would combine the expertise of vocational educators in career preparation and applied learning with more traditionally academic concerns, thereby making the academic curriculum more relevant and engaging and making the vocational curriculum more appealing. Lessening the divisions in the curriculum and in the physical layout of the high school can also lessen the status distinction between “career-bound” and “college-bound” students. Together, these efforts can address the need that all students have for a solid academic education as well as for preparation for adult life, including work.

Despite the recognition on the part of many vocational educators that career exploration and preparation are more important than ever, other stakeholders and decision makers in high schools have often gone in different directions. Vocational reforms have typically remained as marginal as vocational education in many high schools. The amount of federal and state funding for CTE has remained constant over the last two decades, meaning that it has declined as a percentage of the federal education budget from about 6% to 2.5% (Silverberg et al., 2002).

A Consensus on Effective Reform Elements

Secondary education reform in the last 2 decades has converged around several components. Despite a shortage of data on outcomes for several of the secondary reform efforts, something approaching a consensus has emerged that a combination of these components can yield positive results overall and leads to more equitably distributed learning among social classes of students. This near-consensus has come from groups that include school reformers, policy groups, and researchers (American Youth Policy Forum, 2000; Coalition of Essential Schools, 1998; Lee & Smith, 2001; Legters, Balfanz, Jordan, & McPartland, 2002; Lynch, 2000; National Association of Secondary School Principals, 1996; Phelps & Hanley-Maxwell, 1997; Herman et al., 1999). Many of the agreed-upon elements of successful high school reform parallel those found to support CTE reform (described earlier) and thus are promising for all students. These elements can be grouped according to whether they support the structure, the capacity, or the pedagogy of reforms. The characteristics of the three categories are as follows:

1. Structural reform supports
   a. Vertical integration of curriculum spanning middle schools, high schools, and community colleges
   b. Career exploration beginning in middle school
   c. Career academies or similar learning structures of small communities that focus on broad career clusters
   d. Block schedules or other alternative schedules for longer learning times
   e. Partnerships with business and postsecondary institutions

2. Increasing capacity for reform supports
   a. Interdisciplinary teacher teams with common planning times
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b. Focused, sustained, better-funded professional development

c. Work-based learning opportunities from job shadowing to actual work experiences

3. Pedagogical reform supports

a. High academic standards and student learning supports to meet the standards

b. Frequent, performance-relevant assessments

c. Interdisciplinary curriculum that integrates rigorous academics and real-world applications, often with a career focus

d. Project-based learning

e. Technology integrated into classroom learning and used by teachers to monitor student progress

In addition, there is a near consensus that career exploration and guidance should begin early, probably in middle school, to engage young students at risk of dropping out and to provide enough knowledge and experience for them to participate in meaningful work-based learning experiences in workplaces in their junior or senior year of high school (Jackson & Davis, 2000; Pauly et al., 1994).

A final component of successful secondary school reform is district-level, or more broadly, systemic-level support for creating and sustaining reform. Stringfield (1995, 2000b) and Datnow and Stringfield (2000) have explored the supports necessary for schools to successfully implement and sustain virtually any of the reforms discussed earlier. The two authors conclude that a shared focus on reliable reform is necessary. This can be referred to as reliable co-construction. Summarizing 16 studies of school change efforts, Datnow and Stringfield (2000) describe eight necessary characteristics for reliably sustainable reform:

1. The reform must have a finite set of widely shared goals.

2. Goals must be tied to a long-term, whole-team focus on key measures of school improvement.

3. Districts must develop a coordinated and broad-based plan for disseminating information about reform options, prior to the school- or district-level commitment to reform.

4. Schools must engage in a thoughtful, critical process of inquiry about what needs to change and why.

5. Reform designs (and reform designers) must do the following:

a. View the local context and the diversity of language, race, class, and gender of those involved as strengths to build on;

b. See teachers as assets and collaborators, not simply implementers of reform;

c. Address technical, normative, and political dimensions of change;

d. Affect the whole school, not just a safe “pocket” of people who are particularly eager to change; and

e. Include equity as an explicit goal of reform.

6. The district, school, and any external partners must provide multidimensional, ongoing support and leadership for the reform.

7. Policy systems need to be aligned to support the reform effort.

8. All key players must implement the reform with sensitivity and adaptability (but without academic compromise). States, districts, and design teams must
be willing to change along with the schools and teachers. Such active, shared
growth is at the heart of both co-construction and high reliability.

These elements of reform are far-reaching and require a systemic approach to
change. A few vocational teachers or a small group of vocational and academic
teachers working together cannot accomplish these fundamental changes. Creative
collaborations between local schools, their districtwide and program-specific
administrators, and reform design teams hold great promise for urban areas, which
can capitalize on the expertise of the team and co-construct a reliable approach spe-
cific to their conditions. Reliably creating and sustaining reform is a complex but
knowable and achievable task.

Implications for Additional Research

The intersection of CTE and CSR in high schools is seriously understudied.
This review details what is known about the recent reform efforts that the CTE
community has developed. We have also included CSR designs that incorporate
CTE and that are the subject of research that includes student outcomes. Obviously,
much work remains to be done to confirm or disconfirm the effectiveness of the
reform elements listed earlier. The gaps in the knowledge base are such that sug-
gesting additional research is easy, yet easily overlooked. One possible source of
funding is the Perkins legislation itself. A 2–3% addition to Perkins would net
between $34 and $51 million per year for research and would almost certainly pay
handsome dividends. The following summarizes possible directions for research:

1. The field is badly in need of a set of overlapping studies of diverse efforts at
   high school reform, each with a slightly different lens and set of methods.
   As Cronbach et al. (1981) pointed out, such an approach is almost invariably
   more valuable than a single “would-be definitive” study.

2. Several of the studies should be longitudinal and employ mixed methods
   (Tashakkori & Teddlie, 1998). For ecological validity, the methods should
   match the realities of the constructs being investigated—in this case, the
   long-term effects of diverse CTE reforms on students. The effects must
   include standardized test scores, graduation rates, postsecondary transition
   rates, and labor market participation.

3. Wherever possible, studies should take advantage of naturally occurring
   experiments. When reform is happening and appears to be succeeding, local
   and national funding should be directed toward determining which aspects
   of the effort are succeeding, and why.

4. Funding should be increased for current and future secondary reform designs
   that incorporate CTE as central to their mission. As the research literature
   builds, the potential exists to summarize research into practical reforms for
   formal testing. For example, Success for All and Roots & Wings (Slavin &
   Madden, 2001), an elementary level CSR design, began with a “best evidence
   synthesis” of research on beginning reading. It moved to small field trials and
   to increasingly large efficacy studies. The same can happen, funding permit-
   ting, in CTE. All funding should be tied to specific agreements to participate
   in proactive, longitudinal studies with a focus on multiple student outcomes.

5. Studies are needed at diverse levels and from diverse perspectives—student
   perceptions and outcomes, classroom processes, school and district leadership,
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micro- and macro-political perspectives—all will be important in moving the field to a more scientific and more effective level.

None of these studies will be inexpensive, and all will take time. However, the CTE field and education reform in general have waited for decades for “best practice” to trickle throughout the system, and the NAEP data strongly suggest that this method has not worked. We need to invest in more research.

Implications for Practice

The implications of our review for practice can be summarized in the following recommendations for CTE in linkage with comprehensive school reform:

1. Collaborate across departments and traditional areas. A clear conclusion from prior research is that the aggressive goals of Perkins III, including raising basic skills achievement scores, can be accomplished only by cross-disciplinary teams. CTE teachers, regardless of how hard-working or well intended, will be very hard pressed to improve basic skills and scores on their own. By contrast, whole schools, working in coordinated fashion, have an excellent chance of achieving Perkins III goals. Meetings for joint planning and reflection allow teachers from all parts of the high school to have a say in the kind of reform efforts that are best suited for the students and the context.

2. Provide joint professional development. Most secondary school teachers, whether in CTE or the academic track, are not trained to work with students on improving basic skills. Nor do many high school teachers have training in team teaching and the development of integrated curriculum. Opportunities for shared professional development need to be provided for both CTE and academic teachers. This is an excellent way to introduce faculty members to each other and to the often similar goals and challenges they face. Joint professional development also furthers cross-departmental communication and collaboration.

3. Provide pre-professional training. Although joint professional development will help to address the immediate problem, an important component of the long-term solution lies in how we prepare teachers for the complex, integrated curriculum of reformed high schools. Teacher education programs are the first opportunity to create the ways of thinking necessary to make these reforms work. Building skills in team teaching, curriculum integration, and contextual teaching and learning will assure a future teacher workforce capable of implementing these promising reforms.

4. Incorporate career-based learning into more secondary schools. Academies, magnets, and pathways, as well as some of the reform designs reviewed here, provide students with opportunities for education through, about, and for work. Educators are learning to integrate careers with academic subjects as a hook to retain students in school, to improve their academic skills, and to help them make the transition to college. All schools should consider this means of helping students to meet the higher standards expected of them and to identify their own goals for adult life.

5. Explore external CSR designs and, where appropriate, engage with external partners. Research on school reform indicates that, in more instances than not, local efforts to reform schools run out of energy during their planning
year and do not achieve implementation. External design partners have been through the school change process dozens or even hundreds of times and can be of great assistance in helping schools to move in purposeful, research-proven directions right away. Also, as outside agents, they have few or no ties to local disagreements unrelated to improving student achievement. High Schools That Work and Talent Development High Schools are merely two examples of CSR designs that have shown promising evidence that they can help improve student achievement in multiple contexts.

6. Seek out opportunities with district evaluation offices or local universities, or both, for conducting open evaluations and research on what is and what is not being implemented. Regardless of the reform chosen, if it does not involve continuous feedback and self-assessment, it will eventually die. Most school districts have local research and evaluation offices. Virtually all universities have researchers interested in "real world" projects. Schools that can connect with these additional resources are more likely to continue a process of self-assessment and self-improvement.

Conclusion

Career and technical education has remained on the margins of secondary education since its inception and on the margins of secondary education research for 30 years. However, the immense changes in the United States over the last 30 years necessitate a change. Today, education and career development are intimately intertwined. The continuing technological revolution, the integration of women and minorities into the workforce, and the spins of the economic cycle have produced a society that requires the integration of career preparation into the fabric secondary education. Researchers and practitioners need to re-examine CTE as one means of preparing our nation's youth for the society that they will inherit and the economy that they will direct.

The trajectories of research and practice on CTE and CSR have a seriously underdeveloped, important intersection. Research conducted over the last decade and reviewed here provides valuable clues to the most productive new paths for research and practice. Now is the time to invest in closing the gap in our understanding of how CTE can occupy "a key position in the educational system" (Ray, 1968, p. 312), and help to fulfill the broader agenda of education reform.

Notes

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1 All data are from the U.S. Census Bureau "March Reports," various dates, and reprinted from Stringfield (1995, 2001) with permission of the author. Somewhat similar results, substantially favoring attainment of a college degree, are available for
young adult females. However, the fact that the percentage of young women in the formal workforce has grown from approximately 25% to 80% in one generation makes such longitudinal comparisons problematic.

2 The Eight-Year Study of the 1930s (Aiken, 1942); the Follow Through Classroom Observation Evaluation (Stallings & Kaskowitz, 1974); Federal Programs Supporting Educational Change, or The RAND Change Agent Study (Berman & McLaughlin, 1978); Dissemination Efforts Supporting School Improvement (Crandall et al., 1982); and the Special Strategies Studies for Educating Disadvantaged Children (Stringfield et al., 1997).

3 Note that in the analysis by Borman et al. (2002), such a statement is not necessarily a criticism of the design per se. Rather, it is a statement that more third-party research is needed to make the clearest possible claims regarding the effects of the reform design.

4 In fall 1995, 29% of first-time freshmen enrolled in at least one remedial reading, writing, or mathematics course (Institute for Higher Education Policy, 1998).

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**Authors**

MARISA CASTELLANO is an Associate Research Scientist at the Center for Social Organization of Schools, 5927 Monte Verde Drive, Santa Rosa, CA 95409-3925; e-mail marisa@csos.jhu.edu. Her research interests include improvement of educational opportunities for at-risk students through comprehensive school reform and upgraded career and technical education programs. Correspondence regarding this article should be directed to Dr. Castellano.

SAM STRINGFIELD is a Principal Research Scientist at the Center for Social Organization of Schools, Johns Hopkins University, 3003 North Charles Street, Suite 200, Baltimore, MD 21218; e-mail sstringf@csos.jhu.edu. His research interests include international issues in educational effectiveness and designs for improving programs within schools and for improving schools and school systems that serve historically at-risk populations.

JAMES R. STONE III is an Associate Professor of Work, Community, and Family Education in the College of Education and Human Development, University of Minnesota, 1954 Buford Avenue, St. Paul, MN 55108; e-mail stone003@umn.edu. His research interests include education and work transitions for youth and adults. He currently serves as Director of the National Center for Research on Career and Technical Education.