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ABSTRACT

In 2000 and 2001, the National Research Center for Career and Technical Education conducted a series of projects on career and technical education (CTE) practices, trends and outcomes. Selected preliminary findings from a review of the reports on those projects are as follows: (1) integration of CTE and academic instruction in high schools remains slow; (2) in some schools undergoing reform, CTE has retained its outward, historic framework, continuing to emphasize industrial "shops" that focus on labor market needs, whereas in other sites, CTE has adopted new models or strategies for connecting young people to the business community and postsecondary options; (3) sites with a leader who is committed to technology and a strategic approach have more thorough and successful integration of distance learning and educational technology; (4) 59% of all CTE teachers had completed all teacher certification requirements before they began teaching, and 42% of states required a professional development program for alternatively certified teachers; (5) students reported less participation in school-to-work activities in 1999 than in 1997; (6) general and vocational concentrators reported lower grade-point averages at the end of their school career than did academic concentrators, but dual concentrators reported insignificant differences; and (7) among low academic performers, taking CTE courses significantly reduced the likelihood of their dropping out. (Contains

30 references.) (MN)

What do We Know about Career and Technical Education

Preliminary Findings from 2000 & 2001 NRCCTE Projects

Briefing Paper

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Further, the NRCCTE reports from which the findings are drawn are, for the most part, still in the review process and thus are tentative and should be interpreted with caution. The findings herein may not be cited.

BACKGROUND

Vocational education has been part of the human experience since the earliest of times as children learned survival skills modeling the work of the parent. This informal vocational education experience remains with us today in the many forms of on-the-job training. The earliest forms of formal vocational education were in the preparation of scribes and accountants in ancient Samaria, monks in the European middle ages, and printers in the 18th century. These are with us today in such fields as education, carpentry, medicine, bricklaying, and architecture to name a few.

The purposes, means and methods of vocational education have historically been driven by technology. While relatively static for eons of human existence, technological change began to accelerate in the middle of the 19th century and continues at an increased pace today. As technology drives changes in the workplace, it creates the impetus for change in vocational education.

21st Century Vocational Education

Historically, vocational education was presumed to add value to the curriculum of America's high schools and community colleges in two ways. Vocational education was both a strategy for workforce development and a choice for youth who sought direct routes to the labor market. Over time, vocational education was seen as a strategy for engaging youth in school who might otherwise drop out of the college preparatory focus typical of most high schools. This value is demonstrated in the recent Plank (2001) study that showed the power of secondary vocational education to engage young people in school and significantly reduce the drop out rate for all ability groups, especially those in the lower ability groups. However, critics argue that vocational education encloses students in a restricted set of post high school opportunities and limits their options.

A new value of vocational education is emerging through current National Research Center for Career and Technical Education research. Evidence is beginning to accrue that vocational education is becoming a vehicle to expand student choice and provide academic and technical skills and knowledge necessary to become a better consumer of educational opportunities (see Castellano, Stringfield, & Stone, 2001).

Where it works well, vocational education can be a curriculum that simultaneously responds to the greater needs of society for a skilled workforce and the needs of students for an education that will provide a foundation for continued learning throughout their lifetime. This is accomplished through vocational education's tripartite mission in today's schools. We define these three foci as: education through work, education about work, and education for work. Two of these are historic and the third is a direct outgrowth of Perkins II and Perkins III legislation.

Education THROUGH Work

That most people learn best when the learning occurs in a context or addresses problems of interest to them has become part of conventional wisdom. Dewey advocated "learning through occupations" and later Resnick, who demonstrated the value of contextualized learning. The pedagogic value of this was enshrined in Perkins II and Perkins III legislation forming the framework for both Tech Prep and more generally vocational education programs.

The power of such learning is demonstrated by the work of Castellano, Stringfield, and Stone (2001) who documented a project developed in an integrated carpentry-math class. Students built a trebuchet in

competition with other schools. On the day of the competition, it was the students from this program who triumphed over teacher-led teams from other schools. These students knew the trigonometry required for accurate targeting more deeply than even the faculty from the other traditional carpentry programs. The context of construction trades formed the basis for teaching advanced mathematics skills in an integrated curriculum.

Another model of education through work occurs in career academies. Castellano, Stringfield, and Stone (2001) have documented examples from a health academy in an urban school where students study core academic subjects in the context of the health care industry. Here the curriculum is very broad. In English classes, they learn medical terminology, communication skills, workplace etiquette, and job seeking skills including resume preparation and job interviewing. When they study literature, they study Whitman (who was a Civil War nurse) through the lens of medical treatment. In science, beyond the traditional content, they study anatomy and physiology. In history, they have recently been studying the use of medicines during the American Civil War and World War I. While this is occurring, they study the notions of sepsis in the advanced biology classes. This is an example of an integrated curriculum set in the context of health and medicine. According to Arthur Wirth (1992)[1], Dewey:

> saw pedagogical justifications for using the study of occupations as the means for achieving insight into the evolution of civilization. First, occupations offered opportunities to relate school learning to out-of-school experience. . . . Moreover, they brought into play impulses of children that are central to effective learning: the constructive, which moves from simple coordination to the use of tools and technical skills, the investigative and experimental; and the social, and expressive, which involves sharing and communicating. Being occupied with an occupation maintains a balance between the intellectual and practical (p. 18.1)

Education through work and occupations draws upon the work of cognitive scientists who provide evidence that practical pursuits, such as work, can be an important context for academic learning. Thus, situated or social learning can be the basis of cognition (e.g., Brown, Collins, & Duguid, 1989; Forman, Minick, & Stone, 1993; Raizen, 1989; Resnick, 1987; Rogoff, 1990; Lave, 1988; Lave & Wenger, 1991). Beck (1991), in his examination of business and marketing education, agricultural education, and consumer and family studies showed how each can be used to advance the more general education needs of students. Vocational education facilitates learning, he argued, by making otherwise difficult concepts reachable for students.

Education ABOUT Work

An historic role for vocational education is to teach about work. Education about work, like education through work, is meant to be broadly educative. Knowledge about the work world has an integrity and value in its own right and stands aside knowledge of mathematics, history, and literature as part of a common core of knowledge all students should possess (Goodlad, 1984; Lewis, 1993, 1998). Workplaces, Lewis (1998) argued, are a primary site of the construction of culture, since people spend so much of their lives at work. Thus, what transpires in the workplace constitutes content worthy of a place in the school curriculum. Lewis calls this vocational literacy—the root word vocation being taken in its broadest meaning, suggesting education that integrates the work, family, and community aspects of one's being. All students need to learn about all aspects of work, including the social aspects of work, such as democratic rights in the workplace, safety, the prospect of race or gender discrimination, and the like. They need to know about career ladders, labor markets, job-seeking skills, and job-keeping skills. They need to understand firsthand why some jobs are considered to be better than others. All teachers, but particularly career and technical education teachers, can contribute to this part of a student's development.

One way to achieve vocational literacy is for students in the high school years to work at actual jobs in authentic workplaces. This could be through partnerships with industry (such as co-op programs) under the supervision of the school, and the curriculum could include work aspects such as responsibility, cooperation, interviewing, leading, following, competence, etc. That so many students work while in high

school, with so few of these experiences connected to the school curriculum is truly a lost opportunity (see Stone & Mortimer, 1998). Another way to educate about work is by simulating work, or learning via school-controlled environments, such as was demonstrated by Stern, et al., (1993) in their School-based Enterprises research program. Students in these enterprises learned about business planning and operations, teamwork, time management, and problem solving.

At Cottrell Middle School in Oregon, the curriculum includes in-school jobs for students (Yatvin, 1995). Students work for 20-minute spans during the day, outside of academic periods. Jobs are made available throughout the school (e.g., in the cafeteria, science lab, lunchroom, school grounds). Students can apply for and get jobs such as science aide, groundskeeper, and gym manager. According to Yatvin, who is the superintendent of the school district, students must fill out daily time sheets and undergo periodic evaluations by adult supervisors. She explains, "We expect all workers to be prompt, reliable, polite, and industrious; those who fall short in any area are warned and may be fired." In this way, work becomes the basis of career exploration and guidance (Ries, 1999).

For students in two-year colleges, a focus of the curriculum should also be on education about work. Students who enroll in postsecondary programs without prior career and technical education opportunities, but also adult students who seek retraining, can learn about work during work-based learning experiences. Bragg and Hamm (1997) conducted a national study of work-based learning in community colleges, jointly sponsored by NCRVE-Berkeley and the National Council for Occupational Education. They concluded that students reap valuable lessons on many levels from work-based learning in postsecondary career and technical programs. Ranging from nursing and radiologic technology programs in the health professions to marketing in the business field to fruit tree production in agriculture, valuable learning opportunities utilizing actual workplaces exist in collegiate-level career and technical programs to help students learn about work. Several NRCCTE projects will provide new insight into how vocational education adds to vocational literacy (see Johnson, Charner, & White, 2002; Dykeman & Herr, 2001; Lewis, 1993, 1998; and Castellano, Stringfield, & Stone 2001).

Education FOR Work

Education for jobs or workforce development is an historic and vital part of vocational education. While this generally is considered to be the focus of postsecondary occupational education, many secondary systems provide these opportunities as well. Regional vocational centers, vocational high schools and even comprehensive high schools in many states provide high school age youth the opportunities to learn skilled crafts and trades for many high demand and family supporting occupations. Regardless of venue, workforce development must be derived from actual workplace needs and must also address the broader economic and educative needs of the worker. Bragg's work on Tech Prep demonstrates the value of coordinated sequences of vocational students in post education labor market activities. Current NRC research by Stone, Bae, & Aliaga, will shed further light on the extent to which secondary and postsecondary vocational education programs are developing the future workforce.

Vocational education serves three purposes in K-14 education today: (1) education through work, (2) education about work, and (3) education for work. The first two of these are particularly well suited for K-12 education, though many postsecondary institutions engage students in these ways as well. The third dimension is particularly suited for postsecondary but many secondary institutions engage students in these ways as described earlier. Secondary schools that provide an expansive academic and vocational curriculum premised upon broad career clusters clearly articulated with career and technical programs at the postsecondary level that offer greater specificity and more direct application to immediate employment should enhance further postsecondary education and workplace training opportunities over a lifetime.

Vocational Education: Recent Trends

Federal intervention in vocational education began with the Morrill Act of 1862. Calling for the training of agriculturalists and mechanics, this Act established the federal government as a major player in the

development of the nation's workforce. In the early part of the 20th century, the world's first war of machines created a demand for a more technologically literate workforce and the Smith-Hughes Act was the result. Designed especially for those many students not expected to complete or continue beyond high school, Smith-Hughes emphasized practical learning in occupations deemed necessary to the nation's future. Over the years, more occupational clusters were added to the original focus on agricultural and mechanical arts.

One thing we have come to realize is that continuing education is no longer a luxury but a survival strategy. In today's world, economists argue that the relative demand for more highly educated workers is rising, the relative demand for more experienced workers is rising, and the relative demand for highly skilled workers is rising (Bresnahan, Brynjolfsson, & Hitt (1999). While the demand for skilled workers is rising, this does not translate to a dramatic increase in the need for a baccalaureate-trained workforce.

Current BLS data show that by the Year 2006 approximately 20.6% of the projected job openings will require a bachelor's degree or more, a figure that has remained relatively constant over the past two decades (Occupational Outlook Quarterly, 1996-2006). Data from the Department of Commerce show that approximately 31% the classes of 1996 and 1997 are completing four-year degrees. This oversupply of baccalaureate prepared individuals may explain both the reported rise in degreed students in two-year college, occupational programs and in well-educated taxi drivers.

As the trend for a more skilled workforce continues, how has the vocational education enterprise fared? Vocational programs are currently offered in approximately 11,000 secondary schools (roughly 66% of the nation's secondary schools), 250 vocational high schools, and 1,100 area vocational centers. Roughly 9,400 postsecondary institutions and other public and private 2- and 4-year colleges offer vocational programs. Unfortunately, many vocational programs are not implemented as coherent sequences of courses and most have no prerequisites.

Between 1982 and 1998, major shifts in course taking have occurred in general education (down 16%) and college preparatory (up 30%), with a relatively small decline in vocational concentrators (down 8%) compared to these other areas. Overall credit acquisition in vocational education declined by more than 20% between 1982 and 1992.

Between 1982 and 1998, the percentage of students earning 3 or more vocational credits has remained about the same, while the percentage of "concentrators" - those taking a sequence of 3 or more courses in a single labor market area - and "specialists" - those taking 4 or more credits in a single labor market area - has declined. (Note: This may reflect a movement in vocational education toward broader career pathways that span more than one occupational area, or it could mean that students are taking courses for avocational reasons (e.g., fulfilling elective requirements, career exploration)).

Over the same period, vocational students increased their average credits earned in all academic subjects. In fact, the percent of vocational concentrators completing a "New Basics" curriculum – 4 years of English and 3 years each of math, science, and social studies - rose from 5% to 46%. Yet, compared to college preparatory students, vocational students still take considerably less math and science.

Funding the Vocational Education Enterprise: Funding for Research and Development

Between FY 1980 and 1999, overall funding for Department of Education programs increased by 177%, while vocational education funding has increased only by 47%. In 1980, vocational education funding was about 6% of the total Department funding; it is now only about 3%.

Recently the House Labor, Health and Human Services, Education (Labor/HHS/Education) Appropriations Subcommittee recommended increased Perkins appropriations with an additional $134 million or 10.85% provided over FY 2001. Highlights include a proposed $150 million (13.6 %) increase for Basic State Grants, bringing the total for FY 2002 to $1.250 billion. Tech Prep would receive an additional $4 million (3.8%) for FY 2002, which would bring its funding up to $110 million, the first increase in Tech Prep in quite some time. There were no new monies targeted for Research and Development, Dissemination, or

Professional Development. In fact, funding for National Programs is projected to be reduced by a substantial amount, more than 30%.

Presently, the Congress invests $2,225,000 in CTE R&D through Perkins funding and an equal amount for Dissemination. This amounts to an R&D investment of .00178. The National Science Foundation reports that the U.S. spends an average of 2.6% of GDP annually on this function. Industry spends between 2.8% and 7.8% annually on R and D depending on industry sector.

The vocational education R&D situation is aggravated by the reduction in research and dissemination funding from $6,000,000 in 1996 to $4,500,000. These funds were split evenly between the two Centers in the 1998 recompetition reducing the effective funding from $4,000,000 for R and D in 1996 to the present $2,225,000. Without adjusting for inflation, the present funding for R&D is roughly half of what it was five years ago. Funding for Dissemination and Professional Development has remained approximately level during that time.

AN INITIAL SUMMARY OF FINDINGS
THE NATIONAL RESEARCH CENTER FOR CAREER AND TECHNICAL EDUCATION

The following findings reflect the 2000 and 2001 work of the National Research Center for Career and Technical Education (NRCCTE). The NRCCTE reports from which the findings are drawn are, for the most part, still in the review process and thus are tentative and should be interpreted with caution.

The NRCCTE's agenda is derived from the original Perkins III legislation that defined five areas of research. These five areas provide the frame within which we develop research directions that are influenced by our continuing needs sensing activities and on-going discussions with OVAE staff. The following are highlights of the first two years of work discussed within the context of the legislative framework.

Findings from Year 1 projects are identified with a single asterisk. Findings from Year 2 projects are identified with a double asterisk. As these studies complete our quality control process, the full reports will be available on the National Centers' website: www.nccte.com.

Integration of Vocational-Technical and Academic Instruction

Given the relatively low status that vocational education has in high schools, and the fact that vocational and academic staff often interact little, much less collaborate (Little, 1993), spreading reform based on curriculum integration has proven 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 (Levesque et al., 2000). Since curriculum integration is rarely implemented absent other changes, it is difficult to attribute any student outcomes to curriculum integration practices (Castellano, Stringfield, & Stone, 2001).

Schools that move beyond Tech Prep and engage in whole school reform are uniformly characterized by strong leadership at the building and district level over time (Castellano, Stringfield, & Stone 2001). Those schools successfully engaged in whole school reform have usually had strong leadership that is often credited with turning the school around (Castellano, Stringfield, & Stone 2001).

In some schools undergoing education reform, CTE has retained its outward, historic framework. That is, schools still offer industrial "shops," agriculture, business, or trade and technical programs with an emphasis on labor market needs. While they may not look too different than before, these schools now emphasize connecting young people to the business community and postsecondary education, especially two-year colleges. In other sites, however, CTE has "morphed" into new models or strategies for connecting young people to the business community and postsecondary options, including four-year colleges (Castellano, Stringfield, & Stone 2001).

Curriculum integration is more difficult to implement in programs that are multi focused than in those with a single occupational focus. Curriculum developed "In-house" is generally more effective than 'pull out programs' (Johnson, Charner, & White, 2002).

Curriculum integration is more easily delivered in a single school than when multiple schools are involved. Small learning communities appear to provide the best environment for design and delivery of integrated curriculum (Johnson, Charner, & White, 2002). It is poorly defined in the literature and in the field (Johnson, Charner, & White, 2002).

With the exception of a number of curriculum integration efforts developed within the context of Tech Prep consortia, curriculum integration models driven by post-secondary institutions were particularly hard to find. It is usually part of a project or initiative with multiple components rather than a stand-alone endeavor (Johnson, Charner, & White, 2002).

Curriculum integration is facilitated when schools reorganize the structure of the school into an academy structure defined by teacher teams or "houses." Absent the structural support, curriculum integration efforts are haphazard and dependent on individual teacher initiative (Castellano, Stringfield, & Stone 2001). Tech prep participants are more likely to enroll in articulated courses than non-Tech Prep participants (Bragg, 2001). Business, mechanics/repair and precision production are the most common areas supporting articulated courses (Bragg, 2001).

Distance Learning and Educational Technology (Thomas, 2002)

When there is a leader who is highly committed to technology integration, and when there is a strategic approach to implementing integration, there is more thorough and successful integration. Use of the Internet does not dramatically transform teaching; rather, it serves as a tool within the structure of teaching already in place.

Schools' Internet access appears to be major source of access for students who do not have Internet access at home. Teachers use the Internet because they view it as a current, convenient, realistic source of material that's accepted and demanded in society. They are encouraged to use the Internet when their schools offer training, adequate hardware, technical support, and Internet access in their classrooms.

Teachers are discouraged from using the Internet when their schools' computers and networks are outdated, slow, or unreliable, or their schools have limited access to Internet-equipped computers. They are also discouraged by filters, the overabundance of information on the Internet, and insubstantial websites.

Schools do not always have the resources to acquire the equipment and infrastructure necessary for technological integration. Schools need leaders who can provide technological and curricular guidance.

Academic Knowledge and Vocational and Technical Skills

There are four identifiable clusters of career development interventions used in K-12 education. Work based interventions promote both career and academic self-efficacy and motivation through sustained and meaningful interactions with work sites in the community. Advising interventions provide direction, resolve impediments, or sustain planfulness in students about their goals for the future. Introductory interventions awaken a student's interest in their own personal and professional growth. Curriculum interventions promote career and academic knowledge and skills through means and content relevant to the world of work (Dykeman & Herr, 2001).

There is a large gap between the rate career development interventions are offered by schools and the rate they are utilized by students (Dykeman & Herr, 2001). Career development interventions appear targeted to specific student populations (i.e., the at-risk student) rather than the general student population. These

interventions occur so infrequently that their ability to leverage positive student outcomes is limited (Dykeman & Herr, 2001).

Professional Development

Teacher Background and Qualifications (Ruhland, 2002)
Fifty nine percent of all CTE teachers had completed all teacher certification requirements before they began teaching. Forty seven percent of all CTE teachers reported completing a bachelor's degree, 18% reported completing a 5th year or post-baccalaureate program, and 28% completed an alternative certification program. Three percent reported, "other."

Of those not initially certified, 70% completed certification since being hired. Agriculture, health, and trade and industrial education had the highest percentage of initially, non-certified teachers and the highest percentage of alternatively certified teachers. Of those who completed pre-service teacher training, 61% felt they received "very adequate" preparation in subject matter knowledge. Only 16% felt the preparation in pedagogy and 19% felt classroom management was "very adequate."

Teacher Characteristics
A slight majority (53%) of CTE teachers definitely plan to continue teaching for eight years or more. Twenty nine percent probably plan to continue teaching eight years or more. Nine percent are actively seeking other employment. Three percent plan to retire within eight years and the remainder selected other categories.

Certification and Licensure. Of the states reporting (N=35):
Twenty nine percent of states report using alternative certification in agricultural, business, health, marketing and trade and industrial programs (Ruhland, 2002). Thirty two percent of states report using alternative certification in family and consumer sciences and technology education. (Ruhland, 2002).

The most common alternative teacher certification reported by respondents for secondary academic teachers and CTE teachers provides for emergency certificates or waivers that allow the individual to teach, most often without any on-site support or supervision, while taking traditional teacher education courses needed for full certification.

Teacher Preparation and Professional Development
Forty two percent of states reporting indicated they required a professional development program for alternatively certified teachers (Ruhland, 2002). Professional development workshops (58%) were the most common type of support provided to beginning CTE teachers. Respondents identified other types of support to include: mentor (52%), support from faculty and administration (21%), courses provided to meet licensure requirements (7%), and in-service programs (2%) (Ruhland, 2002).

In schools identified as meeting the needs of disadvantaged students, professional development opportunities were often provided by the teachers attesting to the strength of the teaching staff (Castellano, Stringfield, & Stone 2001).

We found that the nation's CTE dissemination system has been almost exclusively "producer-driven". Like the rest of the educational field, it is not only complex but also rather disorganized; therefore, it is not necessarily user-friendly. The main barriers to knowledge use, at least in CTE, are not at the level of individual resistance. They lie in the rigidities induced by institutionalized organizational fields, organizational designs that do not foster learning, and leadership agendas that are not consistent with the research findings.

That research utilization involving "sustained interactivity" should be included in any redesign of a school or technical college. Sustained interaction between researchers and practitioners may increase the impact of research by enlarging the field of CTE communication systems.

Several other ideas are key in successful information dissemination. We do not always need elaborate infrastructures or sustained interactivity to ensure the incorporation of new ideas in practice. Also, dissemination systems should include practitioners as partners, incorporate action research, and use constructivist-based forms.

Accountability and Program Improvement

Secondary (Stone, Bae, & Aliaga, 2002)
Analysis of 1999 enrollment rates in CTE and participation in STW Activities showed that 17.4% of high school students or about 2.3 million adolescents, participated in a career major or pathway and 11.4% have engaged in a job shadowing experience. The analysis also showed:

- 8.4% of juniors and seniors participated in cooperative vocational education
- 6.6% of juniors and seniors participate in tech prep
- 6.2% of juniors and seniors participated in apprenticeship or internship
- 5.4 % of high school students participated in school based enterprises
- 4.6% of high school students participated in a mentoring activity
- 6.1% of high school students reported being a CTE concentrator
- 5.5% of high school students reported being a Dual concentrator

In 1999, students reported less participation in STW activities than in 1997. Also in 1999, fewer students reported a dual concentration and more reported a vocational concentration than in 1997.

Postsecondary
Tech Prep participants were more likely to be NCES defined concentrators and specializers than non-tech prep students. Business was the most prevalent area of concentration (Bragg, 2001). In 1999, fewer students reported taking at least one vocational class than in 1997 but more students reported taking at least one math and one science class. Compared to academic concentrators, general concentrators were more likely and vocational and dual concentrators less likely to report not participating in any STW activity/program (Stone, Bae, & Aliaga, 2002).

When we look at participation in specific STW activities as a function of curriculum concentration, we find that vocational and dual concentrators are more likely than academic concentrators to report participation in tech prep, coop education, school based enterprise, and apprenticeships. General concentrators were less likely than academic concentrators to report participation in Tech Prep, Job Shadowing and Mentoring. There were no differences amongst academic, vocational and dual concentrators in reported participation in Job Shadowing or Mentoring. There was no difference between academic concentrators and dual concentrators in reported participation in apprenticeships (Stone, Bae, & Aliaga, 2002).

Thirty seven percent of students in public, two-year postsecondary institutions are enrolled in an "applied" associates degree program (e.g., business/secretarial, technology). More than 50% of students are similarly enrolled in private two-year institutions. The largest postsecondary enrollments were in business/secretarial, allied health and technology/mechanical (Stone, Bae, & Aliaga, 2002).

Seventeen percent of students in public, two-year postsecondary institutions are enrolled in certificate programs, and 42% of students in private postsecondary institutions are similarly enrolled. Among all students in public, two-year postsecondary institutions, 22% indicate they enrolled to obtain job skills, 37% for transfer credits (Stone, Bae, & Aliaga, 2002).

Among employed postsecondary students, 84% indicated gaining skills for a new job or career was an important consideration in their decision to go to school while working (Stone, Bae, & Aliaga, 2002). Student enrollments have increased in "mature" Tech Prep sites since the early 1990s rising to about 15 percent of high school students in study sites although evidence suggests that lower socioeconomic status students are over represented in Tech Prep (Bragg, 2001).

Academic Course Taking

There does not appear to a consistent pattern of course taking in math within Tech Prep consortia or between Tech Prep consortia. There may be program specific behaviors within Tech Prep (Bragg, 2001). However, there has been an increase in math course taking by Tech Prep students between 1995 and 1997 (Bragg, 2001).

Core Performance Indicators

Academic Achievement
General and vocational concentrators report lower GPA at the end of their school career (controlling for 8th grade GPA) than do academic concentrators. Dual concentrators report slightly lower GPA but the difference is not statistically significant (Stone, Bae, & Aliaga, 2002).

The analyses of 12th grade test performance categorize individuals according to whether or not they fulfilled a CTE concentration during high school (defined as completing 3 or more Carnegie units during 4 years of high school) and whether or not they fulfilled an Academic concentration. Analysis for achievement of four core academic areas (reading, mathematics, science, and history) show that students completing an academic concentration (defined as at least 4 Carnegie units in English, 3 in mathematics, 3 in science, and 3 in social studies but not a CTE concentration) exhibit the greatest achievement growth between 8th and 12th grades. Significantly behind this group, but ranking second, are Dual Concentrators (those who completed both academic and CTE concentrations). Ranking third are those who completed neither academic nor CTE concentrations. Finally, those exhibiting the least achievement growth between 8th and 12th grades are those who completed a CTE concentration but not an academic concentration (Plank, 2001). High school Tech Prep students perform as well as their non Tech Prep peers in math (Bragg, 2001).

HS Diploma Attainment
CTE course taking is a significant contributor to reducing the likelihood of dropping out of high school for all ability groups but especially for low academic performers (Plank, 2001).

Placement/retention in Postsecondary Education and Training
There was no effect of participation in STW activities on post-high school college and employment expectations (Stone, Bae, & Aliaga, 2002). The most common transition pattern was high school to 2-year college followed by high school to 2-year and 4-year college. High school to 4-year only was the least common pattern in the sites studied for both tech prep and non-tech prep students. There was variation across the sites (Bragg, 2001). More than 75% of participants in "mature" Tech Prep sites enrolled in some form of postsecondary education within one to three years of high school graduation (Bragg, 2001).

Preliminary findings suggest that Tech Prep participants enjoy differential wage increases over time and also acquire more highly skilled and technical jobs. Articulation agreements have not been demonstrated to materially enhance students' extending education pathways beyond high school (Bragg, 2001).

Formal articulation agreements do not appear to be easing the transition to postsecondary education. Transcripts often do not highlight articulated credits, and kids often are not told how to take advantage of the credits they earned (Castellano, Stringfield, & Stone 2001).

Postsecondary Degree or Credential Attainment
Individuals who had completed a CTE concentration but not an academic concentration were by far the most likely to be purely or primarily workers (as opposed to being students) during 1993 (the first full calendar year after high school, for most). Dual concentrators ranked second in their likelihood of being purely or primarily students during 1993; they lagged significantly behind pure academic concentrators in this area, but were ahead of pure CTE concentrators and those who had fulfilled neither CTE nor academic concentrations (Plank, 2001).

There are more than 100 company sponsored IT certification programs (Bartlett, 2002). It is not clear how powerful a signaling device these new credentials are in the labor market (Bartlett, 2002).

In IT companies participating in this NRC survey, we find that 73% of US firms specify IT certificates for certain IT positions and, 55% of job applicants have industry-sponsored IT credentials. Employees with IT certificates reduce training costs and increase likelihood of success for new employees. Skill certificated (only) employees have limited advancement opportunities, participate less in HRD, are more likely to turnover and are less a part of the IT 'team' (Bartlett, 2002).

Personal Development

There was no relationship between major or STW participation on self reports of risky behavior (early sex, smoking, drinking or marijuana use) (Stone, Bae, & Aliaga, 2002). Compared to academic concentrators, general concentrators are more likely to report school behavior problems (absences and tardiness). Vocational and dual concentrators are not different from academic concentrators in reports of school behavior problems (Stone, Bae, & Aliaga, 2002).

The NRCCTE reports from which these findings are drawn are, for the most part, still in the review process and thus are tentative and should be interpreted with caution. The findings herein may not be cited.

As these studies complete our quality control process, the full reports will available on the National Centers' website: www.nccte.com.

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