Improving Secondary Career and Technical Education through Professional Development: Alternative Certification and Use of Technical Assessment Data

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Professional Development Joint Working Group

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Executive Summary

Secondary career and technical education (CTE) is a field in transition. It is moving from a primary focus on preparing students for entry-level employment to preparing them for continuing education and training as well as employment. The rapid pace of change in technology and the global economy has created a demand for workers who are able to learn and adapt, and CTE must prepare its students to meet these demands. Greater emphasis is being placed on assessment to improve accountability and to verify that students have acquired the skills to undertake these challenges. These higher expectations come at a time when more students are taking CTE courses and fewer CTE teachers are graduating from teacher education programs. The field has responded by recruiting more teachers from business and industry, but those who enter teaching in this way typically have had little pedagogical training. Neither these teachers nor many of their colleagues who enter the profession through a traditional teacher education program are prepared to use technical skills assessment data to help students gain higher levels of competence.

The National Research Center for Career and Technical Education (NRCCTE) is responding to these developments with a number of projects, some of which are being conducted by its own staff and others that are being directed by institutions that are partners in the NRCCTE consortium. Two of the projects are developing professional development models for improving the skills of secondary CTE teachers. The Southern Regional Education Board (SREB) is developing and testing an induction model for alternatively certified teachers; that is, those who have not completed a traditional teacher education program. NOCTI (formerly the National Occupational Competency Testing Institute) is applying its expertise to a professional development model designed to improve the ability of secondary-level CTE teachers and administrators to interpret data from technical skill assessments to improve instruction.

Alternative Certification

One of the most important challenges facing CTE is the need to build a high-quality teaching force. The new demands and responsibilities on CTE teachers range from integrating grade-level literacy and numeracy to support increased student achievement to designing intellectually challenging projects and real-world problems that will engage an increasingly diverse population of learners. Alternative routes to CTE teacher licensure, embraced for nearly 100 years as a viable way of transitioning those with highly valued industry experience into the teaching profession, are one strategy for meeting the demand for more and better CTE teachers. Although an increasing percentage of teachers are entering the teaching profession through alternative routes, the requirements for these pathways vary greatly, and a debate continues to rage as to whether alternatively certified teachers are less or equally effective as traditionally prepared teachers in impacting student achievement.

In partnership with the NRCCTE, SREB is developing an induction model for new CTE teachers pursuing an alternative route to certification that will increase their competence, self-efficacy, and career commitment. The model is designed to build the capacity of beginning CTE teachers to offer instruction that is intellectually demanding and standards-focused and thus more likely to improve CTE students' academic achievement. The model also builds CTE teachers' capacity to

design instruction that is actively engaging using strategies like project-based learning and cooperative learning. Students who are actively engaged intellectually and emotionally in their high school courses are more likely to stay in school and graduate on time and less likely to need developmental (remedial) courses at the postsecondary level.

The induction model includes 196 hours of professional development delivered through a 10-day summer institute prior to the first year of teaching; three, two-day workshops during the first year; and a 10-day summer institute following the first year. In addition, the model includes the support of coaching from the professional development instructor, on-site guidance from a mentor and administrator, and participation in an electronic community of practice. An iterative development process is being used to design the model. In Chapter 2, this report presents the findings of the first round of field tests of four training modules that comprise the professional development component of the model. The content of the modules was field tested between June 2009 and February 2010 in a series of four sessions each including three, six-hour days of training. Two of the four field test sessions were held in Oklahoma and two were held in South Carolina. A total of 46 teachers participated, representing different levels of education, work experience, and CTE content areas.

An analysis of the field test data provided clear indicators as to changes needed in program materials to meet the needs of alternative route teachers. Many learning activities were revised to fit the audience in order to provide more time for reflection or to clarify content. Field test participants identified key elements of the modules that they felt would be necessary for new teachers prior to entering the classroom, including: (a) the use of rubrics, (b) formative and summative assessment, (c) how to use a table of specifications to align their instructional goals and assessments to technical standards and 21st century skills, (d) getting to know students, (e) engaging students in developing classroom rules and procedures, and (f) classroom management scenarios. Data suggested that three strategies used by program developers were particularly effective in supporting participant learning: (a) use of examples in participants' content areas, (b) use of "floating" one-on-one and small group coaching during cooperative learning segments, and (c) facilitated small group discussion in the afternoon or evening to structure reflection. Field testing on the model will continue through 2012, when the fully-developed model will be ready for rigorous experimental testing.

Use of Technical Assessment Data

The term "data-driven decision making" has become ubiquitous in education, and yet it seems to be most often discussed with reference to policy decisions related to reporting requirements and accountability. With the increasing emphasis on the use of standardized tests for reporting on school, teacher, and student achievement, the true purpose of testing—that of program or instructional improvement—could be lost or buried under the need to use the results for reporting and rating purposes. An understanding of assessment data, including their interpretation and many uses, can encourage teachers who have used data for classroom improvement to continue to do so and help those who have not used assessment data see the value in using them for classroom improvement beyond the meeting of regulatory requirements.

During the first year of the NOCTI project, teachers and administrators were surveyed to determine if and how they use analyses of testing data to modify curriculum and instruction, how they learned to use data, the effectiveness of their prior training, and the topics on which they would like to increase their knowledge and skills. The survey results defined the felt needs of respondents. Short case studies were also conducted with districts that demonstrated extensive use of test data to identify the changes that were made in how instruction was planned and delivered.

The findings from the first year, as well as an exhaustive literature review, were used to develop a professional development program to improve the ability of secondary CTE teachers and administrators to interpret assessment data to guide instructional improvement. The program, entitled CTEDDI (Career and Technical Educators Using a Data-Driven Improvement Model) includes training in analyzing data from the participants' own students and ongoing mentoring and coaching. Educators are also provided access to an electronic professional sharing site where they become members of a community of practice. This program was field tested in nine locations, and information collected from the facilitators and trainees was used to identify changes needed to improve the materials and process. The methods and findings from the first two years of this project are presented in detail in Chapter 3 of this report. The revised version is undergoing additional review in new sites, and planning has begun to roll out the model through technical assistance to states that elect to provide this professional development to state-selected groups of teachers. Using test results in this way is one of the core components of continuous quality improvement and strongly encouraged by the accountability requirements and legislative intent of Perkins IV.

The projects discussed in this report respond to core needs of the field, but the professional development challenge is far more extensive than what these projects alone address. Secondary CTE serves a large segment of secondary students and must contribute to their academic as well as technical learning. Most CTE teachers will need considerable professional development to broaden their teaching skills and to learn to use data for program improvement. The professional development they receive should be directly related to the courses they teach and of sufficient intensity and duration to influence their instruction. In the present economic climate, providing adequate time for effective professional development may be the most difficult challenge of all.

Chapter 1

Where We Are

In December 1998, the American Vocational Association changed its name to the Association for Career and Technical Education (ACTE). This new name was chosen to reflect changes that had been occurring in the field during the last two decades of the 20th century. In 2000, Lynch published a paper in which he identified forces acting on vocational education that led members of the largest association representing the field to conclude that the name of their association should be changed. He grouped these forces into four categories: (a) the new economy, (b) public expectations, (c) cognitive research on learning, and (d) school reform. The convergence of these factors motivated secondary-level career and technical education (CTE) to increase the emphasis it placed on preparing its students for postsecondary education. In the 13 years since the new name was adopted, the influences that Lynch identified have continued and intensified. In this report, we examine the expanded expectations for CTE and discuss their implications for professional development.

Much more is expected of today's CTE teachers, especially those at the secondary level, than was the case in the past. For most of its history, vocational education prepared its students for entry-level employment in jobs that required specialized skills below those at the professional and managerial levels and usually did not require a bachelor's degree. Most vocational students felt no need to continue their education after high school. In the 1980s, the influences identified by Lynch converged to create a demand for skills at a higher level than could be taught in high school. Offshoring and automation eliminated millions of low-skill, repetitive jobs and created a demand for workers who could use new technology and continually learn and adapt to changes that could not be foreseen but were certain to occur. Employers found it increasingly difficult to hire workers with the skills they needed, and pressures mounted for education to raise standards and increase rigor. In 1990, these pressures were reflected in the reauthorization of the federal vocational education legislation, the Carl D. Perkins Vocational and Technical Education Improvement Act, which added the attainment of academic skills as one of the outcomes by which vocational programs were to be evaluated. Improving students' academic skills became a mandated responsibility of vocational education programs in public institutions that received federal funds, as virtually all do.

The two subsequent reauthorizations of the federal legislation in 1998 and 2006 strengthened this emphasis on improving academic skills. The current legislation (Perkins IV) requires every recipient of federal funds to offer at least one program of study (POS) that includes rigorous career and technical content aligned with challenging academic standards and leads to an industry-recognized credential or certificate at the postsecondary level, or an associate or baccalaureate degree (P.L. 109-270. Sec. 122[c][1]). The first performance indicator for CTE programs required by the legislation is student attainment of "challenging academic content standards" and "academic achievement standards," as adopted by the state in accordance with No Child Left Behind (Sec 113[B][2][A][1]).

The stress on academics in secondary CTE will increase as states begin to implement the Common Core State Standards that have been developed by the National Governors Association

Center for Best Practices and the Council of Chief State School Officers (2010a, 2010b). The governors and chief state school officers of 48 of the 50 states, plus the District of Columbia, supported the development of these standards, and as of March 2011, 41 states and the District have officially adopted them. The standards for English Language Arts (ELA) and Literacy explicitly state:

> The Standards insist that instruction in reading, writing, speaking, listening, and language be a shared responsibility within the school. . . . The grades 6–12 standards are divided into two sections, one for ELA and the other for history/social studies, science, and technical subjects. This division reflects the unique, time-honored place of ELA teachers in developing students' literacy skills while at the same time recognizing that teachers in other areas must have a role in this development as well.
>
> Part of the motivation behind the interdisciplinary approach to literacy promulgated by the Standards is extensive research establishing the need for college and career ready students to be proficient in reading complex informational text independently in a variety of content areas. (p. 4)

Standards are specified for reading and writing in science and technical subjects for Grades 6-8, 9-10, and 11-12. The standards for mathematics, however, do not address the responsibility of other content areas to contribute to learning nor do they establish different standards for Grades 9 through 12. Instead they set forth standards for six different "conceptual categories" that high school students should understand and be able to use.

Tied closely to the adoption of standards are measures to ensure these standards are being met. The way in which Perkins IV links its first performance indicator (attainment of challenging academic content and achievement standards) to the standards established by NCLB is one of the most prominent signs of how CTE has been affected by the calls for increased accountability in all of education. The second indicator is attainment of technical skill proficiencies as measured by assessments that are aligned with industry-recognized standards. When the results from such measures are properly analyzed, they can provide guidance for program and instructional improvement. The NOCTI study discussed in this report has developed methods to improve the ability of teachers and administrators to use technical assessment results for these purposes.

Shortage of CTE Teachers

The requirements in Perkins IV and the Common Core State Standards expand what is expected of CTE teachers at a time when anecdotal evidence suggests that many school districts are finding it difficult to hire anyone with the occupational knowledge and experience needed to teach the classes they offer. We are unaware of any national estimates of the number of CTE teachers needed in the various occupational areas, but a number of key indicators imply widespread shortages. Among the most prominent of these are the concerns of the state directors for CTE. These officials have administrative responsibility for all CTE programs in their states that receive federal funds, and thus have daily contact with the problems facing the field. In 2009, their concerns led the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) to publish *Teacher Shortage Undermines CTE*. This

publication cited the difficulties schools experience in finding qualified CTE teachers and identified three main factors as producing the shortage: increased enrollments in CTE courses, the decline in four-year teacher preparation programs, and the number of teachers reaching retirement age.

The increased enrollments in CTE are due mainly to the number of secondary school students. This generation of students has been referred to as the "baby-boom echo," the children of women who were born during the original 1946 to 1964 boom. In the 1980s, the number of annual births increased to levels last seen during the original baby boom, and these levels have continued to the most recent year for which data are available (U.S. Census Bureau, 2009). Various national surveys have found that virtually all students take at least one CTE course and about 20% of students take several (Levesque et al., 2008). Analyses of trend data indicate that, despite the increase in academic requirements during the last two decades of the 20th century, the percentage of high school students who take CTE courses has remained relatively steady. Larger high school enrollments yield larger CTE enrollments.

Bruening et al. (2001) documented the decline in the number of institutions offering teacher education in CTE during the 1990s. More recent data are not available, but most observers think the number of such programs continued to decline during the past 10 years. Those that remain are producing fewer new teachers than in the past. Programs that previously had primarily prepared CTE teachers responded to the increased demand for corporate trainers and began emphasizing human resource development instead. Their graduates entered business and industry rather than the classroom. This shift was signaled by a change in the name of the council that includes most of the universities that offer doctoral programs in CTE. This council was established in 1976 to increase the visibility and influence of vocational education in higher education and adopted the name the University Council for Vocational Education. In 1998, as the number of students seeking degrees in human resource development increased, it changed its name to the University Council for Workforce and Human Resource Education (UCWHRE; Reynaldo Martinez, personal communication, October 27, 2010).

The evidence on the extent to which retirement contributes to the CTE teacher shortage is more questionable. Earlier in the decade, Ingersoll (2003) found that among all elementary and secondary teachers, retirement accounted for only about one-fourth (23.7%) of teachers leaving education. Ingersoll analyzed data from four nationally representative surveys of schools conducted between 1987 and 2000 by the National Center for Education Statistics (NCES). He found that there was an adequate overall supply of teachers, but added that there could be shortages in certain content areas. Shortages, Ingersoll concluded, were primarily due to high teacher turnover associated with job dissatisfaction and the appeal (e.g., higher salaries) of nonteaching jobs. The one analysis in which he presented results for CTE teachers showed their annual turnover rate (13.4%) to be comparable to that of all teachers (14.3%).

Another major indicator of the shortage of CTE teachers is the increase in the number with alternative certification. In some occupational areas, especially the construction and mechanical trades and health, alternative certification has been the primary method of entering teaching. Since the earliest years of vocational education, several years of occupational experience has been required of all new teachers. In recent years, however, alternative certification has increased

in occupational areas previously dominated by graduates of four-year programs. We have been unable to find any national estimates of the number of alternatively certified CTE teachers, but Bottoms and McNally (2005) provided information based on teachers in high schools in 30 states that are part of the High Schools That Work (HSTW) network. A survey of 12,000 such teachers who were hired in the five years from 2000 to 2004 found only 25% were graduates of teacher education programs. The high schools in the HSTW network are engaged in an intensive effort to improve the rigor of their CTE offerings, but three-fourths of the new teachers these schools hired did not complete traditional programs.

As the number of alternately certified teachers increases, the debate about their effectiveness continues. Advocates for traditional four-year programs (e.g., Darling-Hammond, 2002, 2009) stress the need for a sound grounding in human development and pedagogy to effectively guide students' learning. Proponents of alternative certification point to an emerging body of research (e.g., Constantine et al., 2009) that typically finds few or no significant differences in the tested performance of students taught by alternatively and traditionally certified teachers. All of the research on this topic that we could locate was conducted with elementary and secondary teachers in general education, not with CTE teachers. We did locate three studies of traditional and alternatively certified agricultural education teachers (Duncan & Ricketts, 2008; Rocca & Washburn, 2005; Wash, Lovedahl, & Paige, 2000), but they examined self-reported characteristics of the teachers (e.g., feelings of self-efficacy and participation in professional development), not student outcomes. Regardless of the merit of the research and arguments on both sides, alternative certification is needed if more CTE classes are to be offered.

Secondary CTE thus finds itself facing a unique set of challenges. Its teachers must have qualifications that can be acquired only through gaining several years of occupational experience. Those who are recruited from business and industry often do not have four-year degrees, and even those who have degrees typically have little or no pedagogical training. Nevertheless, they teach classes with disproportionate numbers of students with special needs and below average academic skills (Levesque et al., 2008), and they are expected to improve their students' academic skills in addition to teaching occupational skills. To compound the challenges, there are fewer teacher education programs in higher education that offer the kind of preparation needed to respond to these expanded expectations.

NRCCTE Projects

The National Research Center for Career and Technical Education (NRCCTE) cannot respond to all of these challenges, but two of its partners are conducting professional development projects that are responding to some. The first is being conducted by the Southern Regional Education Board (SREB). The principal investigator for this project, Dr. Gene Bottoms, originated the High Schools That Work (HSTW) initiative at SREB in 1987 and has directed it since. SREB is currently assisting over 1,200 high schools and career centers in 30 states and the District of Columbia to implement the HSTW principles.

Data collected from HSTW schools indicate that the majority of new CTE teachers have not completed a traditional, four-year teacher education program If these new entrants are to become effective teachers, they need support and preparation in how to manage a classroom and to plan,

deliver, and assess instruction. The SREB project has developed an induction model that provides such preparation and also includes mentoring, instructional coaching, guidance from school principals, and an electronic community of practice. In Chapter 2, we present the rationale and research underlying this model, describe how it was developed and field tested, the findings that emerged from the field tests, and the implications of these findings for the preparation of alternatively certified CTE teachers.

The second project is being conducted by NOCTI (formerly the National Occupational Competency Testing Institute). NOCTI is applying its expertise to a project designed to improve the ability of secondary-level CTE teachers and administrators to interpret data from technical skill assessments to improve instruction. During the first year of this project, teachers and administrators were surveyed to determine if and how they use analyses of testing data to modify curriculum and instruction, how they learned to use data, the effectiveness of their prior training, and the topics on which they would like to increase their knowledge and skills. Short case studies were conducted with districts that demonstrated extensive use of test data to identify the changes that were made in how instruction was planned and delivered.

The findings from the first year were used to develop a professional development program to improve the ability of secondary CTE teachers and administrators to interpret testing data to guide instructional improvement. The program includes training in analyzing data from the participants' own students and on-going mentoring and coaching. This program was field tested in nine locations, and information collected from the facilitators and trainees was used to identify changes needed to improve the materials and process. The methods and findings from the first two years of this project are presented in more detail in Chapter 3.

We conclude this report by discussing how the two NRCCTE projects relate to the increased expectations for secondary CTE and the mandates of Perkins IV. All indicators imply that more and more teachers will be recruited from business and industry and need alternative certification. The accountability requirements of Perkins IV involve increased attention to technical skill assessments and the use of the data from these measures. The SREB and NOCTI projects will provide assistance in both of these areas. We also briefly discuss teachers' need for content that is directly related to the courses they teach and for opportunities to collaborate and reflect on their practice with other teachers. The current economic climate may make it increasingly difficult to provide time for professional development of sufficient intensity and duration to be effective.

Chapter 2

Professional Development for CTE Teachers Entering the Profession through Alternative Routes

CTE teachers who are well trained and supported in entering the teaching profession are more likely to remain in the field and build their teaching skills over time, resulting in better instruction and improved learning (Hunt & Carroll, 2003; Joerger, 2003; Joerger & Bremer; 2001). In partnership with the NRCCTE, SREB is developing an induction model for new CTE teachers pursuing an alternative route to certification that will increase their instructional competence, self-efficacy, and career commitment. The model is designed to build the capacity of beginning CTE teachers to offer instruction that is intellectually demanding and standards-focused and thus more likely to improve CTE students' academic achievement. The model also builds CTE teachers' capacity to design instruction that is actively engaging using strategies such as project-based learning and cooperative learning. Students who are actively engaged intellectually and emotionally in their high school courses are more likely to stay in school, acquire high school diplomas in four years, and enter postsecondary institutions without the need for remediation (Castellano, Stringfield, Stone, & Wayman, 2003). This chapter describes the iterative development of an induction model and the findings of the field testing of four training modules that comprise the professional development component of the model.

Rationale

Increasing secondary enrollment in CTE programs, the declining number and size of traditional CTE teacher preparation programs, and the growing number of teacher retirements have created a concern about the lack of supply of CTE teachers (DeWitt, 2010; NASDCTEc, 2009). To compound this supply challenge, high-quality CTE teaching in the 21st century has placed new demands and responsibilities on CTE teachers, from integrating grade-level literacy and numeracy that will support increased student achievement to designing intellectually challenging projects and real-world problems that will engage an increasingly diverse population of learners. Research is needed to identify the best strategies for bringing teachers into the field, helping them make a successful transition to teaching, and encouraging their long-term commitment to the profession.

When new CTE teachers lack crucial skills, they often become so discouraged by the complexity of the work and lack of formal and informal organizational supports that they leave the profession (Hunt & Carroll, 2003; Joerger, 2003). The U.S. Department of Education published a study on teacher attrition and mobility that estimated that 25% of all new teachers leave within the first three years (Marvel, Lyter, Peltola, Strizek, & Morton, 2006). The ultimate problem resulting from poorly trained CTE teachers with inadequate school support and subsequent high rates of teacher attrition is that CTE students will not receive engaging, academically rigorous instruction, increasing the probability that they will drop out (Castellano et al. , 2003).

Alternative routes to CTE teacher licensure, embraced for nearly 100 years as a viable way of transitioning those with highly valued industry experience into the teaching profession, are one strategy for meeting the demand for more and better CTE teachers. The requirements for these

pathways vary greatly (Zirkle, Martin, & McCaslin, 2007) and a debate continues to rage as to whether alternative route teachers are less or equally effective as traditionally prepared teachers in impacting student achievement (Constantine et al., 2009; Darling-Hammond, 2009). For alternatively certified CTE teachers to make a successful transition to teaching and meet the demands of preparing students for further learning and the workplace, sufficient on-going support is needed. Induction experiences, the professional development and support activities that are designed to help teachers in the first few years of teaching, can provide the additional support that alternatively certified teachers need to meet the challenges of CTE teaching (Joerger & Bremer, 2001; Ruhland & Bremer, 2004).

The Need for Quality CTE Teachers

The current policy context in CTE reflects the belief that increasing teacher quality through effective preparation and professional development is key to improving the academic and technical achievement of CTE students. In 2006, the Perkins IV legislation called for professional development of CTE teachers to be "high quality, sustained, intensive, and focused on instruction, [increasing teachers'] academic knowledge and understanding of industry standards." This legislation echoed the push for improvement in teacher quality from NCLB and the recommendations of the National Assessment of Vocational Education that called for better teacher quality in CTE (Cramer, 2004; Silverberg, Warner, Fong, & Goodwin, 2004). State CTE leaders have identified recruiting, training, and retaining high-quality CTE teachers as a critical priority to meet the challenge of improved student achievement (High Schools That Work Board, 2007) and ACTE's Teacher Quality Task Force lists developing stronger induction and mentoring programs among its top priorities (DeWitt, 2010).

Much is required of teachers in meeting the challenge of improving students' technical and academic achievement (Gray & Walter, 2001). Implementing a CTE curriculum within the concept of career pathways and POS requires an understanding of career development; supporting academic achievement means integrating high-level literacy and numeracy; and engaging all students in learning, including the significant percentage of students in CTE courses who have special learning needs, demands an understanding of sophisticated instructional strategies such as cooperative learning and project-based learning. Unfortunately, as noted, many CTE teachers are typically less academically and pedagogically prepared than teachers of other subjects (Cramer, 2004; Gray & Walter, 2001). Alternatively certified CTE teachers are less likely to have a baccalaureate degree and more likely to be farther removed from college (Gray & Walter, 2001). Even if CTE teachers have a postsecondary degree, they often come to teaching straight from the workplace; most have been out of school for a longer period of time than other teacher candidates. Additionally, their postsecondary focus of study may have required fewer academic courses (Cramer, 2004). These circumstances suggest that alternatively certified CTE teachers may lack that skills and confidence to integrate the level of reading, writing, and mathematics that students will need to succeed in school as well as the workplace.

The Challenge of Alternative Routes to Teaching

In the field of education as a whole, there has been an explosion in the number of teachers entering through alternative certification programs. All states now offer alternative routes to

certification, although their requirements vary. It is estimated that between 20% and 33% of all new teachers enter the teaching field through alternative pathways (Feistritzer, 2007; U.S. Department of Education, Office of Postsecondary Education, 2006; Walsh & Jacobs, 2007). Although alternative routes to certification seem to be filling a need that grows out of teacher turnover and resulting teacher shortages (Garcia & Huseman, 2009), there is disagreement about the quality of the preparation and effectiveness of alternatively certified teachers. Programs are criticized for leading to high attrition rates, particularly because teachers have no clinical student teaching experience (Darling-Hammond, Chung, & Frelow, 2002). Another contention is that there can be a negative impact on student achievement if teachers enter the classroom before they are adequately prepared. Recent evidence, however, suggests that there may be little if any difference in the effect that alternatively versus traditionally prepared teachers have on student achievement. A study conducted by Mathematica Policy Research found no difference between the mathematics and reading achievement of elementary school students whose teachers entered the profession through an alternative route and the achievement of students who had traditionally certified teachers (Constantine et al., 2009).

Because industry experience is a valuable qualification for CTE teachers, alternative routes have existed for nearly 100 years in the CTE field, particularly in the areas of trade and industrial education and health occupations. Ruhland and Bremer (2003) found the percentage of alternatively certified CTE teachers to be about 28%, but the numbers may be much higher; in a survey of 12,000 CTE teachers at High Schools That Work sites in 30 states, 75% of teachers reported entering through an alternative route (Bottoms & McNally, 2005). To date, no experimentally designed studies exist comparing traditional versus alternatively certified CTE teachers' impact on students' academic and technical achievement. However, the increased demand for CTE teachers due to higher enrollment, teachers leaving the profession, and the decline in the number and enrollment in traditional teacher preparation programs underscores the need for alternative certification programs as a pathway to CTE teaching (NASDCTEc, 2009) and these programs will likely remain a "prevalent, if not the dominant" route to CTE teaching in this century (Gray & Walter, 2001, p. xiii).

One of the challenges in ensuring the quality of CTE teachers who are alternatively certified is the wide variation in the requirements and degree of support provided to teachers as they enter the profession through those routes. An analysis of existing alternative routes to CTE certification and licensure revealed that requirements for these teaching pathways vary from state to state and even within states (Zirkle et al., 2007) . Of the 105 alternative routes identified, 53 required bachelor's degrees and 32 required completion of an organized teacher preparation program similar to a traditional pathway. Many pathways provide newly hired CTE teachers with provisional certification if they have experience in the career field in which they are to teach (Ruhland & Bremer, 2003; Zirkle et al., 2007). As teachers begin their first year under the provisional certificate, they are required to complete pedagogical coursework provided by a university, state agency, or local district over an extended period of time. This route may or may not require a postsecondary degree, depending on whether one was required in the career field. In addition to variations in required work experience, current employment, and educational experience, the alternative certification pathways also vary in the requirement of induction or mentor programs. Only 21 of the 105 alternative routes identified required teachers to take part in an induction or mentoring program (Zirkle et al., 2007).

Needs of Teachers Who Enter the Profession through Alternative Routes

As a consequence of entering the field through alternative routes that do not provide traditional pedagogical preparation, teachers may lack the knowledge, skills, and confidence required to plan, deliver, and manage a challenging, engaging, and meaningful learning experience for students. In the field of education in general, many alternatively certified teachers, although they tend to have high expectations and strong idealism when they begin teaching, struggle to meet the demands of their jobs (Honawar, 2007). Only half of the alternatively certified teachers surveyed in a study for Public Agenda and the National Comprehensive Center for Teacher Quality said they felt prepared to teach compared to more than 80% who had completed a traditional teacher preparation program, and 54% reported needing more time working with a classroom teacher during pre-service (Rochkind, Ott, Immerwahl, Doble, & Johnson, 2007). Fewer than half of alternatively certified teachers say they received any training in the summer prior to teaching (Honawar, 2007). Stone (2000, cited in Suell & Piotrowski, 2007) studied alternatively prepared teachers in California and found that they listed their top need as curriculum development, followed by classroom resources, teaching strategies, techniques for handling difficult students, and classroom management.

Historically, research studies have pointed toward the unique needs of alternatively certified CTE teachers. Using survey data from a national stratified sample of 352 CTE teachers in 15 states, 43% of whom were alternatively certified, Heath-Camp and Camp (1990b) found that CTE teachers entering teaching from business and industry with little pedagogical training seemed to have more problems than CTE teachers who were traditionally certified. Similarly, in a study investigating the nature of teacher concerns and effective induction practices of a group of North Carolina CTE teachers, alternative route CTE teachers were found to have more concerns in general than those entering from a traditional route (Kirby & LeBude, 1998). Many CTE teachers who were alternatively certified knew nothing about their curriculum and needed orientation, help, and time to learn its scope and how to prepare lessons (Heath-Camp & Camp, 1990a). Few new CTE teachers received curriculum guides or even any feedback or evaluation on their work (Camp & Heath-Camp, 1991). Furthermore, beginning CTE teachers entering teaching from business and industry tend to be unfamiliar with lesson planning, CTE student organizations, the administrative red tape of schools, or student misbehavior (Heath-Camp & Camp, 1990b).

More recent research found similarities between the needs of beginning CTE teachers and those of beginning secondary teachers in general, including the development of skills to address classroom management issues, learn instructional methods, motivate students, and manage demands on personal time and resources (Joerger & Bremer, 2001). In addition to these skills, the Joerger and Bremer study outlined specific topics to meet the needs of CTE teachers in the areas of personal management (managing time effectively); pedagogy (designing effective lessons and using alternative teaching methods); students (motivating and disciplining); curriculum (determining scope, sequence, and pace of courses); program (facility management); system (advocating for funding and support); and community (establishing support from parents). Similar to these areas, alternative route CTE teachers surveyed at High Schools That Work sites expressed the need for professional development in four instructional

categories: planning, instructional methods, assessment, and supporting students (Bottoms & McNally, 2005).

Ruhland and Bremer (2004) studied traditionally and alternatively certified CTE teachers' perceptions of their first year of teaching. Traditionally certified teachers were more likely to report they were better prepared in pedagogy; alternatively certified teachers were more likely to report they were better prepared in knowledge of subject matter. The alternatively certified teachers in the study expressed a need for additional ongoing support in two areas of classroom practice: classroom management and working with special needs students. These needs are echoed by online survey data from those who employ CTE teachers at High Schools That Work sites (Bottoms & McNally, 2005). Supervisors identified classroom management as the most prevalent major deficiency among CTE teachers employed within the last five years. More than half of the respondents identified teaching strategies as a weakness for new CTE teachers. Forty-three percent of administrators surveyed believe that newly hired CTE teachers lack the skills to address student diversity and special needs.

In summary, CTE teachers who enter through alternative routes are more likely to feel confident about their knowledge of the career field and less likely to feel confident in their ability to teach that knowledge to students. Alternative route CTE teachers' major areas of concern in assuming their teaching responsibilities are classroom management and students motivation, as well as planning instruction for special needs students, concerns echoed by the administrators who supervise them. Research indicates that these teachers also need professional development in planning, instructional methods, assessment, and how to support struggling students. In addition to professional development, CTE teachers who enter through alternative routes require support through feedback about their work, strategies for managing added demands on time and energy, and resources for planning and teaching.

Quality Induction Programs for Alternatively-Certified Teachers

In response to the needs of beginning CTE teachers and in recognition of the essential role that alternative certification plays in a field in which recruiting teachers with valuable work experience is key to maintaining and improving the quality of the teaching force, a consistent, high-quality approach to induction programs for alternatively certified teachers is needed. Joerger and Bremer defined induction as "all of the teaching and professional activities and events experienced by beginning teachers from the time they sign their initial teaching contracts until they are fully and successfully acculturated into the profession" (2001, p. v.). Induction programs are designed to improve the transition to teaching, increasing teaching effectiveness and career commitment.

Induction programs typically focus on the basics teachers need to survive their first year of teaching—classroom management, obtaining resources, designing a lesson plan—as well as becoming familiar with the school and learning to be a reflective practitioner. Induction activities include on-going personal support, assessment and feedback, continuing education, and socialization into the profession (Joerger & Bremer, 2001). But typical induction programs assume prior knowledge and classroom experience associated with traditional certification routes and the processes and jargon used in these programs may not be appropriate for alternatively

certified teachers (Szuminski, 2003). Alternatively certified CTE teachers have unique needs that require a unique set of induction strategies.

At beginning of their first year of teaching alternatively certified CTE teachers specifically need:

- a mentor in the same or related instruction area;
- a support group;
- curriculum, resources and tips from previous instructors;
- an orientation to career and technical student organizations;
- more preparation time prior to the beginning of courses; and
- access to a variety of workshops (Joerger & Bremer, 2001)

As part of the first year of teaching, alternatively certified teachers also required continuous orientation that addresses all aspects of teaching, a handbook that includes resources and supplies, and a help hotline that provides solutions and connects them with other new and beginning teachers (Joerger & Bremer, 2001).

Ruhland and Bremer (2004) asked beginning CTE teachers about factors important to them in deciding whether or not to continue in the teaching profession. In this study, traditionally and alternatively prepared teachers were equally likely to remain in the profession, but that likelihood depended most on the degree to which the first year of teaching was a positive experience. Differences between why alternatively and traditionally certified teachers were likely to remain in the profession were found on three factors: sense of accomplishment, availability of a mentoring program, and recognition and support from a supervisor. Ruhland and Bremer concluded that these differences may be due to a lack of self-confidence experienced by alternatively certified teachers in their first year of teaching, indicating a need for additional support. If the first year of teaching is a positive experience, CTE teachers are more likely to remain in the profession.

In a study of the perceptions of alternatively certified CTE teachers toward their mentoring and preparation activities, Briggs and Zirkle (2009) reported that teachers valued a summer workshop experience prior to the first year of teaching and subsequent courses that focused on teacher tasks that included classroom and lab management, instruction, and making presentations. Visits from course instructors were also important to the beginning teachers. The study findings outlined teachers' top priorities for mentoring topics, including: planning, time management, student assessment, ways to prevent burnout, classroom management, and working with the political and cultural climates of their schools and districts. Teachers perceived mentoring to be most useful when the assigned mentor was from a similar content area, when duplication of course and employment materials was reduced, when paperwork was reduced, and when the mentors met with mentees on a regular basis.

Although the aforementioned research clearly indicated that beginning teachers and CTE teachers specifically express a need for better support in the first year of teaching, recent research from a study of comprehensive induction by Glazerman et al. (2008) concluded that mentoring and professional development do not make a significant difference in teaching practice, student outcomes, or career commitment. There is a vast difference in the experiences and knowledge of the beginning teachers who received induction services in the Glazerman study and the CTE

teachers for whom the proposed induction model described in this chapter is designed. Over 90% of the teachers in the Glazerman induction study were already certified to teach. They majored in education in college and participated in 11 or more weeks of student teaching, primarily at the elementary school level. Furthermore, the Glazerman comprehensive induction study focused on the mentor relationship and helping beginning teachers use evidence from their practice to recognize and implement effective instruction. The proposed model is a coherently integrated combination of professional development and support designed to scaffold CTE teachers' learning and maximize impact on teaching practice. The selection of specific induction activities and the quality of their delivery are essential to the success of induction models. Briggs and Zirkle (2009) highlighted the problem that exists today of poorly designed mentoring and induction programs that lack practical and research-based topics specifically designed for CTE teachers. Further research is needed to inform the field about the specific induction activities that will ultimately result in improved teacher performance and career commitment.

Conceptual Framework

The proposed intervention is an induction model that targets the malleable factors associated with high-quality induction programs through two primary components: on-going professional development and support. Professional development is designed to respond to the problem of inadequate CTE teacher instructional competence and self-efficacy in planning and delivering high-quality instruction. Support elements are designed to respond to the problems of isolation and dissatisfaction with school culture reported by teachers that leave the profession across all disciplines (Borman & Dowling, 2008; Brill & McCartney, 2008).

The induction model is designed to respond to conditions in the field. Those conditions include 105 different routes to certification for CTE teachers (Zirkle et al., 2007), dictating a wide array of entry requirements from state to state. At the same time, research on teacher attrition suggests that between 25-75% of new teachers leave the classroom within their first three years (Bottoms & McNally, 2005; Marvel et al., 2006). Finally, the vision articulated in Perkins IV demands that CTE teachers can plan, deliver, and assess engaging instruction that (a) integrates academic content, especially in reading and math, (2) ties to technical concepts and standards in the teacher's subject area, (c) connects with students' interests, talents, aspirations, and broader program of study, (d) helps students see how coursework is tied to all aspects of their industry, and (e) equips students with essential 21st-century skills. These conditions suggest the need for a new teacher induction model that could be adopted by states to increase the pedagogical skills of new teachers consistent with Perkins IV while mitigating some of the common drivers of teacher attrition by providing sustained school-based support to new CTE teachers in their first year.

Prior studies have identified factors that contribute to early career teacher attrition. Those factors include: (a) inadequate technical instructional skill (Baldacci, 2006; Lemov, 2010), (b) unsupportive professional cultures (Moore Johnson & The Project for the Next Generation of Teachers, 2006), and (c) low confidence or sense of efficacy (Tschannen-Moran & Woolfolk Hoy, 2001).

Drawing on prior research in the fields of teacher preparation and induction (Borman & Dowling, 2008; Brill & McCartney, 2008; Heath-Camp & Camp, 1990a; Joerger, 2003),

program developers adopted a basic conceptual framework for an induction model aimed to address teacher attrition, shown in Figure 2.1.

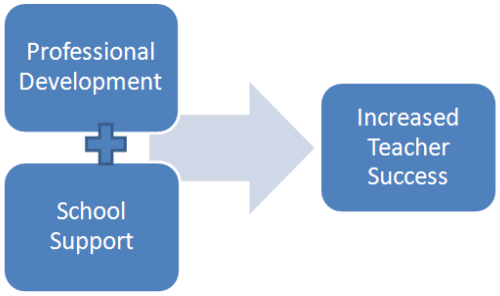


Figure 2.1. Basic conceptual framework.

Such a model has been implemented before with mixed results (Glazerman et al., 2008). Induction models nearly always provide professional development, although it is often not focused enough on technical pedagogy (Lemov, 2010); some induction models have combined professional development with collegial support through mentors and networking (Glazerman et al., 2008). To differentiate this conceptual framework – and therefore the induction model – from the basic framework, program developers further defined each element in terms of quality. As shown in Figure 2.2, it is the co*mbination* of high quality professional development and high quality site-based support by mentors, administrators, and coaches that program developers expect will yield increased levels of teacher instructional competence, self-efficacy, and career commitment, and therefore differentiate outcomes from this induction model from those of similar prior efforts.

Figure 2.2. Differentiated conceptual framework.

As shown in Figure 2.2, *high quality professional development* is defined as teacher learning experiences consistent with research on effective adult learning. Specifically, professional development must engage teachers with new content and experiences that include dialog with peers, application of new learning through authentic tasks, and reflection on their learning

(Mezirow, 1997). *High quality school support* is defined as regular structured weekly interaction between a new teacher and a qualified mentor and separate structured weekly interaction with an administrator; regular monthly interaction with peers through online learning communities; and quarterly observation and feedback from a skilled coach. Teacher *instructional competence* is operationally defined as performance in instructional planning, use of instructional strategies, assessment, and classroom management as measured by a validated classroom observation protocol. Teacher *career commitment* is defined as teacher self-report of intent to remain in the field of teaching for more than three years as measured by an instrument for assessing career commitment. Teacher *self-efficacy* is defined as the degree to which teachers feel they can influence students and their learning as measured by the Teacher Sense of Efficacy Scale (TSES) developed by Tschannen-Moran and Woolfolk Hoy (2001) and corroborated by teacher interviews and focus groups.

Components of the Induction Model

Professional Development

Teacher professional development is among the most comprehensively researched aspects of the schooling enterprise. The proposed induction model draws substantially on this knowledge base. Sparks and Hirsh (1997) reviewed the literature and best practices in professional development and identified the following characteristics of training most likely to lead to changes in on-the-job behavior, such as the training designed for the proposed induction module. Those characteristics include:

- Focused on individual and organizational development (DuFour, DuFour, & Eaker, 1998; Senge, 1999);
- Aligned with school and district strategic plans (Fullan, 2001);
- Focused on student needs and learning outcomes (DuFour et al., 1998);
- Job-embedded (DuFour et al., 1998);
- Facilitates teachers' study of their own teaching and learning rather than placing "experts" in the role of "transmitting" knowledge (Darling-Hammond & Sykes, 1999);
- Focused on both content-specific and generic instructional skills (Ball & Cohen, 1999); and
- Involves the principal as instructional leader to sustain growth (Fullan, 2001; Senge, 1999; Sergiovanni, 1999).

The interrelationship between training and organizational support is a strong theme and justifies the vital school support aspect of the proposed induction model.

The framework and content for the professional development component of the induction model, specifically aimed at increasing new CTE teachers' instructional competence and self-efficacy, was developed in the first year of the project. Four professional development modules were framed around the perceived needs of beginning teachers (Heath-Camp & Camp, 1990a, 1990b; Joerger & Bremer, 2001; Rochkind et al., 2007) and standards outlining what both beginning and expert teachers need to know and be able to do

(Danielson, 1996; Interstate New Teacher Assessment and Support Consortium [INTASC], 1992; National Board for Professional Teaching Standards [NBPTS], 1997).

The four professional development modules include: (a) instructional planning, (b) instructional strategies, (c) classroom assessment, and (d) classroom management. The framework for these modules is outlined in Table 2.1. These content areas respond directly to the need for new CTE teachers to be better prepared to deliver high quality, engaging instruction that integrates rigorous academic material with CTE content around intellectually demanding projects and activities (Hunt & Carroll, 2003; Joerger, 2003). Further, a significant component of all four modules focuses on assessing and addressing the diverse needs of all learners, thereby responding to the need for highly competent CTE teachers able to intellectually, emotionally, socially, and behaviorally engage all "students including special populations" (Perkins IV).

Table 2.1
Framework for Professional Development Modules

Module Title and Description	Module Outcomes—Areas of Teacher Instructional Competence
Module 1: Instructional Planning Effective CTE instruction is carefully planned to target the academic and technical skills within a career pathway that prepare students for both further learning and the workplace.	Create short-term and long-term standards-based instructional plans based on the varying learning needs of students. Specific Areas of Emphasis: • Plan instruction that reflects the new mission of CTE, supporting both college- and career-readiness • Set instructional goals that incorporate industry standards, 21st century skills, all aspects of an industry, and high-level academics (reading, writing, mathematics, and science) • Make instructional modifications for diverse learning needs • Plan collaboratively with colleagues, advisory committee, and postsecondary partners Reflect, both individually and collaboratively, on the effects of instruction and use the reflective process to continually improve instructional practice. Specific Areas of Emphasis: • Reflect individually with guiding questions and the use of a professional portfolio • Reflect collaboratively through the use of protocols for providing feedback and looking at student work
Module 2: Instructional Strategies Research-based instructional strategies engage and motivate students and deepen learning.	Use instructional strategies that actively engage students in learning and encourage the development of problem-solving, critical thinking, and teamwork skills. Specific Areas of Emphasis: • Use problem-based and project-based learning with real world place problems and tasks • Design intellectually demanding assignments • Use cooperative learning • Integrate academic skills, including embedded literacy and

Module Title and Description	Module Outcomes—Areas of Teacher Instructional Competence
	numeracy
Module 3: Classroom Assessment Assessment provides a clear picture of students' performance in relation to the standards, informing teaching practice and further learning.	Use formal and informal assessment strategies to evaluate student progress toward learning goals and provide feedback to improve student learning. Specific Areas of Emphasis: • Use formative and summative assessment methods that prepare students for workplace and postsecondary types of assessment (for example, employer and college-readiness exams) • Incorporate student self-assessment, especially through a portfolio of work • Use rubrics to clearly define assessment criteria • Create written exams that mirror standardized-assessment-type or employer-exam-type questions • Assess student progress in using reading, writing, and mathematics to solve problems and take action in the field • Develop a plan for grading and reporting student progress
Module 4: Classroom Management A well-managed classroom centers on respectful, collaborative relationships that support student learning.	Create a learning environment that encourages student motivation, positive behavior, and collaborative social interaction. Specific Areas of Emphasis: • Establish appropriate rules and routines for the CTE lab • Create a culturally responsive classroom • Offer rewards and recognition to encourage effective effort and increase student motivation • Design extra help to support all students in reaching standards • Communicate with parents and engaging them in supporting students' success

Concept papers were developed for each module, outlining content and the rationale for that content based on literature and best practice. These concept papers are included in Appendices 2A through 2D. Expert panels reviewed the concept papers, ensuring that the content was comprehensive and appropriate for a teacher induction program. Professional development sessions—detailed through a guide for participants and a guide for instructors—were designed for each module. The instructor guide includes an overview and objectives for units based on topics within the module and learning activities and objectives for each lesson. Presentation slides and suggested artifacts to support the learning activities have also been developed for the instructor. The participant guide includes an overview and objectives for each unit (also printed in the instructor guide), handouts to support the learning activities led by the instructor, planning forms, suggested activities beginning teachers can do with their assigned mentors and building administrators, and field activities for implementing and reflecting on the use of the plans developed in the professional development sessions. The module units and lessons are outlined in Appendix 2E.

In addition to the content of the modules, the professional development component of the induction model includes a suggested sequence and delivery to affect the intended outcomes of instructional competence and self-efficacy. The sequence of the modules is designed to provide support before, during, and after first-year CTE teachers begin classroom teaching through three phases: (a) 10 days of intensive instruction during the summer prior to the first year of teaching, (b) successive nine-week segments of application and reflection through delivery of instruction in their own classroom, aligned with each quarter of the school year, (c) three two-day workshops corresponding with each quarter of the school year that focus on refining and deepening understandings, and (d) 10 days of structured reflection, reinforcement, and revision in the summer following the first year of teaching. This sequence responds to the inadequacy of existing models of first-year teacher preparation that fail to provide adequate individualized support to new CTE teachers throughout the first year in the classroom (Alliance for Excellent Education, 2008). Providing such support addresses three problems: early career teacher attrition as a result of a difficult first year (Kapadia, Coca, & Easton, 2007; Smith & Ingersoll, 2004), longer time-to-competency of new teachers (Villar & Strong, 2007), and the varying needs of the widely diverse population of adult learners that are CTE teachers.

In addition to addressing the content and sequence of professional development, the induction model also outlines, through the instructors' and participants' guides for each module, specific delivery methods that reflect the primary principles of adult learning (Knowles, 1975; Knowles & Associates, 1984) and model instructional practices that teachers will be expected to use in their own classrooms. Instruction will incorporate cooperative learning, as well as project- and problem-based learning (Merrill, 2007; Schmidt, 1993). Cooperative learning provides an opportunity for social interaction and social construction of knowledge and skills among the adult learners. The module instruction is organized around projects that involve the complex tasks of teaching, engaging beginning teachers in problem-solving, decision making, and investigative activities, and providing the opportunity to create realistic products that they will actually use in their classrooms (Jones, Rasmussen, & Moffitt, 1997; Thomas, 2000; Thomas, Mergendoller, & Michaelson, 1999).

The first summer session (10 days) includes the most essential concepts from each topic that the teachers need in the classroom, including curriculum and instructional planning, how to get to know students, and how to set the right tone. These topics have immediate relevance and applicability to their first weeks on the job. Teachers plan out the first nine weeks of instruction in some depth and craft a skeleton outline of instruction for the next nine weeks. They also identify a significant, authentic activity, problem, or project that would cover at least 10 days of instruction and involve problem-based learning. As they plan that problem, project, or activity unit, they identify the embedded literacy and mathematics skills and look for instructional strategies and methods for enhancing those components. Additionally, they learn how to assess students' performance using both paper-and-pencil and performance assessments, focusing on technical skills, literacy and mathematics. All of these instructional design choices are made for the purpose of best preparing teachers for their first days and weeks on the job where they have an opportunity to test their new learning in the authentic environment of their classroom, consistent with research indicating that adults learn best when they can apply and reflect on their

learning (Knowles, 1975; Mezirow, 1997).

Support

In addition to professional development, the induction model provides beginning CTE teachers with the support of a mentor, coaching from the professional development instructor, the support of their principal or school administrator, and participation in on-going communities of practice through electronic conversations and guided reflection.

Mentoring. As a result of their research, Heath-Camp, Camp, Adams-Casmus, Talbert, and Barber (1992) and Joerger and Bremer (2001) recommended a structured mentoring program for providing support and encouragement. In a literature review on beginning teacher induction, Serpell and Bozeman (2000) found that many researchers regard mentoring as the most critical component of induction programs, with teachers regarding it as one of the most helpful parts of induction. The review also pointed out that those new teachers who had mentors said they were more prepared and more likely to stay in teaching. Smith and Ingersoll (2004) found that teachers who had mentors in the same subject field and who collaborated with other teachers were more likely to stay in teaching after their first year. Mentoring relieves the isolation many new teachers feel and provides them with collaborative problem-solving, emotional support, motivation and encouragement, and information and suggestions (Joerger, 1997). The literature is very clear that mentors themselves must be veteran teachers who are rigorously selected; that there should be administrative support for the mentoring; and that contact between the mentor and the beginning teacher should occur at least weekly, if not daily (Allen, 2003; Burk, Ford, & Mann, 1996; Feiman-Nemser, Carver, Schwille, & Yusko, 1999; Feistritzer & Chester, 2000; Hunt & Carroll, 2003; Villar & Strong, 2007; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007; Zeichner & Schulte, 2001).

In the proposed induction model for CTE teachers, trained mentors address the problem of CTE teacher dissatisfaction with teaching and school culture (Rowley, 1999). Each new CTE teacher participating in the model has a mentor who is a master teacher at his or her school. All teachers selected as mentors participate in a two-day training session to prepare them to support new CTE teachers. The mentor training focuses on developing skills as mentors of CTE teachers, providing explicit guidance on how to differentiate mentor support to new teachers early in the school year and during subsequent months. Each mentor's strengths and experiences are assessed and the mentor training adapted to meet the needs of the mentors. Mentors participate with the new teachers in the CTE induction training and in the follow-up training. In addition, mentors also work with the instructor and participate in the community of practice as a way to further strengthen and polish their skills. During the school year, mentors meet with the new teachers for at least 15 to 20 minutes each day for the first month and then for an hour per week during the rest of the school year to discuss critical issues that have arisen. They also participate with their beginning teacher in the electronic communities of practice and monthly webinars.

Coaching. The induction model includes a coaching component to undergird the mid-year instructional support element. The coaching component of the model recognizes that the problems of practice new teachers encounter are not solved solely through training. Technical assistance and coaching are necessary to help new teachers translate their own learning about

how to deliver quality instruction and manage classrooms into effective classroom strategies in practice (Yoon et al., 2007). The instructors from the initial summer workshop also fulfill the role of instructional coaches for new teachers. The instructor acting as coach returns three times during the year before each follow-up workshop to determine how well the new teacher is implementing what he or she is learning and to seek evidence that the practices teachers are learning at each training session are being put into place. The instructor communicates with the mentor and local administrator prior to each school visit to discuss what would be most helpful to the new teacher during the visit.

The instructor in the role of coach observes the new CTE teacher's classroom instruction, particularly in view of the four strands from the training, observe any gaps that need to be addressed, and provide a written critique with suggestions on how to continuously improve in each area and address gaps. The instructor in his or her role as coach seeks evidence that the administrator and mentor are supporting the new teacher and gives suggestions for further support. The instructor as coach is expected to meet with the new teacher, the mentor, and the administrator to engage in a professional dialogue on the new teacher's successes in the classroom, gaps or challenges in implementing the new knowledge and skills, and necessary adjustments for addressing these gaps. Finally, the instructor in the role of coach identifies issues and topics that can be dealt with at the follow-up weekend workshops and determine how the initial training can be improved and modified to better meet the needs of the beginning teachers. All instructors use a common format when they conduct coaching visits and a common rubric to describe their findings on the new teachers' accomplishments, challenges, plans, and the presence and quality of support from the administrators and others.

Communities of practice. Encouraging the development of professional networks and communities of practice responds to two aspects of the problem this proposed induction model is designed to address. The first of those problems is the instructional competence and self-efficacy of teachers. Engagement in communities of practice is known to contribute to meaningful adult learning (Mezirow, 1997), maximizing learning outcomes from the professional development modules. The second problem the induction model is designed to address is organizational support. Teachers benefit from being able to learn and grow through collaboration in professional learning communities (Ball & Cohen, 1999; Borko, 2004; Stone, Alfeld, & Pearson, 2008). Sharing experiences in a group is also important for adult learning (Knowles & Associates, 1984). New teachers also benefit from a peer support group limited to beginning teachers and including meetings, listservs, and other mechanisms to discuss common experiences, successes, challenges, solutions, and resources (Heath-Camp et al., 1992; Joerger & Bremer, 2001). Communities of practice create a collegial environment that can meet teachers' needs for encouragement and a sense of belonging, thereby reducing feelings of isolation that may lead new teachers to give up and leave the classroom.

In the proposed induction model, instructors play a key role in building a community of practice around the knowledge and skills participating new teachers are developing. In addition to the workshops throughout the year, beginning teachers participate in electronic coaching that includes reviewing (on a monthly basis) new teachers' electronic reflective journals. In these journals, new teachers describe what worked each week, what did not work, new insights they gained, where they are having difficulties, where they need help, what they plan to do in the

following week to try to address issues that have emerged and how they hope to build on their successes for the coming week. At the end of each month, teachers are asked to review their entries and summarize the big ideas learned over the course of the month, deficits they still need to address, and how they plan to address them. These journals add an important reflection for the teachers and a qualitative dimension that will assist the evaluation of the project implementation.

The community of practice is further supported by listservs and blogs. These tools, in addition to teachers' reflective journals and coaching visits to participants' schools, serve to identify a list of difficulties or challenges that the participating new teachers are having; prioritize them; research their solutions; and develop a webinar (an online seminar/workshop) on one topic each month. During each webinar, new teachers and their mentors have 15-minute intervals to discuss how the new teachers can incorporate the research-based practices and strategies in their instruction to address the difficulties. The intent is for new teachers to walk away with a clear idea of how to solve the problems they encounter.

Administrator and school system support. The problems of teacher instructional competence, self-efficacy, and career commitment are ultimately problems that school districts and schools own. New teachers especially need to feel supported by administrators and colleagues. This includes time allotted for preparation, collaborative planning and peer assistance, and supportive and timely feedback (Hunt & Carroll, 2003; Stigler & Heibert, 1999; Yoon et al., 2007; Yopp & Young, 1999). Indeed, research suggests that the problems of career commitment of CTE teachers are likely the result of school systems (Camp & Heath-Camp, 1991). The induction model requires buy-in and support from district and school leaders (Szuminski, 2003). Such buy-in ensures:

- Teachers' attendance at the training to learn and subsequently implement the practices learned is a priority for the school and district.
- The school in which the teacher works has planned to support implementation of the practices learned.
- The district is committed to supporting teachers as they attend training and return to the school site to apply what they learned
- Participants in the training know why they are there and understand what they are expected to do to prepare for the training and what they must do when they return to their schools.

The administrator support element of the induction model addresses the key aspect of ensuring the success of the participating CTE teachers. The designated administrator supervising the beginning teacher participates in two days of training during the 10-day summer institute along with the mentor assigned to the beginning teacher. The supervising administrator is expected to meet with the mentor and the new CTE teacher at least monthly to discuss implementation of what the teacher learns in the training. The supervising administrator is also expected to visit the new CTE teacher's classroom weekly for the first month (then monthly) and observe classroom practices, using a checklist targeted around the four strands from the training. The supervising administrator meets with the teacher and the mentor to provide feedback. In addition, the supervising administrator is expected to support the time needed for the new teacher and mentor teacher to meet and encouraged to be supportive in an informal way (e.g., when meeting in the

hallway, asking how it's going and what support is needed).

Methodology

Theoretical Framework for Research Approach

To conduct investigation of the field test, and to generate data that can be used to successively develop and revise the induction model, program evaluators looked for a theoretical framework to provide methodological guidance. The framework selected was a "design research" approach (Middleton, Gorard, Taylor, & Bannan-Ritland, 2008). Design research is characterized by a seven-phase cycle of inquiry that Middleton et al. (2008) called the "'compleat' design experiment." The aim of the design experiment is to investigate the relationship between the intended function of an intervention, the design or form of the intervention, and the behavior resulting from the intervention. The field test reported here fits into the cycle at Phase Four, which involves prototyping and trials using an "iterative, progressive and disciplined" approach (Middleton et al., 2008, p. 32). Middleton et al. (2008) wrote, "The articulation of the hypothetical structure to be investigated is critical for a design experiment to be truly an *experiment*" (p. 34). Accordingly, the aim of the inquiry is not only to generate data that can be used to make revisions to the teacher induction materials and delivery, but to refine the theory of change based on learning that emerges through field testing.

Using this approach ensures that in successive rounds of testing and revision, program developers can explain how the model contributes to outcomes. This is a key departure from traditional approaches using experimental design and was, in part, a response to the guidelines for Institute for Education Sciences (IES) Goal 2 development and innovation projects (Albro, 2010). Independent of Goal 2 guidelines, however, these methods remain the most appropriate for developing a "product" (a finished set of materials that comprise an induction model for new CTE teachers) over the course of three years for which the small numbers of teacher participants involved render an experimental design and/or use of inferential statistical procedures unreliable, inadequately nuanced, and poorly aligned to research questions.

Purpose and Research Questions

The induction model is being developed through three rounds of field tests. The first round focused on the content and delivery of the professional development modules. Subsequent years will include a field test of the full induction model and a state-led field test of the model to determine feasibility of implementation. Data from each field test will be analyzed and used to improve the model. In this chapter, the data from the field test of the professional development modules is reported. This field test occurred during the 2009-2010 school year. The field test was guided by three objectives: (a) to test the theory of change on which the induction model is based, (b) to identify content revisions to the instructional module delivered, and (c) to identify structural revisions to the design of the overall induction model. Six research questions guided the field tests:

1. Are module materials relevant, usable and clear? If not, why?
2. Is the scope of module content reasonable? If not, why?

3. Is the delivery of modules consistent with research-based adult learning principles? If not, why?
4. Do teacher participants produce artifacts reflecting the intended outcomes of each module were achieved? If not, why?
5. Are our assumptions of what constitutes "teacher instructional competence" appropriate for first and second year CTE teachers? If not, why?
6. Do the measures used during the first year of field tests generate the kind of information needed to tell us that the model is working as intended? If not, how do they need to be revised?

Methods and Procedures

Evaluators developed a design to generate multiple data sources to inform each research question (see Table 2.2). Participants were selected by state agency partners. Program developers provided partners with the following criteria as guidelines for selecting participants:

- Candidates should meet all basic requirements to participate in a state-approved route to alternative certification in CTE;
- Candidates should exhibit basic mastery of the content area in which he/she will teach;
- Candidates should have one or fewer years teaching experience;
- Candidates should contribute to the diversity of the group by content area expertise, professional experience, postsecondary education level, expected teaching setting (e.g. comprehensive high school or technology center), and personal characteristics; and
- [Added for Field Tests 3-4] Candidates should possess advanced mastery of basic literacy and numeracy.

Description of Data Collection Methods

***Observation*.** Evaluators observed all four field tests, making entries in a log to record levels of participant engagement based on observation of body language and on- or off-task discussion. These logs were used to illuminate other data sources, such as the participant quick cards, to illuminate what was happening in the classroom at specific times throughout the field test. In addition, state partners (personnel from CTE divisions at the state department of education) as well as CTE teacher educators from local universities observed each field test and completed a structured observation journal.

***Quick cards*.** In order to capture participant response to specific segments of training with as much fidelity as possible, evaluators developed "quick cards" to be administered at the end of each segment of instruction, approximately every 60-90 minutes throughout the three days of training. Cards were coded with participant IDs. At the direction of evaluators, participants paused to "card," requiring that they record the specific time called out by evaluators and rate the immediately preceding segment of training on four dimensions of adult learning quality: (a) relevance to their classroom, (b) opportunities for dialog with peers, (c) opportunities to apply learning, and (d) adequacy of time devoted to the segment. The ratings were on a scale of 1 to 6 with 1 the lowest and 6 the highest.

Table 2.2
Year 1 Research Matrix: Evaluation of Content, Scope, and Relevance

Research Question	Observations	Quick Cards	Pre-Post Constructed Response	Pre-Post TSES	End of Day Evaluation	Teacher Focus Groups	Instructor Debriefs	Expert Panel
Is content relevant, useable, clear?	X	XX			X	X		
Is the scope of content reasonable?					X	X	X	
Is it delivered consistent with adult learning principles?	X	XX						
Do artifacts reflect intended outcomes?			X	XX				
Are our assumptions of "teacher instructional competence" appropriate?						X	X	
Do our measures function as we need them to?								X
Population/Sample	Evaluators and Observers		Teacher Participants				Instructors	Expert Panelists

Pre-post tests. A pre-post test 'battery" was administered to all participants and included three elements: (a) constructed response items created for each of the four field tests, based on expected learning outcomes defined by program developers; (b) demographic information including open response questions asking about participant motivation to become a teacher, and (c) the Teacher Self-Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001), a validated instrument that measures teacher self-efficacy using three subscales: efficacy in student engagement, efficacy in instructional strategies, and efficacy in classroom management. Evaluators experimented with different models of administration of these over the year before settling on the optimal arrangement of administering the pretest electronically prior to arrival at the training, and administering a paper-and-pencil posttest at the end of the third day of training to ensure maximum participation rates. Teacher self-efficacy scale results are reported in Appendix 2F.

End-of-day evaluation. At the end of each day of training, participants completed an end-of-day evaluation that asked participants to rate the following elements on the whole for each day: concepts presented, binder materials, activities, and overall value. The instrument used seven semantic differential scales on which participants were asked to rate each element: clear/confusing, realistic/unrealistic, engaging/boring, relevant/pointless, useful/useless, organized/scattered, and challenging/easy.

Focus groups. Every teacher participated in a 60-90 minute focus group on one evening during the three-day training. Participants for each focus group were purposefully selected to ensure racial and gender diversity. The focus groups during the fourth field test were selected to distribute personalities that tended to dominate conversation, based on experience with that cohort during the third field test. Protocols were modified slightly to conform to the specific content of each field test; however, the purpose of the protocol was to identify areas of strength in the modules and areas that need improvement with a view to identifying the underlying needs of new CTE teachers that were either met or not met through the modules. Participant insights regarding sequence of content were also solicited. Focus group protocols, as well as protocols for the instructor debriefing are included in Appendix 2G.

Instructor debriefs. At the end of each field test day, instructors were debriefed using a brief structured interview protocol designed to uncover expert assumptions, particularly those on-the-fly decisions that expert instructors make that deviate from planned activities. Instructors were also asked to identify aspects of the training that they felt were most successful and to reflect on what they felt teachers learned, identifying the evidence (what did they see or hear) that led them to their conclusions.

Observer interviews. Observers were also interviewed at the end of each day with two questions: what learning objectives do you feel teachers learned today, and what did you see or hear that tells you they learned this?

To address Research Question 6, a panel of national experts was convened twice to review the overall evaluation design and instrumentation. The panel was comprised of published scholars with expertise in using design research to develop teacher preparation experiences, evaluating large scale alternative teacher certification efforts, CTE teacher education, and general program evaluation. The panel provided substantial feedback that contributed to revisions to the instrumentation over the course of the year.

Data Analysis

All interviews, focus group transcripts, and constructed response items were analyzed using qualitative open coding (Corbin & Strauss, 2008; Miles & Huberman, 1994). Simple paired samples *t* tests were conducted on the pre-post data from the Teacher Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001). All TSES items were entered into SPSS and were analyzed using basic statistical tests of mean differences.

Findings

Analysis of data from each field test generated myriad findings that program developers used in successive cycles of revision and retesting over the course of the year. Selected findings that emerged in all four field tests are reported here. Findings fall into four categories: characteristics and needs of participants, strategies that enhanced participant learning, planning logistics and content of professional learning, and methodological findings.

Characteristics and Needs of Participants

The content of the modules was field tested between June 2009 and February 2010 in a series of four sessions each including three, six-hour days of training. Two of the four field test sessions were held in Oklahoma and two were held in South Carolina. A total of 46 teachers participated, representing different levels of education, work experience, and CTE content area (see Table 2.3).

Table 2.3
Demographic Characteristics of Field Test Participants

Characteristic	*n*	%
Gender		
Male	24	52
Female	22	48
Race/Ethnicity		
White	35	76
American Indian	7	15
African American	5	11
Hispanic	1	2
Age		
Less than 25	2	4
25-34	17	37
35-44	13	28
45-54	10	22
55-64	4	8
Highest Level of Education		
High School only	1	2
High School with professional training	13	28
Associate's Degree	5	11
Bachelor's Degree	19	41
Beyond Bachelor's Degree	8	17
Subject Area		
Agriculture and Natural Resources	3	6
Arts, Audio, Video Technology and Communication Services	4	8
Construction	7	15
Education and Training Services	2	4
Health Services	9	18
Hospitality and Tourism	2	4
Human Services	5	11
Information Technology Services	5	11
Legal and Protective Services	1	2
Manufacturing	3	6
Transportation, Distribution, and Logistics Services	3	6
Scientific Research, Engineering and Technical Services	1	2

Note. Some participants self-identified more than one racial/ethnic category.

Two findings emerged primarily from analysis of focus group transcripts regarding the characteristics and primary concerns of the participants in these field tests. The first finding speaks to the level of basic literacy and numeracy skills found within this group of alternatively certified CTE teachers. The second finding emerged without prompting in multiple focus groups, pointing to the key challenges and concerns facing these new CTE teachers.

Oklahoma's state policy for recruiting alternatively certified CTE teachers introduces virtually no barriers to entry, including no minimum score requirement on tests of basic skills. Accordingly, participants in the two Oklahoma field tests demonstrated a wide range of basic literacy and numeracy skills. Observations by instructors and guest observers suggested that the concepts of integrating academic content such as literacy and numeracy skills were especially challenging for these CTE teachers, some of whom did not have strong mastery of those basic skills themselves. The participants indicated awareness of this during focus groups. Referring to a text on project-based learning, one participant said, "There were a lot of large words in there that could have been re-worded in another way. I can't tell you those words because I didn't know the meaning of them. And that went kind of rough. A lot of us are not college people, okay? We worked in the field for 25-30 years. I'm just stating that. And some of those larger words probably need to be put in more of a layman's terms." Other field test groups noted concern regarding the cognitive demand of integrating academic content into CTE instruction as part of the constellation of skills expected of a brand-new teacher, noting that teachers are not likely to be receptive to instruction in doing this until the second half of the first year.

Regardless of their pre-existing levels of basic skills, all field test groups of teacher participants indicated that what is foremost on their minds is how to motivate students and manage their classrooms. One focus group participant said, "My biggest battle right now is keeping the kids interested. We can write rubrics until we're blue in the face, and write lesson plans, and write long-range plans, and write critical maps and all this stuff. But, for whatever reason, it's just keeping the kids' interest and motivation." The verbatim phrase, "You can lead a horse to water but you can't make them drink," came up independently in several focus groups.

Professional Development Characteristics and Strategies that Enhanced Participant Learning

Data suggested three strategies used by program developers were particularly effective in supporting participant learning: (a) use of examples in participants' content areas, (b) use of "floating" one-on-one and small group coaching during cooperative learning segments, and (c) facilitated small group discussion in the afternoon or evening to structure reflection. Based on feedback from the instructors, observers, and participants, many learning activities were revised to fit the audience, to provide more time for reflection, or to clarify content. For example, a lesson was added on asking classroom questions based on comments from observers and module reviewers. The literacy lesson was expanded to include sample literacy assignments such as reading technical journals, writing each week in class, and assigning a basic report as part of a project.

Participants in the first focus group raised program developers' awareness of the importance of linking the content of the modules to specific examples tied to their CTE content areas. One participant said, "I need more specific training in the areas I teach," whereas another participant stated plainly, "I really can't use the material I learned here because it is not connected to my content." Following that feedback, program developers took explicit steps to determine the content areas of participants in advance of subsequent field tests, and put together resource binders with content-specific examples for every teacher's content area. In the focus group for the third field test, participant comments suggested this change was having its intended effect. One participant noted, "You go to other trainings and [what they present] doesn't really apply [to me]. It's overall, generalized teaching strategies. You come here and it's reversed. Here, you sit down and you have people who understand what CTE teaching is…and say, 'This is how you apply this to your classroom.'"

With regard to coaching, several data sources suggest that teacher learning is best supported when there are coaches to move among small groups during cooperative learning segments. Participant interviews and focus groups both yielded strong agreement that this was an important aspect of learning for them that helped to "individualize" instruction. The quick cards show spikes in relevance, dialog, and application following segments where there was small group-coach interaction (See Figure 2.3).

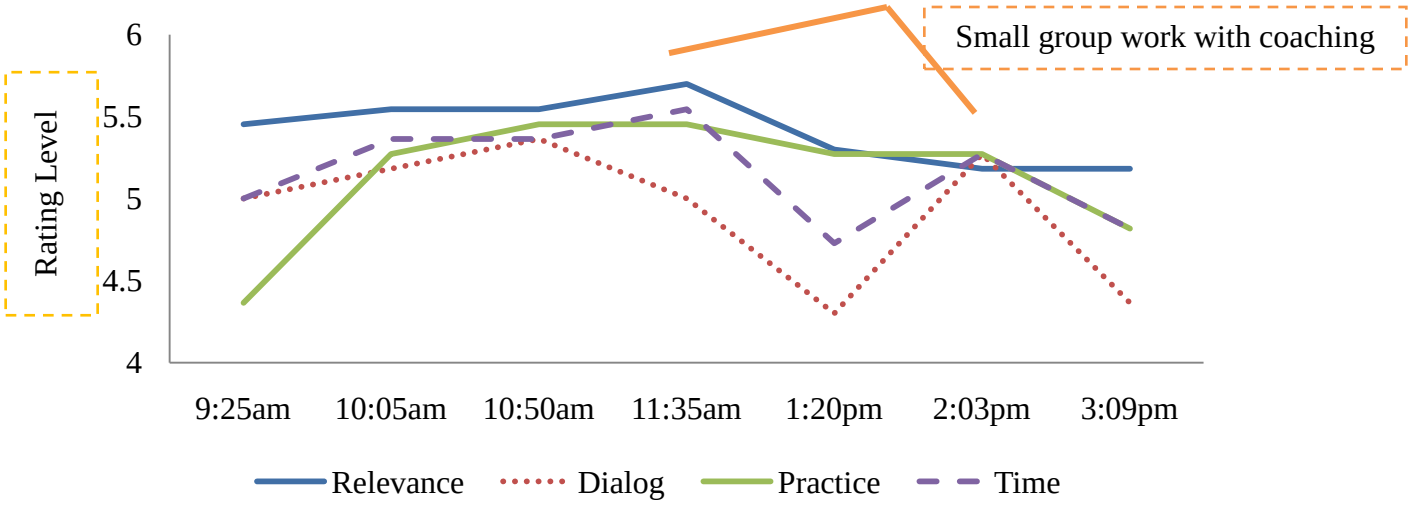


Figure 2.3. Quick card ratings of adult learning quality from Day 1 of Field Test 2.

Participants in the focus groups noted that the coaches do not have to have content expertise in their CTE area, but only expert knowledge in the process – whether it is rubrics, testing, or instructional strategies. Observers noted that although the cooperative learning strategies used throughout the modules are consistent with adult learning principles, they were not equally effective for all groups, particularly those that do not receive a visit from a coach/instructor during their small group discussion.

Finally, facilitated discussion following the formal training agenda helps teachers further process their new knowledge. Though participants liked a brisk instructional pace, they indicated in focus groups that having an informal but semi-structured time to debrief, "process," and "digest"

what they learned was tremendously beneficial to their learning and to facilitating connections among participants. During the field test, the focus groups performed this function.

Planning Logistics and Content of Professional Learning

Feedback from teacher-learners, as well as from state agency administrators in planning modules, underscores how important it will be to select optimal days and times for the three two-day follow-up sessions during the 2010-2011 school year. School holidays, end-of-term grading periods, and other school-based demands on teachers must be balanced with limited school resources for substitute teachers to cover participants' absences.

Across all four field tests, teachers identified key elements of the modules that they felt would be necessary for new teachers prior to entering the classroom. Those elements were segments on: (a) the use of rubrics, (b) formative and summative assessment, (c) how to use the table of specifications to align their instructional goals and assessments to technical standards and 21st-century skills, (d) getting to know students, (e) engaging students in developing classroom rules and procedures, and (f) the twelve classroom management scenarios.

Methodological Findings

The expert panel reviewed the model's design and instrumentation twice during the first year of field testing. Recommendations from the panelists focused on enhancing the qualitative methodologies to generate more descriptive data, including adding interviews of individual participants and adding detailed questions to protocols for observers and instructors regarding their observations of participant learning.

Panelists also interrogated the use of teacher retention as a measure of program impact given the influence of the current economic climate and the short time frame for the project. In lieu of retention data, panelists recommended the use of measures of career commitment as a more accurate proxy for the outcome the program aims to achieve, and further suggested adding a school climate measure to the evaluation design to account for other, more powerful influences on teacher attrition. Evaluators are incorporating all of these suggestions into the evaluation design for the coming year.

In addition to findings generated by the expert panelists, evaluators captured key challenges to implementing the design methodologically. The original design of this model included a selection process that would allow for basic skills testing as well as pretesting. However, the constraints of how new CTE teachers are hired interfered with implementation of rigorous selection methods. Specifically, because there is a very compressed timeline between date of hire and the beginning of the first 10-day summer institute offered as part of the induction model, the amount of time available to vet teacher applicants ranges from 0 to 10 days. It also introduces methodological challenges in generating a pre- measure of teaching. Accordingly, as the project moves forward, a cross-sectional design will be employed to compare measures of teacher participants early in their first year with measures of a comparison group of teachers who do not participate in the induction model.

This same challenge has implications for the underlying stance of the project in terms of what kinds of teachers program developers aim to support. Some programs like Teach for America use rigorous recruitment and selection methods to screen out all but the "best and brightest" with the most potential for success. The timing challenges that emerged in preparing the field test helped program developers to clarify that this induction model is designed to raise the bar across the board, for all teachers, not just those who show exceptional potential. This will have implications for the research design because it will be more difficult to show improvement on average. Accordingly, in coming years, program evaluators will focus on creating "rich, thick descriptions" of each individual participant to enable better analysis of how elements of the induction model interact with individual characteristics.

Implications

The year-long field testing process reported here was the beginning of a three-year effort to develop and refine a model of new CTE teacher induction. At this stage, it was not the intention of program evaluators to produce findings that could speak to the success of this training effort in equipping teachers with teaching competency or self-efficacy. However, early findings can still be of use to researchers or program developers who are undertaking similar projects to support new CTE teachers. Two particular findings have implications for program design and research methodology.

One such finding emerged from the discovery of state practices that influence the hiring, and therefore the selection, of possible participants for a two-week residential summer program. Because implementing a meaningful selection process for participants in a summer institute would require identifying prospective teachers in the spring, it is likely that participants will either not be brand-new teachers, or that participants will not meet more rigorous selection criteria (because there is not enough time to "weed out" applicants who do not meet higher standards). Program developers can plan for either contingency depending on what conditions and priorities prevail in a given state. If it is the former, where participants have already completed a year of teaching, some elements of professional development could be eliminated, such as how to organize the classroom, whereas other elements could be more deeply explored, such as how to integrate academic content into CTE coursework. If the hiring date is late in a given state, it is likely that some participants will come to the summer institute with low-level basic skills and accommodations will need to be made in instructor vocabulary and reading and writing assignments for teacher participants.

In terms of methodological implications, the individualized "rich, thick" profile approach that program evaluators of this induction model will take in future field testing iterations is likely the best research approach for any multi-state effort. The reason for this is the discovery that not only are there substantial differences in existing state requirements and support between states, but there are dramatic differences in support offered to teachers of different content areas within a single state. When levels of state support and training are high, it would be difficult to distinguish between the effects of this induction model and the effects of state support. Using a case study approach to explore and compare the experiences and outcomes of individual teacher participants in light of their content areas, years of classroom experience, years of industry experience, and other state- or university-provided support and preparation, among other factors,

is more likely to detect program influence than a large-scale statistical model until more reliable measures of teaching are developed that could be used as the basis of a value-added model. In either case, the costs of conducting such an inquiry are substantial. Selecting representative cases to include in an in-depth case study approach can keep costs down, although having to hire consultants or train principals to conduct teacher observations with adequate inter-rater reliability can drive costs up for a large-scale statistical approach.

Following the field test of the full induction model in 2010-2011, two states will be selected to lead field tests of the full induction model with their own facilitators and a second cohort of beginning teachers in 2011-2012. Project staff will train these facilitators during the 2010-2011 field test. These tests of the model will provide some idea of the feasibility of this model to be implemented at the state level.

With subsequent revisions based on the data from the field tests, the resulting fully developed set of materials and processes for the induction model will be ready to be implemented to scale in 2012. Results of the field test will be published with the goal of informing the field. Technical assistance to states, districts, and community colleges will be available on the use of the materials to shape or improve their own programs.

Chapter 3

Professional Development for Teachers and Administrators on the Use of Assessment Data

The term "data-driven decision making" has become ubiquitous in education, and yet it seems to be most often discussed with reference to policy decisions related to reporting requirements and accountability. Deserving at least equal attention, according to Boudett, Murnane, City, and Moody (2005), is the ability of teachers and administrators to use student assessment results to determine student skills and instructor effectiveness and then use the results to improve overall instruction. Yet not a great deal of research has been reported on this topic, and very little appears in the literature about career and technical educators' use of assessment data, particularly as it relates to program and instructional decisions. Although the term *assessment data* can be very broadly defined, the primary focus of the study reported in this chapter was on standardized summative assessments. In addition, although several forms of data were addressed, the main focus was on technical assessment, relevant because it is required by Perkins IV.

The purpose of the first year of the NOCTI study was to determine through descriptive survey research how secondary CTE educators use technical assessment data to improve program curriculum and to identify individual and group instruction needs. Of particular interest were how they learned to make use of the data, what specific types of professional development were provided if any, their perception of the effectiveness of this training, and finally what types of professional development they would consider most effective for the future.

In the second year, the results of the Year 1 research were used to inform the creation of a professional development program for secondary CTE teachers and administrators on how to effectively interpret assessment data and use that information to make instructional improvements in the classroom. The developed intervention included the materials necessary for implementing the training, a facilitator/delivery system for maintaining the system within the school setting, and a preliminary pilot test evaluation of the effectiveness and feasibility of the program. The purposeful sample for the first-year survey research targeted CTE educators in five states (Illinois, Missouri, Oklahoma, Pennsylvania, and Virginia) and included a representative sample of secondary programs in both career-technical centers and comprehensive high schools. Within those states and schools, educators were targeted in four occupational clusters (Business Education, Construction, Health Science, and Manufacturing). State and cluster selection information is discussed in a section to follow on Year I.

With the increasing emphasis on the use of standardized tests for reporting on school, teacher, and student achievement, the true purpose of testing (program and student improvement) could be lost or buried under the need to use the results for reporting and rating purposes. An understanding of assessment data, including their interpretation and uses, can encourage teachers who have used data for classroom improvement to continue to do so and help those who have not used them see the value in using test data for classroom improvement beyond mere reportage. This is supported by the findings in the survey; of those educators who indicated that their opinion of testing had improved, several commented that the main reason for the change was a better understanding of tests and the use of assessment data. The more teachers understand the

process and function of assessment, the more they are likely to see it as a tool rather than a threat (Cromey, 2000).

Characteristics of the desired and needed professional development were identified by the survey and a continuous literature search process, as well as a series of case studies of schools' successful use of data for instructional improvement. As the research indicates, effective professional development for teachers must be of a relatively long duration, strongly contextualized, collaborative, activity-based, include an emphasis on analysis and reflection, and be connected to comprehensive change processes focused on improving student learning (e.g., Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Smith, Hofer, Gillespie, Solomon, & Rowe, 2003; Wayman, Midgley, & Stringfield, 2005). However as Smith et al. (2003) indicated, effective professional development alone is unlikely to result in productive long-term change unless other factors are taken into account, such as time and resource availability, organizational support, and the feasibility of implementation and continuation of learning within the school system.

The goal of the intervention developed was to create and pilot professional development for CTE teachers on the use of technical assessment data for data-driven decision making that is both based on sound principles of learning and delivered in a manner that is sustainable within a school system. For the cycle to be complete, it is imperative that teachers be able to diagnose problems by looking at evidence (data) and then receive training to be able to plan instructional modifications around that evidence (Butler & McMunn, 2006).

The intervention developed as part of this study involves multiple stages, illustrated in the chart below, which is adapted from a model suggested by the Institute of Education Sciences (IES, U.S. Department of Education, 2009b). Several of the stages overlap in time and include (a) the development and refinement of the professional development training, including content matter, structure of the training (including layout, exercises, etc.), delivery, and related facilitator materials, (b) the selection and development of measurements to assess the effectiveness of the learning and the successful application of that learning to the classroom, (c) the selection of appropriate pilot sites, (d) the selection of facilitators/coaches, (e) the administration of the training and coaching, and (f) the initial evaluation of the program process and effects. Figure 3.1 below lays out the intervention, the theory of change applied, and associated resources, activities, outcomes, and measures.

A total of nine secondary CTE school sites in the sample of five states were selected to pilot the professional development on the use of assessment data. An administrator and team of teachers from the targeted four clusters were identified at each site. Some of the sites participated in Round 1 of the pilot and others in Round 2, which was planned to start a month later so as to allow for the application of learning from Round 1, in consonance with the principle of continuous iterative refinement of the intervention.

Facilitators selected for their ability to engage participants in the topic provided the highly interactive, project-based initial training. Unique aspects of this intervention are the opportunity for participants to work with data from their own students (via technical skills pretests donated by NOCTI) and to work with a cohort of peers to develop action plans that relate to their specific

schools and classrooms (Wayman & Cho, 2008). After the initial training, participants were coached over several months in their school environment by the same facilitators who provided the training. Educators were also encouraged to interact with others who were receiving the professional development, thus forming a professional learning community, which has been shown to be helpful for learning and growth through collaboration (Ball & Cohen, 1999; Borko, 2004; Stone et al., 2008).

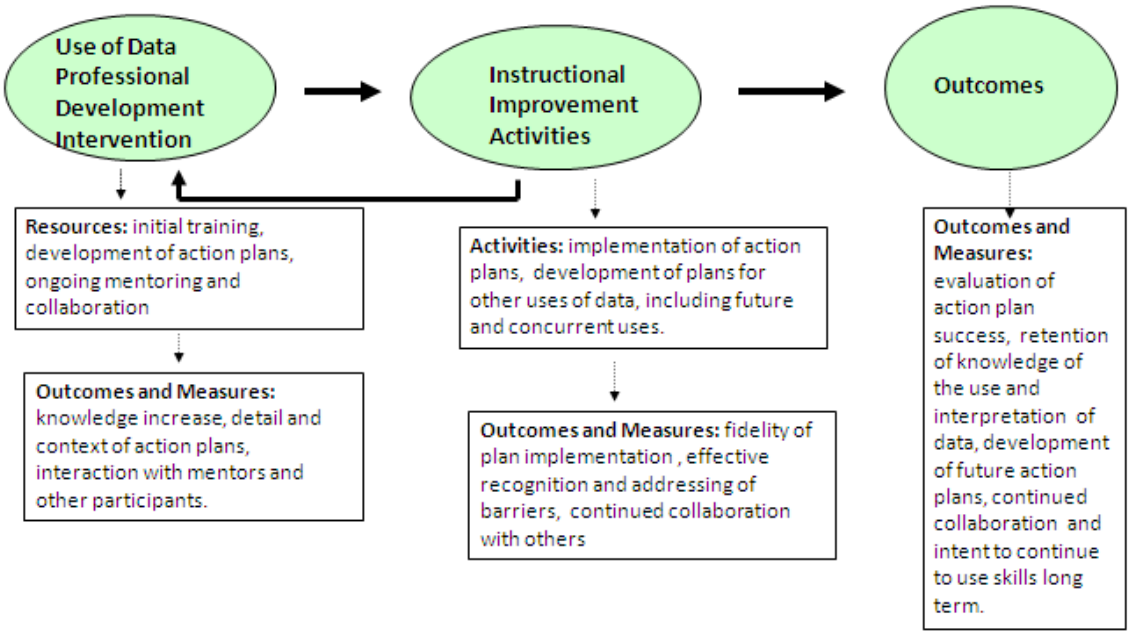


Figure 3.1. Simple model of change: Teacher professional development for the use of assessment data (adapted from the IES model of change; IES, U.S. Department of Education, 2009b).

Year 1: Survey and Case Studies

Purpose and Goal of Year 1 Activities

This descriptive survey study was an investigation into how secondary CTE educators use technical assessment data to improve program curriculum and to identify individual and group instruction needs. Of particular interest was how they learned to make use of the data, what specific types of professional development were provided, if any, their perception of the effectiveness of this training, and finally what types of professional development they would consider most effective for the future.

The following objectives were undertaken in this study:

- The primary objective was to investigate the extent of and processes for CTE educator use of technical assessment data to inform instructional decisions and the source(s) of knowledge that enable them to do so.
- The second objective was to examine the types of professional development CTE educators have received related to the use of data from technical assessment, to determine

how the offerings have been perceived by those participating, and to learn how they have applied them.

- The third objective was to find out how administrators and teachers rate the effectiveness of types of professional development on this topic, and what characteristics of the professional development they judge have helped or would help them develop skills for making instructional improvements. Associated with this objective was the intent to do a review of relevant literature to gain insights about what others have reported as desirable professional development characteristics and to include them in the findings.

The associated research questions, posed as hypotheses, were:

1. Those who know more about test data interpretation tend to use the data for the purpose of instructional improvement aimed at higher student achievement than those who know less.
2. Those who use test data for program improvement perceive an impact from the data-driven changes.
3. Those who use test data for program improvement have had professional development on the topic.
4. No significant differences exist between the comprehensive high school CTE responses and the regional CTE center program responses.

Methodology

The principal research strategy used was survey research with a purposeful sample of five states with representative examples of both secondary career-technical centers and comprehensive high school CTE programs. The study design involved the development and conduct of a survey distributed through the directors of all the secondary career-technical centers in each of the states and the CTE coordinator of a like number of comprehensive high schools to all the CTE instructors in the same four selected program areas. The number of schools in the final sample was 265, some of which offer all four programs and others as few as one. The rationale for conducting the survey at both career-technical centers and comprehensive high schools was that they were representative of the two types of CTE delivery institutions at the secondary level, and this allowed for a comparison of the data between them. That rationale is supported by NCES data, which indicate that 49.4% of CTE students are served through high school based programs and the remainder through either full-time or part-time CTE regional centers (Institute of Education Sciences, U.S. Department of Education, 2009a.

The sample frame was delimited to four selected programs from the full range of programs the schools offered so that the data for those programs could be compared across sites. The criteria for selection were intended to result in a set of programs as representative as possible of the whole of CTE, and as non-duplicative as possible of variables such as capital intensity, program outcome with regard to certification, student gender preponderance, cluster, and use of technology. The overriding criterion was that they be commonly enough found among schools that the set would have a high probability of providing a large number of schools for the sampling frame. Further, they were to be programs in areas of at least average occupational growth as rated by O*NET (U.S. Department of Labor, 2008). On that basis, the following

programs, with suggested occupations within the clusters, were selected, for the reasons indicated at that time:

- business education (accounting) — is not capital-intensive and some segments lead to industry certification, some segments use high technology (accounting is in Financial Services, a national high growth industry that is economically critical, projected to add substantial numbers of new jobs, and is being transformed by technology and innovation);
- construction (carpentry) — a national high growth industry that is economically critical, projected to add substantial numbers of new jobs, and is being transformed by technology and innovation (within the construction industry, carpentry has average expected growth) ;
- health science (nurse assisting) — a national high growth industry that is economically critical, projected to add substantial numbers of new jobs, and is being transformed by technology and innovation (nurse assisting is a support occupation, which is expected to grow much faster than average);
- manufacturing (welding) — is also a national high growth industry that is economically critical, projected to add substantial numbers of new jobs, and is being transformed by technology and innovation (welding leads to industry certification and is relatively capital-intensive, high technology use).

The survey link was emailed to each local school CTE director with an introduction and a request to forward the email to up to two other administrators and a total of up to eight instructors in the selected four programs. Each message included a support letter from the CTE Director of that state, the purpose being to underscore the school directors' perception of the study as important and enhance their motivation to distribute it and complete their own copy. The message also contained information about an incentive—each person who completed a survey received a gift certificate in thanks. Although research on the use of incentives favors prepaid incentives over postpaid incentives (Armstrong, 1975; Dillman, 2007), the effect of postpaid incentives, although smaller, can have an impact on survey response rates and especially dropout rates, including Internet, or online, surveys (Deutskens, Ruyter, Wetzels, & Oosterveld, 2004; Göritz, 2005, 2006; Heerwegh, 2006). In the marketing field, it has been found that payment after the fact is likely to yield more completed surveys than payment up front (D. Friedmen, personal communication, June 11, 2008). Follow up with non-respondents was accomplished by personal email and ultimately by phone.

Target sample. One of the main criteria for selection of the states, beyond their having relevant types of CTE delivery systems, was that NOCTI could obtain the data efficiently because those in the organization have a working relationship with educators at several levels in those states. Professionals at NOCTI believe, based on experience, that the likelihood of obtaining quality responses is enhanced when existing relationships are involved. Importantly, this also meant that considerable time and resources could be saved over the alternative of taking a random sample and then having to search out the related information; thus, convenience was a factor. Furthermore, some randomization was possible within those states. It should be noted that geographical representation was not a criterion. A comprehensive sampling frame was developed as part of this study.

The states that best fit the criteria and were included in the study were Illinois, Missouri, Oklahoma, Pennsylvania, and Virginia. A description excerpted from the State Profile (NASDCTEc, 2008) of each of these states with regard to CTE follows:

- Illinois — 26 of 666 public high schools offer solely (or primarily) CTE courses (note that the NCES data lists 50 CTE centers, so the definition may be substantially different due to academic coursework offered at the CTE center); 341,340 students enrolled in CTE; Illinois envisions their career clusters as organized around five specific career clusters: Health Occupations, Business, Marketing and Management Education, Industrial and Technical Education, Agricultural Education, Family and Consumer Sciences.
- Missouri — 57 of 572 public high schools offer solely (or primarily) CTE courses; 147,717 students enrolled in CTE; Missouri believes that Career Clusters provide the infrastructure for a seamless educational transition between all learner levels. The mission includes support for high quality professional development for teachers.
- Oklahoma — 54 of 466 public high schools offer solely (or primarily) CTE courses; 115,894 students enrolled in CTE; Oklahoma believes that Career Clusters offer many benefits and should be used as a basis for high school reform.
- Pennsylvania — There are 81 regional career and technical schools and of the 501 public high schools approximately 300 offer some CTE courses; 96,338 students enrolled in CTE; career clusters are decided upon and implemented at the local level based upon Pathways.
- Virginia — 49 of 296 public high schools offer solely (or primarily) CTE courses; 208,852 students enrolled in CTE; The State Board of Education has allowed students who have an industry certification/state licensure and who are CTE program completers to count this for up to two verified credits for graduation.

It should be noted that all of these states are in the HSTW network, which requires considerable attention to assessment data, as well as other conditions, so their educators may be different in their responses than those in non-HSTW states. However, not all schools in each of the HSTW states participate in the HSTW program, so it cannot be inferred that the schools sampled pay a greater attention to data than in other states; ultimately, this focus depends on the voluntary involvement of the sample sites that the state departments of education helped select, and any others identified as having similar involvement in the issues studied.

Literature review conducted to inform instrument development. The survey development was preceded and informed by a literature search on the topic of data-driven instructional decision making, particularly with reference to CTE. Further, an inventory was made of the known types of professional development or other assistance that were offered to educators, on this and other topics. These are not all specific to CTE, yet are informative. For example, the course at Harvard University described by Boudett et al. (2005) could generate ideas for CTE even though it was applied in another setting. The model recommended by Guskey and Sparks (1996) of the National Staff Development Council, being used for other NRCCTE work, indicates that the characteristics of quality professional development involve content, process, and context. These categories form a framework for studying the nature of the professional development that was

reflected in the survey. The survey was thus developed with the background of as much information as possible.

Instrument development. The Principal Investigators drafted two surveys to be administered online, one for CTE administrators and a second for CTE teachers. The developers felt that beginning with separate survey forms would be a cleaner way to approach the task than to try to think of both pools of responders simultaneously. Starting from the types of questions submitted as part of the approved project proposal, the developers sought information from the literature review with an eye toward targeting the remaining most relevant and important questions and to give the surveys content validity. In the course of the development, internal sources were also tapped for input.

The intent was to develop the survey so as to generate responses across the topic of the use of data for instructional improvement, especially the use of technical assessment data to both (a) improve program curriculum and (b) identify individual and group instructional needs. Of particular interest were survey findings that relate to how the educators learned to make use of data, what specific types of professional development were provided, if any, their perception of the effectiveness of this training, and what types of professional development they would consider most effective for the future.

Significant attention was given to the best way to ask the questions and to format and design the instruments, with the understanding that such detail might make a difference in how willing the recipients would be to respond. Care was taken to limit the total time required to what the respondents might consider reasonable to commit to it. The manner in which items were asked was geared toward minimal use of open-ended questions, because open-ended questions tend to have a lower response rate (Darby, 2007; Dillman, 2007).

Because contact information was needed to send the gift certificates, the surveys were not anonymous; however, recipients were assured that the contact information would be used only for the purpose of follow up and that no respondent would be identified by name in the data set or the resulting report unless permission was requested and granted.

Survey Review Process

The survey drafts were reviewed and discussed widely so as to gain team consensus on their efficacy to gain the desired information. The process was composed of several steps.

Other NOCTI staff reviewed the instruments for clarity and sensibility and to get an estimate of the time for completion. Then the surveys were submitted for review to selected professional development experts in the CTE field, including other NRCCTE partners, to ascertain if the "right" questions were being asked. A review response form was developed to encourage some standardization in the form of the responses. In each stage of review, the participants were sent information by email about the purpose of the study, the methodology, and the objectives of and process for the agreed-to type of review. After receiving the detailed reviews from these experts, the surveys were revised and finally merged to form one survey that could be administered to

both administrators and teachers because the bulk of the survey could be worded so as to apply to both.

A cognitive laboratory was conducted with selected survey pilot participants to better ensure that the meaning of the survey items was clear and interpreted in the same way by multiple participants, for the sake of survey reliability. The purpose was to identify any point of misunderstanding and obtain suggestions for improvement. For the cognitive laboratory methodology, participants were asked to complete a survey while talking to the facilitator and to verbally report their thoughts related to each item on the survey. The cognitive lab was conducted individually by phone. The participants were emailed the draft survey and asked not to look at it until the phone call was initiated. Revisions were made on the basis of their input and suggestions. Finally, the instrument was submitted to OVAE for review. The instrument was then finalized to incorporate OVAE suggestions.

Data collection. The initial activity was to explain the project to each of the five CTE State Directors and to request their support and participation. All the Directors were willing to cooperate and expressed enthusiasm for the study. They each wrote a support letter to include with the request for survey completion.

NOCTI staff prepared the database of those to whom the survey would be emailed. With the welcome assistance of the CTE Directors of the five targeted states, they obtained the names and addresses of career-technical centers and comprehensive high schools in the selected states. This list was limited to those schools that had one or more of the four program areas chosen for the study.

Next, the staff selected a random sample of the CTE centers and of a like number of comprehensive high schools that offer the same four CTE programs. The size of the sample pulled from each state was dependent on the number of CTE centers with one or more of the four programs chosen for the study.

The schools' CTE director's email address was researched on the school website if not available on the state website. Telephone contact information was also gathered for use when following up with non-respondents. This final sample was provided to the Pennsylvania State University Survey Research Center (PSUSRC).

The PSUSRC was subcontracted to administer the survey, so as to use its specialized expertise and also so that the administration would be seen as strictly objective and not subject to influence by an assessment company. Care was taken to send the survey at a time when educators might be most available to respond. This meant that, because the arrangements were not completed before some schools were scheduled for their Spring Break, the surveys were sent after schools were back in session.

The surveys were distributed first by email and followed up with emails two or three times as a reminder with the survey URL embedded in the message for ease of access. Telephone and email support from NOCTI was offered so as to respond to any questions regarding the survey itself.

The follow-up process to all non-respondents was made first by email and then by phone calls from the PSUSRC. One of the principal investigators made the State Directors aware of the number of responses obtained from their respective state, in the hopes that they would encourage further participation. This was deemed preferable to NOCTI's contacting the responding survey sites directly.

The PSUSRC conveyed respondent results on a regular basis. The NOCTI staff emailed the respondents a thank you message and then arranged for a gift certificate sent through Amazon.com.

Case Studies

To thoroughly investigate the status of data use in schools and provide a more complete context for the development of an intervention, the NOCTI team conducted interviews during Spring 2009 with directors of seven schools that were known to the team as involved in the use of data for instructional improvement. These are the schools that participated in four states, three of which happen to have been in the sample:

- Fort Osage Career and Technology Center, Independence, MO
- High Desert Region, Redmond, OR
- Eastern Center for Arts and Technology, Willow Grove, PA
- Erie County Technical School, Erie, PA
- Reading-Muhlenberg Career and Technology Center, Reading, PA
- Fairfax County Virginia Public Schools, Fairfax, VA
- Virginia Beach City Public Schools, Virginia Beach, VA

The descriptive survey protocol investigated the types of data and depth of data use by both secondary CTE administrators and teachers to determine how technical assessment data were used to improve program curriculum and identify individual and group instructional needs. Schools in this sample used data from a combination of core curricular tests, industry certifications, and job ready skill assessments; longitudinal data provided important information at the programmatic level. The administrators in this sample indicated that, although professional development is typically centered on curriculum, there were recent initiatives to help teachers use their data to review low-performing competency areas. One case study was the focus of an April 2010 NRCCTE podcast entitled *NOCTI Professional Development on Assessment Data Use: Case Study with Aldo Jackson of Erie Co. Technical School*.

Survey Findings

The survey data were compiled by the PSUSRC as the surveys were returned. Preliminary data were sent to NOCTI for analysis and interpretation as groups of responses were received. Schools in the sample received several email follow-up contacts, as well as a final reminder by phone. Incomplete surveys were counted, in general, because responders were told that response to all items was not required.

The responses to the survey were many fewer than hoped for (a total of 87), so a powerful analysis was not possible, and the data and subsequent conclusions and implications should be viewed with caution. At least one response was received from 19% of the schools sampled, with career centers showing a much higher response rate (31%) than comprehensive high schools (6%). However, the dataset has been reviewed from a descriptive standpoint (e.g., response frequencies), the hypotheses have been examined in as much detail as possible, and several potential trends related to the study hypotheses could be seen in the data set. Incidentally, the difficulties in collecting responses for a more powerful analysis were somewhat related to issues mentioned earlier in this document.

A complete copy of the descriptive findings can be found in Appendix 3A. Of the respondents, the vast majority (89.6% of administrators and 92.3% of teachers) indicated that their CTE students took end-of-program technical assessments. The results of these assessments were used for a variety of purposes, the most common of which was maintaining a continuous improvement process, making improvements to programs in areas in which scores were weak, and reporting to outside bodies. Other very common uses included documenting schools and program progress, and helping students receive certification for the job market. In addition, the majority of the respondents felt that the amount of test data they received was adequate.

A primary objective of this study was to investigate the extent to which CTE educators use technical assessment data to inform instructional improvement and the sources of knowledge that enable them to do so. A majority of the responders indicated that they do use technical assessment data to make instructional decisions (68.8% of administrators and 69.2% of teachers). Of those who did not use the data to make improvements, most expressed a belief that they should be using them. Some examples of instructional changes that were made by teachers based in part on technical assessment data included changing lesson plans to place more emphasis in areas in which students scored low, adding more projects and exercises in areas in which the group scored low, re-evaluating textbooks and other materials, and requesting additional supplies or equipment. With individual students, common instructional strategies after data analysis included providing poorly performing students with additional assistance and using student strengths to motivate them.

When asked how they learned to use data to make instructional decisions, the most common mode among administrators was during teacher or administrative training (31.3%), followed by self-taught (18.8%). For teachers, the most common method was self-taught (30.8%), followed by teacher training (17.9%) and professional development while a teacher (15.4%).

A second objective of this study was to examine the types of professional development CTE educators have received related to the use of data and how those offerings were perceived. Among the administrators who responded, 68.7% had received such professional development. Among teachers, 64.1% had received professional development. Of those who had received such professional development, most seemed to feel that the training contained information they needed and at an appropriate level. For administrators, the most common topics on which they had received professional development included how to interpret and apply student test data, information on types of tests and test items available, and the meaning of test-related technical terms. For teachers, the most common topics were how to measure student and classroom

improvement over time, the meanings of technical terms used on tests (e.g., norms, means, standard deviations) and information on types of tests and test items available.

A third objective of this study was to determine how educators rated the types of professional development and what forms of professional development on use of assessment data they felt would be most useful. The results were mixed, but they did seem to indicate that a mixture of formal training and practical follow-up would be the most helpful.

Respondents were also asked about areas for which they did not have professional development but which they wished were available. For teachers, the areas most frequently cited included training on what questions test data can and cannot answer, information on appropriate and inappropriate uses of test data, information on how tests are developed and what makes a good versus a poor test, the meaning of technical terms used on tests, how to interpret group-level test data, and how to select the most appropriate measure for the curriculum. For administrators, the most frequently cited training was how to interpret student-level test data; how to interpret group-level test data; how to compare classroom or individual data to school, district, state, or national averages; how to measure student and classroom improvement over time; and information on types of tests and test items available.

Respondents were also asked whom they would prefer as a delivery agent for professional development in the use of assessment data for data-based decision making. The top three choices for teachers were a knowledgeable teacher or peer (preferred by 53.8%), a consultant (preferred by 12.8%) and a representative from a professional testing organization (preferred by 12.8%). The top four choices for administrators were a school, district, or state data specialist (preferred by 20.8%), a knowledgeable teacher or peer (preferred by 18.8%), a consultant (preferred by 16.7%) and a representative from a professional testing organization (preferred by 16.7%)

As indicated above, many respondents indicated that they do use data for the purpose of making instructional improvements, although many administrators (77.1%) also indicated that they felt their teachers had a need for additional training on the use of assessment data for data-based decision making. Overall, both teachers and administrators indicated that they had a positive perception of the value of technical skills assessments, although administrators had a slightly more positive view than did teachers (83.3% of administrators indicated that they had a “very positive” or “somewhat positive” perception; for teachers, 71.3% fell into those categories).

Respondents were also asked whether their opinion on the value of technical skills assessment had changed over the past five years. For administrators, 50.0% indicated that it remained the same, as did 53.8% of the teachers. However, many indicated that their opinion had become more positive (37.5% of administrators and 25.6% of teachers). For those individuals, the most common reasons given involved the fact that they gained a greater understanding of the need for and application of test data, and that they had seen the value by applying it. Of the administrators, 4.2% indicated that their opinion had gotten more negative, as did 7.7% of teachers. Of those, the major reason was concern over the compromise of true student learning due to an overemphasis on tests.

The current study posed four research hypotheses, the first of which was that educators who know more about test data interpretation will tend to use the data for instructional improvements than those who know less. To examine the data statistically, a proxy knowledge variable was calculated by adding respondents' reported teacher training in interpreting assessment data and making instructional adjustments based on assessment data (pulled from Survey Item 34) and professional development in how to interpret student-level test data, how to interpret group-level test data, and how to measure classroom improvement over time (pulled from Survey Item 40). This variable was significantly correlated with whether or not an educator used data to make instructional improvements (Survey Item 16: $r = .314$; $p = .003$). A similar correlation was found when comparing the knowledge variable to number of specific types of instructional adjustments made at the class level (Survey Item 21: $r = .266$; $p = .013$) and the individual level (Survey Item 23: $r = .252$; $p = .018$). However, it should be noted that the correlations reported here and below are small and may have little if any practical significance.

A second research hypothesis in the study was that those who use test data for program improvement perceive an impact from the changes. The descriptive findings show qualitative support for this hypothesis, as can be seen in Survey Items 16-18 and 21-23 in Appendix 3A. Some of the types of instructional changes educators made are discussed above. When asked if they found those changes to be effective, the majority of respondents indicated that they did see them as effective (58.4% of administrators and 70.7% of teachers). The rest of those who responded to the question indicated that they were unsure.

To examine the data statistically, perceived effect (very effective or somewhat effective) was correlated with whether or not an educator used data to make instructional improvements (Survey Item 16). No significant results were found ($r = .087$; $p = .553$). When perceived effect was compared to the number of specific types of instructional adjustments made at the class level (Survey Item 21), there was still no significant effect, although the correlation was stronger ($r = .230$; $p = .112$). When perceived effect was compared to the number of specific types of instruction adjustments made at the individual level (Survey Item 23), there was a small significant effect at the $p < .05$ level ($r = .319$; $p = .026$). Given that most respondents who made changes to instruction based on data reported seeing an effect, the restriction of range in the data is the likely cause of the lack of statistical significance.

A third research hypothesis in the current study was that those who use test data for program improvement have had professional development on the topic. Various responses to several questions in the descriptive findings indicate that educators see the value of using data to make instructional improvements, and that professional development can be helpful in learning how to interpret and apply data most effectively.

To examine the data statistically, a proxy professional development variable was calculated by adding respondents' reported professional development regarding how to interpret student-level test data, how to interpret group-level test data, and how to measure classroom improvement over time (pulled from Survey Item 40). This variable was significantly correlated with whether or not an educator used data to make instructional improvements (Survey Item 16: $r = .244$; $p = .023$). A significant correlation was not found at the $p < .05$ level when relating the professional development variable to number of specific types of instructional adjustments made at the class

level (Survey Item 21: $r = .181$; $p = .094$) and the individual level (Survey Item 23: $r = .185$; $p = .085$).

This current study also had a fourth hypothesis, that there would be no significant differences between the comprehensive high school CTE responses and the regional career-technical center program responses. Respondents from the two groups were compared using *t* tests on the variables used in the first three hypotheses (knowledge, receipt of professional development related to data interpretation, use of data to make instructional improvements, perceived effect) and no significant effects were found. However, the number of respondents from comprehensive high schools was very small ($n = 10$), so no conclusions about differences can be made.

In addition to the objectives and research hypotheses discussed above, the survey also solicited information on a variety of other factors that were determined to be potentially helpful in addressing a fourth objective, to be completed beyond Year 2—that of creating a professional development system geared toward improving educator understanding of the use of technical assessment data and increasing the use and effectiveness of such data in making instructional improvements. To that end, a number of other questions were asked, including how assessment data are disseminated, by whom, and how frequently. Respondents were also asked about issues such as time available to analyze data, ability to work in teams when interpreting data, and the processes used to make instructional decisions. A summary of the responses to these questions can be found in Appendix 3A.

Case Study Procedure and Findings

According to the literature (Cromey, 2000; Dembosky, Pane, Barney, & Christina, 2005, Schmoker, 2003), many teachers and schools lack the skills necessary to make effective use of data; however, NOCTI project staff found through early interaction with State Directors that some school administrators have embraced the process to learn how to do so and have implemented positive changes as a result. NOCTI determined that it would be helpful to include a component of qualitative descriptive research by collecting and presenting the practices of several individual schools in a variety of states. An interview protocol was developed to elicit the relevant information, and individual project staff members contacted and interviewed the director of each school. The resulting case studies provided a context for understanding the types of data-driven improvements considered feasible within a school setting.

One such site in the High Desert District of Oregon used assessment data to make curricular changes. In this district, end-of-year assessment data have exposed lower-than-the-norm scores in blueprint reading, and teachers have been tasked with developing instructional strategies to raise these scores. In addition, instructors at the community colleges have been involved with secondary teachers in designing instructional enhancements in this area. Thanks in part to an interest in learning analysis and review of end-of-program technical assessment data, this district experienced a doubling of its professional development budget. Although the site is relatively new (three years) to the utilization of assessment data as a path to improvement, staff and administration now speak a common language throughout the High Desert region. There is a solid understanding of the relationship between standards, assessment data, and program improvement. In addition to the doubling of professional development resources, collaboration

with community colleges has resulted in a full articulation program now in place with the Oregon Institute of Technology. This site has increased its credibility and has been finding more uses for technical assessment data each year.

Another site, Reading Muhlenberg Career & Technology Center (RMCTC) located in Reading, Pennsylvania, tracks a variety of data, including technical and academic assessments and industry certifications, and has used these data to review program trends, adjust curriculum, and work to increase the number of industry certifications awarded. In addition, RMCTC now has two coaches to help teachers with academic integration skills in literacy and numeracy. The RMCTC Director indicated that the school is more data- rich and results-oriented than a few years ago.

Fort Osage Career and Technical Center (FOCTC), located in Independence, a suburban city in Northwest Missouri, serves five school districts with 15 programs representing eight of the career clusters. FOCTC uses several industry certifications as well as NOCTI tests to assess the competencies of their program completers. Due to the level of detail provided, NOCTI pre- and posttests enable FOCTC to see both program and individual student growth. Analysis of disaggregated data and alignment with both curriculum and national standards contribute to instructional strategy development. These data are woven into the school culture; the pre- and posttest results by major area are compared with the amount of time spent on instruction in that area in an attempt to recognize patterns. As a result of FOCTC work in assessment, there is much greater focus on national standards, and the level of academic and technical instruction has increased. According to the Director, the analysis of the NOCTI test blueprints and comparison to areas of instruction was an eye-opener for some of the staff, especially in the technical areas FOCTC has made plans to continue to improve the quality of their programs and their instruction. There is a common understanding of the objectives and FOCTC leadership has provided both the resources and the guidance to continue their advancement.

In May 2007, International Organization for Standardization (ISO) published updated guidelines to facilitate the implementation of quality management systems in education organizations (2007). Erie County Technical School (ECTS), located in Erie, Pennsylvania, and serving 11 school districts, exemplifies how continuous improvement can be linked to ISO 9001 standards by their use of technical assessment data. Administrators and staff have collaboratively been able to “drill down” to find “root causes” of curricular issues impeding program improvement. There is a solid understanding of the relationship between standards, assessment data, and program improvement. ECTS teachers also maintain a program level alignment to CIP (Classification of Instructional Program) codes to ensure that the curriculum will reflect the nationally accepted content. Thanks in part to the analysis of end-of-program technical assessment data, and a team of 14 dedicated educators, ECTS was among the first schools in Pennsylvania to achieve the ISO 9001 certification.

Continuous improvement efforts benchmarked to award criteria are another spur to professional development that involves data collection and analysis. An example is the state-level Virginia Governor's Exemplary Standards Award program. The purpose of this program is to raise the rigor and quality of CTE programs across the state. This is a two-step process: Program instructors work with business advisory groups and postsecondary faculty to validate their

attainment of rigorous standards, and then apply for the Governor's designation. This is a continuous quality improvement process engaging K-12 and higher education, the business community, and state, regional, and local officials. The opportunity to earn this distinction creates an incentive for programs to meet high academic standards and improve other measures of program quality, strengthen their partnerships and alignment with postsecondary education and industry, and demonstrate relevant and positive outcomes. All CTE programs are eligible to seek exemplary status. The criteria for the awards ensure that all programs earning exemplary status will raise the science, technology, and mathematics (STEM) literacy of participating students through rigorous academic and programmatic standards. In determining an exemplary program, the evaluation criteria include program excellence, educational significance, evidence of effectiveness and success, and replicability and usefulness to others; these standards were adopted originally from the National Dissemination Center for CTE at Ohio State University. Exemplary programs are identified through documented nominations followed by site visits. Programs earning this distinction form a growing network of exemplary programs to share best practices with each other and with other programs striving for the designation (Virginia Career Education Foundation, 2009).

One of the awardees of the Virginia Governor's Exemplary Standards Award is the Virginia Beach City Public Schools (VBCPS) that consists of 11 secondary schools and two Career Centers. VBCPS has adopted the Virginia Governor's CTE Exemplary Standards as the operational standards for all district programs. Teachers and administrators focus on trend data from end-of-program assessment as they plan for school improvement. These data support the effectiveness of CTE. The facts on student success, documented by assessment data, are used to justify equipment and resource purchases. VBCPS educators also discuss end-of-program data with their business and industry advisory members. Leadership at VBCPS clearly wants to use solid, reliable data to help their teachers succeed. According to state reports, over 96% of CTE students make a successful transition upon graduation to the workplace, higher education, or the military.

Also in Virginia, Fairfax County Public Schools (FCPS) consists of 25 diverse secondary schools in which programs in all 16 clusters serve approximately 26,861 students. In addition to academic tests, students are assessed in “soft skill” areas; a cadre of teachers has assembled resources that serve as both curriculum and a professional development tool. FCPS uses a third-party assessment from NOCTI (Workplace Readiness), and information on competence in this area is collected by the state. In the area of technical skill assessment, FCPS uses 32 different licensures or certifications, including NOCTI assessments, to assess the majority of their completers. FCPS has utilized information gleaned from the assessment data for a variety of school improvement purposes. From a policy standpoint, the board has established a goal to increase the percentage of certifications gained by class each year. In addition, FCPS has used the data to make curricular changes – “beefing up” certain areas of the curriculum and re-sequencing lessons. FCPS has begun to use pretests to gauge individual progress and help identify gaps. This focus on continuous improvement has fostered collaborative efforts, as lead teachers who are more familiar with assessment have been guiding other teachers. Although new to the utilization of assessment data as a path to improvement, the Director says that FCPS staff and administration see the benefits and have begun to address related issues surrounding assessment and data, thereby becoming much more sophisticated in the use of data for

improvement of instruction. Specifically, due to FCPS' size, consistent and well-timed professional development can be an issue, as can coordinated test ordering and lab space utilization for testing. FCPS has designed a centralized ordering process and a team to help disaggregate results of testing. In addition to the increasing emphasis on using these data for professional development, the data have helped inform the collaborative curriculum rewrites that FCPS participates in with business and industry partners.

Year 1 Discussion

Lack of skill and training in technical skill assessment, data interpretation and its use is especially acute among CTE teachers. Many enter the teaching field via alternative routes and may not receive basic training that traditionally prepared teachers receive as a part of their education (Bottoms & McNally, 2005). This situation was supported by the findings in the survey conducted in the first year of this project. In that survey, almost 46% of the administrators responding indicated that their teachers had not received general professional development in the use of technical assessment data. When asked about professional development related to specific uses of test data (e.g., how to interpret the data, how to apply it) between 41% and 54% of teachers indicated that such professional development was not available but that they wished it were. Of those who used data to make instructional decisions, over 30% indicated that they were self-taught.

In the survey conducted by the authors in the initial phase of this project, the majority of respondents indicated seeing value in using standardized test data. Of those who were not using such data to inform instructional improvements, the majority indicated that they felt they should be using them.

Importantly, even though the results reflect a relatively small sample, these survey and case study results provided a confirmation of the critical need for professional development on the topic of using technical skills assessment data to make improvements in instruction. In addition, the findings provided specifics about what the nature of that professional development should be. What the literature reveals about the type and characteristics of professional development reported as state-of-the-art for effectiveness was corroborated by the survey.

The findings from the survey research and case studies were used to create new professional development opportunities that were designed and piloted in the following year of the project These were designed to be cost-effective and efficient and to include strategies and approaches that:

- Will improve and increase instructional personnel's knowledge, skills, and ability to help students meet challenging and rigorous academic and CTE skill proficiencies;
- Will advance instructional personnel's understanding of effective instructional strategies that are by scientifically based research; and
- Are sustained, intensive, and classroom-focused.

A more detailed description of the professional development design and pilot phase is found in the following section of this chapter.

Year 2: Development and Piloting of the Professional Development Intervention

Purpose and Goal of Year 2 Activities

The overall purpose of the Year 2 activities was to use (a) the results of the Year 1 research on educator use of assessment data and (b) guidance from the literature for the creation of a professional development program geared toward secondary CTE teachers and administrators on how to effectively interpret assessment data and use the information to make instructional improvements in the classroom. The developed intervention was to include the materials necessary for implementing the training, a facilitator/delivery system for maintaining the system within the school setting, and a preliminary pilot test evaluation of the effectiveness and feasibility of the program.

The goal was to develop and pilot professional development for CTE educators on the use of technical assessment data for data-driven decision making that is both based on sound principles of learning and delivered in a manner that is sustainable within a school system. For the cycle to be complete, it is imperative that educators be able to diagnose problems by looking at evidence (data), receive the training to be able to plan instructional modifications around that evidence (Butler & McMunn, 2006), and then be motivated to apply the training in the classroom.

Three research questions formed the basis of the professional development for K-12 educators targeted toward the use of assessment results:

1. Have educators increased their knowledge about technical assessment data as a result of the professional development intervention?

2. Are educators able to apply their knowledge of technical assessment data to improve instruction as a result of the professional development intervention?

3. Will educators be more motivated to apply their learning about technical assessment data to instructional improvements as a result of the professional development intervention?

The intervention was to be a professional development strategy that, although research-based, could be provided in a very practical manner. Facilitators selected for their ability to engage participants in the topic provided highly interactive, project-based initial training. Unique aspects of this intervention are the opportunity for participants to work with data from their own students (via technical skills pretests) and to work with a cohort of peers to develop action plans that relate to their specific schools and classrooms (Wayman & Cho, 2008). After the initial training, participants were coached over several months in their school environment by the same facilitators who provided the training. Educators were also encouraged to interact with others who were receiving the professional development, thus forming a professional learning community, which has been shown to be helpful for learning and growth through collaboration

(Ball & Cohen, 1999; Borko, 2004; Stone et al., 2008). Principals and administrators were included in the professional development to help provide critical support within the workplace environment (Dembosky et al., 2005; Mason, 2002). Because much of the training and development occurred on school grounds, the financial costs to the school were minimal. Further, because many of the activities took place in the context of work that is already being done by educators, the professional development was highly contextualized, guided by learner needs, and easily implemented and maintained within the school environment.

The following sections provide detailed information about how this intervention was developed and pilot tested.

Methodology

In addition to the survey and case study findings from Year 1 of this project, the findings yielded in the literature review also informed the creation of the pilot intervention. Other NRCCTE professional development projects were also consulted to provide additional information. One such source was the SREB modular materials for alternative certification of CTE teachers, which are discussed in Chapter 2. The NRCCTE Math-in-CTE project also yielded proven principles for the professional development (Stone et al., 2008)

In preparing to develop the intervention, a framework of criteria was established to guide the work. An understanding of the underlying processes related to the use of assessment data for improving instructional and student outcomes was sought from the survey analyses, as well as the malleable factors to be addressed. Contributions from the literature provided guidance on distinguishing between effective and less effective professional development characteristics. The findings from the initial survey as well as additional contributions from the literature review and other NRCCTE projects informed the development and refinement of the professional development strategy in terms of content, structure, delivery, and maintenance. The literature review continued for the purpose of enhancing the professional development materials and process as the project continued. The case study results provided an additional resource for development of the intervention.

Selection of the Sample

Although the term *assessment data* can be very broadly defined, the primary focus of this study was on standardized summative assessments. In addition, although several forms of data were addressed, the main focus was on technical assessment, relevant because it is now required by Perkins IV. Furthermore, although many educators can benefit from professional development on the use of assessment data, the target audience (or population) was defined as teachers and administrators of secondary CTE programs, as they were the subjects of the Year 2 study and those whose needs were researched. The researchers assumed that the selection of these educators, who have much in common and must all deal with the same focal point of technical assessment, would make it easier for the educators to comprehend the material and apply it to their schools and classrooms.

A total of nine secondary CTE school sites in five states were to be selected to pilot the professional development on the use of assessment data. Five of these were intended to be in Round 1 of the pilot and four in Round 2, which was planned to start a month later so as to allow for the application of learning from Round 1. Selection criteria were based in part on survey findings and in part on phone interviews with the administrator and a pilot site visit. The first priority was to select sites from among those who participated in the previous year's survey. Schools seen as most suitable included those with (a) multiple CTE programs from among Business Education, Construction, Health Science, and Manufacturing, (b) an interest in improving their use of data for decision making, and (c) willingness to participate in the training, coaching, and data collection phases of this project. For each of the five states, schools meeting these criteria were culled from the survey responses and prioritized on the aforementioned criteria and with regard to a distribution among urban, suburban, and rural sites. These were then discussed with the CTE State Director in each state to get input on suitability and other factors operating within the state.

For most of the states, this process was sufficient to move forward with calls to the potential sites to explain the project and seek agreement to participate. In Illinois, however, few sites met the criteria, partly because of the relatively small number of survey responses. It had been agreed that, in such a case, other states and schools would be evaluated for participation. In consultation with the State Director of CTE, the decision was made to work with two career academies in the Chicago Public Schools (CPS), and their agreement to participate was gained within the CPS system. Because this would possibly bring the total number of pilot sites to nine, permission was sought and granted by the NRCCTE to move forward with the understanding that the budget implications would not be problematic.

Project staff developed a site call protocol to ensure that all relevant information, including both the responsibilities and benefits of participation, would be conveyed to the administrator of each of the potential pilot sites. A single member of the project staff was designated to make the calls to gain some standardization of approach. In a few cases, the school administration decided, after consideration, not to participate.

As a result of these calls, sites that responded positively were visited (a) to gain a more thorough understanding of their intentions and potential to be responsive to the initiative and (b) to offer a more complete description of the project and details related to participation directly to the sites' educator teams. Project staff members were assigned to visit schools in specific states. They used a site visit handout and a team-developed protocol to ensure that no details were inadvertently left out. Subsequent to the visit, they shared their notes regarding the visit with other project staff. These same staff members continued to monitor the progress of the pilot test in the states to which they were assigned. One exception to this process was in Oklahoma, where the two sites were not brought on board before the Facilitator's Training, so those visits were made subsequently by the facilitator.

The list of pilot sites is as follows:

- Illinois: Prosser Career Academy and Simeon Career Academy, Chicago, IL
- Missouri: Rolla Technical Center, Rolla, MO; South Central Career Center, West Plains, MO
- Oklahoma: Central Tech Career Center, Drumright, OK; Kiamichi Tech, McAlester, OK
- Pennsylvania: Clearfield County Career and Technology Center, Clearfield, PA; Swenson Arts and Technology High School, Philadelphia, PA
- Virginia: Valley Vocational Technical Center, Fishersville, VA

The administrator and a total of two to five teachers from each school participated in the program so as to encourage communication among the group and the development of a community of practice. In one case, two administrators participated, whereas in another, no administrator participated, due primarily to a misunderstanding about the requirement for an administrator to be part of the team. In some cases, a test coordinator joined the team. The total sample size from all sites numbered 48 individual educators.

Developing a research-based intervention. A summary of the literature conducted by Smith et al. (2003) indicated that the effectiveness of different types of professional development is subject to debate, and that philosophies of how professional development should be delivered have shifted from more traditional models, such as workshops, toward such models as study circles, coaching, collaborative problem-solving groups, and practitioner inquiry. Although specific lists differ somewhat, research indicates that an ideal effective professional development for K-12 teachers should (a) be of longer duration, (b) make a strong connection between the development topics and the context of their work, (c) include a strong emphasis on analysis and reflection, (d) include a variety of activities, (e) encourage teachers from the same workplace to participate together, (f) be continuous and ongoing, and (g) be connected to comprehensive change processes focused on improving student learning (Banilower, Boyd, Pasley, & Weiss, 2006; Darling-Hammond et al., 2009; Dembosky et al., 2005; Guskey, 2003; Lewis, 2000; Smith et al., 2003; Sparks, 1994).

Unfortunately, many forms of teacher professional development still fall short of this ideal (Darling-Hammond et al., 2009) and are generally focused on short-term, standardized sessions that usually do not result in improved content knowledge, altered teaching practice, or enhanced student learning (Kahle, 1999). Efforts were made to find the most effective and feasible way to provide useful professional development for today's CTE teachers.

Given the increasing use of scores on high-stakes achievement tests, meaningful professional development specifically geared toward the use of assessment data must have a strong work connection, link to a comprehensive change processes, have strong teacher involvement (Klein, Hamilton, McCaffrey, & Stecher, 2000) and also address concerns and misunderstandings about the nature of tests and test data among parents, students, teachers, and administrators alike (e.g., Charles, 2008; Cizek, 2005; Herman & Golan, 1991; Phelps, 2009). Unfortunately, the available research also indicates that most teachers and administrators do not have the skills necessary to make effective use of data (Cromey, 2000; Dembosky et al., 2005, Schmoker, 2003).

It is logical to assume that many of the same factors influencing the effectiveness of teacher professional development elsewhere will also be important for professional development on the use of test data and that such factors would apply to CTE teachers. However, it is also important to note that CTE teachers may have some different requirements (de Moura Castro, 2009). CTE teachers are expected to meet their students' needs for career development, technical and academic achievement, and information technology skills. Therefore, CTE teachers must interpret data from technical skills assessments related to their program area and be cognizant of the student's grade level in language arts and math. It can also be argued that CTE teachers serve a more diverse student clientele (NRCCTE, 2010). Finally, the rapidly changing workplace and innovations in technology require ongoing technical upgrades (including evolving theories, new procedures, new materials, industry standards revisions, and new equipment) and curriculum content revisions (NRCCTE, 2010). These differences would indicate that, although the content of the training provided may vary, CTE teachers' professional development needs and the format for maximum retention and application should be similar to those of other teachers.

As indicated above, there is virtually no literature regarding professional development for CTE educators in the use of data to make optimum program and instructional decisions, thereby improving student outcomes. This research-based intervention begins filling this gap by focusing on developing an intervention for CTE that places data for decision making through the use of assessment results within a CTE-specific professional development framework, yet uses the principles identified for effective professional development for all educators. In October 2009, the National Governors Association Center for Best Practices (NGA Center) issued a brief (Grossman & Hirsch, 2009) that outlined approaches states can take to improve the quality of teacher professional development for the ultimate purpose of aiding student learning. Among the suggestions designed to develop new models of professional development, one is especially relevant for this effort, namely the use of student learning data to create individualized professional development plans for teachers. John Thomasian, director of the NGA Center said, in the press release for this brief (Munley, 2009); "As a part of this, it is important to refocus teacher professional development to ensure that it has real-world implications for classrooms and a positive impact on student performance" (p. 1). This intervention uses both achievement and occupational skill data from the participating educators' students to customize the professional development; the thrust of the participating educators' work is to develop and implement an action plan for improving classroom instruction.

Structure of the Intervention

Following the recommendations of Grossman and Hirsch (2009) and the model of change presented at the beginning of this chapter, the intervention involves multiple stages, each discussed in more detail below. Several of the stages overlapped in time and included (a) the development and refinement of the professional development training, including content matter, structure of the training (e.g., layout, exercises), delivery, and related facilitator materials, (b) the selection and development of measurements to assess the effectiveness of the learning and the successful application of that learning to the classroom, (c) the selection of appropriate pilot sites, (d) the selection of facilitators/coaches, (e) the administration of the training and coaching, and (f) the initial evaluation of the program process and effects.

The Materials Development Process

The initial materials developed for the intervention were embedded in the Facilitators' Guide, which contained all educator worksheets and handouts and a PowerPoint presentation for the initial training workshop. The Guide contained four major components: (a) content related specifically to the study and how it is being conducted (e.g., what types of interactions they are expected to have with the educators and how often; what kind of data will be gathered and when); (b) content that the educators will receive; (c) content directed specifically toward the delivery of the training (e.g., interactive activities, strategies for differentiation to allow individual educators to address the specific needs of their students and programs); and (d) content related to establishing and maintaining a facilitating-coaching-guiding relationship with the participants as they apply learning to their school settings, as well as evaluation forms. The educators participating in the pilot workshops received copies of the presentation slides and the worksheets and activities for each of the five steps in the model.

The intervention, CTEDDI (Career and Technical Educators using a Data-Driven Instruction model), presents a five-step model, shown in Figure 3.2, that is intended to be the basis for an annual data cycle used by educators.

Brief background material on how standardized tests are developed, different common formats of standardized tests, and similarities and differences from formative and locally developed assessments were embedded in the content of the training. The content also included a summary of the types of information usually reported on standardized test reports (including at the group and individual level), what common terms mean and how they are related (e.g., average, mean, percent), and how they should be interpreted in an applied setting. Exercises were incorporated on external factors that can impact individual test scores, as well as group test scores and trends over time. In addition to appropriate uses of test data, inappropriate uses were reviewed. Participants learned not only how to interpret different levels and types of assessment results, but also strategies for using those results as diagnostic tools that enable a focus on instructional strengths and weaknesses, making adjustments, and tracking the impact of those adjustments.

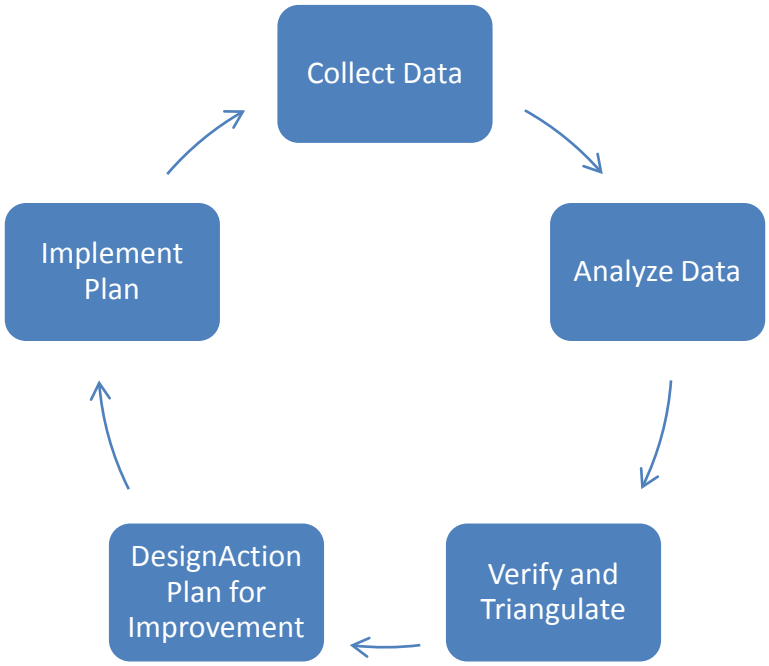


Figure 3.2. The five-step data cycle of CTEDDI.

Evaluation Measure Development

Several instruments were used to measure and evaluate the results of the professional development strategy that focused on using assessment results for improving instruction with the purpose of improving student outcomes. The initial measure was a questionnaire to gather information about prevailing practices prior to training, including how each of the pilot schools had used technical assessment data in previous years. This information was used to provide a baseline for comparison with the educator's practice in response to the intervention.

The next measurement is a content pre- and posttest designed by the project staff and reviewed and revised by additional subject matter experts. This assessment served as a knowledge measure to assess participants' learning and retention of using data for decision making. It was closely aligned to the content standards used to develop the training and measured such factors as educator knowledge of data terms, understanding of how to interpret assessment data, and knowledge of how to apply such interpretations to making instructional improvements. The assessment served as a measure to determine that participants did, in fact, gain knowledge from the initial training. Educators responded to objective items, rather than simply self-reporting on their perceptions of learning to the research staff. This instrument was administered at three points: (a) prior to receiving the training, (b) immediately after receiving the training, and (c) near the conclusion of the project. The second and third assessments included an added performance component to the knowledge assessment, which included an evaluation of the action plans for data use that participants develop during the training and the subsequent implementation of those plans in their school environment. Through the engagement of participants, use of technological tools and resources, and application of in-depth understanding, it is possible to assess educators' skill in interpreting complex, real-data situations and

determining how to use data to improve their educational programs and student instruction. Longer-term retention was measured by the third administration of the assessment.

Midway in the process, participants received a questionnaire asking them to report their perceptions about their use of data, their motivations to use data, the impacts on student achievement they witnessed or expected to witness based on the use of data, the impact of the facilitation process on their use of data, and success stories or challenges encountered. The main purposes of these measures were to assess implementation of the action plans developed during the training, assess the transfer of training to other aspects of instructional improvement (e.g., what other ways are educators using instructional data in addition to the implementation of the initial action plans), assess the motivation to continue using data to make instructional improvements in the future, and track the events and circumstances that assist or hinder educators in applying their improved knowledge and skills in data use in an actual school environment (e.g., time availability, willingness/ability to work collaboratively, coach interactions, support for changes). A similar questionnaire was administered at the end of the project. Facilitators were also surveyed about the process based on their experiences with the participants, and they participated together in discussing their reactions on a final group conference call.

Facilitator Selection and Training

To provide the training at these pilot sites, a total of six facilitators were selected, one located in each of the participating states and in one state, two who elected to share one position. The facilitators were selected based on their skill and experience with training and informal coaching; represented were former CTE state directors, former local superintendents, a specialist at a state professional development center, and professional development consultants. All needed to be willing and available to participate in all phases of the project (including travel to initial training, school visitations, etc.).

The Facilitator Training was planned for collaborative involvement of the Principal Investigators and the primary materials development specialist in working with the six facilitators. Plans were made to train the facilitators on the material, delivery methods, and subsequent follow-up strategies in a face-to-face meeting, with provision for input from the facilitators on the materials and delivery plan.

The facilitators were invited to the training well in advance and scheduled so that all facilitators were able to attend and interact. The training was held in a location in relative proximity to the NOCTI Main Office, so that materials could be transported easily. The facility's training room was selected with regard for the conversational nature and physical set-up of the room with a large round conference table and superior electronic connectivity.

Project staff trained the facilitators as planned. Once the facilitators were trained in the process, they made contact with each of their schools in their state and scheduled their introductory visits and the one-day intervention workshop. They continued to provide the ongoing coaching and mentoring program to the selected educators from each of their schools. Additional follow-ups with and among facilitators occurred via web conferences as the project progressed, so that the

program could be iteratively improved and the facilitators could interact on the basis of their experience in implementing it.

The Initial Implementation

The CTEDDI intervention was piloted at nine sites in five states. There were two rounds of pilot testing during the spring semester of 2009. The professional development materials and process were revised significantly after each round of the pilot process; as the initial workshops were held at pilot sites, both facilitators and educators contributed to the improvements, with the most extensive revisions made between the two workshop rounds. The project staff regards this iterative process as one of the strengths of the project.

The formal professional development workshop is devoted to interactive activities, such as case studies that demonstrate analysis of relevant datasets, and developing a plan to apply the training in the educators' own settings. This training was designed to incorporate standard data analysis and interpretation techniques that would be nationally generalizable.

In the professional development pilot process, educators were encouraged to use data relevant to their school situation. To have a basis for the initial instructional improvement plans, students in the teachers' classes took a standardized technical assessment at two points—once as a pretest to provide material for use in the initial professional development training and again as a posttest to provide an additional opportunity to practice their skills on real student data. Thus, these tests were a source of data for educators to use both for exercises and application. Educators from each pilot school developed a plan as a part of the training and implemented it at their local schools with facilitator coaching. Teachers were interested to compare the data from the pre- and posttests for themselves; however, the tests were not used to draw conclusions about student achievement, which was beyond the scope of this project.

The use of standardized data from their own students not only provided a link to their classrooms to make the training more relevant, but also provided teachers with the information needed to customize and contextualize their initial action plans to the needs of their particular students, programs, and schools (e.g., providing remediation to particular students, adding more teaching time for particular subject matter, using more exercises and hand-on activities, providing more resources for teaching particular material). Schools that were currently using technical assessments could choose to use those existing data for the professional development process. For those who did not use technical skills assessments, NOCTI donated from its standard test battery the assessment and subsequent data report that most closely matched the school's program. The facilitators assisted those pilot sites needing assistance to obtain student data from NOCTI.

NOCTI tests, both at the professional level and at the student level, have been a standard of CTE programs for almost 45 years; these assessments are current, valid, and reliable reflections of the needs of industry in over 70 different occupational areas. Any lack of alignment between test and curriculum content was taken into account when the data were interpreted (e.g., building trades students taking carpentry tests), as were other relevant factors (e.g., depth of content as determined by hours of participation). It was important to stress that educators should have

relevant data to use in the professional development process; however, these data did not have to be from the same test source.

In summary, during the intervention development and pilot phase, educators had standardized data relevant to their particular schools or classes to use during the professional development experience. It is generally assumed that teacher knowledge and classroom practice mediate between professional development and student achievement. However, measuring the indirect effect of teacher preparation on student achievement is imprecise, so this was not attempted in this time period, given that the primary purpose of the study was to impact the data-driven decisions of CTE educators, thereby improving instruction.

Initial Action Plans

The main goals for this research-based intervention were to have the educators produce an implementable action plan based on an analysis of their program's data and to be able to use the data cycle annually for continuous improvement. Reports from the facilitators and drafts from educators at the pilot sites provided an overview of the types of problems derived from data that were transformed into action plans. At the conclusion of the workshop, the educators summarized their findings on an action planning form that specified the goals, indicated the overall strengths and weaknesses in student performance reflected in the data, and listed the high-priority goals with resources, steps, strategies, data required, and indicator(s) of success. Work on the action plan occurred after the workshop and was accomplished with mentoring from the state's facilitator.

Educators entered the planning process from many different perspectives, which were reflected in their plans. Carpentry teachers perceived the need to ensure that standard terminology used in carpentry and the construction trades was being properly incorporated into lessons. Another construction trades teacher observed a weakness in his students' knowledge of interior finishing based on his program's data. A business teacher noted weaknesses in the students' knowledge in areas of accounting, computation, and record keeping. A health sciences instructor conducted a gap analysis and identified two test sections on which to focus her planned interventions. Two other health sciences teachers engaged in discussion over the professional development sharing website on strategies being used to teach specific concepts. One teacher planned to strengthen study skills with her students. Overall, the teachers agreed that this planning process was a valuable exercise.

Some administrators intuitively assisted their staff with the planning process, providing feedback and resources. One administrator focused on attendance issues; however, others removed themselves from the process. Based on the varied participation of the administrators, their role is being better defined as the workshop intervention guide is revised yet again in keeping with the iterative process.

The Iterative Process

Information concerning various aspects of the intervention was sought through various channels that included internal and external reviewers, the facilitators, and the educators at the pilot sites.

The initial package of intervention materials included the Facilitators' Guide, the related series of exercises and worksheets, and a PowerPoint presentation. After multiple internal reviews and revisions, the materials were reviewed externally before being used at the pilot sites. A review response form was developed to encourage some standardization in the form of the responses (see Appendix 3B). The participants were sent information by email about the purpose of the study, its methodology, and the objectives of and process for the type of review to which they had agreed.

Reviewers were drawn from several relevant groups and recruited to assist with materials development:

- content experts in standardized testing and data analysis and presentation (two people)
- subject matter experts in training development and delivery (two people)
- subject matter experts in beginning and fostering small learning communities or "communities of practice" (two people)
- educators who are familiar with using data from standardized assessments (two people)
- educators who are not familiar with using data from standardized settings (one person)

After receiving detailed reviews from these experts, the materials were revised on the basis of their input and suggestions. Next, the facilitators were able to review the materials to suggest improvements.

After the pilot program was delivered, a systematic process was established to make iterative changes and improvements based on information gathered in the field from participants and facilitators. These revisions were then incorporated into the fully developed intervention. At the conclusion of Round 2, the evaluation data were reviewed and several structural changes were made to the intervention materials. Specifically, the following were added to the materials: more stringent criteria for workshop participants, a better defined role for the school administrator, more structured mentoring in the post-workshop phase, tools for monitoring student learning, and a series of post-workshop activities using an online professional development community.

After the school year ended at all nine pilot sites, the NOCTI project staff conducted a web-based conference call with the facilitators to discuss their overall perceptions about improvements that could be made for the next year, as well as to review the changes noted above. Further refinements to the product and process will be made based on upcoming reviews of the latest revisions, with the intent of producing a complete program of research-based technical assistance for CTE schools wishing to implement an annual data cycle.

The Post-Workshop Mentoring Phase

To meet the need for sustained support after the full-day intervention and to achieve the coaching and collaborative problem-solving environment advocated by research (Banilower et al., 2006; Darling-Hammond et al., 2009; Dembosky et al., 2005; Grossman & Hirsch, 2009; Guskey,

2003; Lewis, 2000; Smith et al., 2003; Sparks, 1994), the facilitators remained with their pilot sites for several months after the workshop. The pilot sites participated in several structured mentoring sessions conducted by their facilitator. The groups met on a regular basis to discuss their data plans, problems encountered, and issues that arose.

A CTEDDI online professional development sharing site was developed to meet the need for interaction and support during the implementation process (see evaluation data in Appendix 3C). The website was developed exclusively for the pilot participants and their facilitators. An account was created for each workshop participant and each educator was required to log on and post at least one message at that time. Because educators were located in five states, they had never met face to face, thus presenting a challenge to their communications. A review of the educators' interactions revealed that only a few of them engaged in substantial exchanges on this website, primarily to discuss instructional texts and curricular resources. In light of the interactions of the majority of the educators, which did not advance beyond the introductory level, combined with evidence on the formal evaluations, it was evident that pedagogical components must be incorporated into this online community.

Structuring the Online Community

The main design elements for online learning communities are the social and pedagogical components (Ryman, Vine, & Richardson, 2009), which provide the basis for revisions to the website. To provide the pedagogical structure for the CTEDDI online community, a series of authentic learning tasks in the post-workshop interval will be implemented with structured facilitation. Facilitators, asked to provide an initial review of these additional activities, felt that the activities were an appropriate addition to the intervention. Post-workshop activities are intended to increase collaborative interactions and higher-level thinking among the educators; they will also help with the challenging social aspects of building an online community of practice that is distributed over different locations.

The five main functions of a community of practice are building relationships, sharing, learning, knowledge creation, and collaboration (iCohere, Inc., 2010). Additionally, Wenger, McDermott, and Snyder (2002) stated that characteristics of such a community should be excitement (e.g., novelty), relevance, and value. Incorporating these factors into the design of the website increases the probability that the community will sustain itself over time by eliciting substantial interactions, thus avoiding becoming little more than a network of friends. The main community-building strategy for CTEDDI will be to require community members to participate in varied events to accomplish the five main functions. The first community activities will once again be introductory, needed to build relationships (Ryman et al., 2009), but as part of the post-pilot revisions, the educators will now complete a series of authentic learning tasks, such as posting a revised lesson plan for review by other educators who respond with suggested strategies or resources; such a design will engage the educators in sharing and collaboration through relevant tasks that have immediate value to the educators.

The role of the facilitators is not diminished in the post-workshop phase, as they have the challenge of promoting and sustaining constructive social dynamics and learning dialogues in a distributed community. Morrissey (2000) noted that the creation of a professional learning

community does not occur quickly or spontaneously, but is the product of an intentional effort on the part of an administrator or facilitator. Membership in a learning community involves a paradigm shift from short-duration workshops to a sustained professional learning experience intended to bring about an overall change in the way teachers view the teaching process. Therefore, facilitators must manage the community's interrelated social and learning aspects by maintaining an appropriate flow of discussion in an online learning environment to achieve the critical thinking and problem solving necessary to transition to a cyclic data-driven process of instructional improvement and curricular planning (Ryman et al., 2009).

Deeper learning through participation is a concept that is becoming prominent in professional development practice. By embedding learning tasks in the post-workshop interval, the anticipated result will be collaboration, higher-level learning, and an overall change in the instructional process. Community activities, such as sharing products and ideas, bond members through shared practice, which is no stranger to teachers, because empowering students to participate in shared learning is the basis of a teacher's work. Through participation in a structured community of practice with prompts from a facilitator, teachers can reflect on their classroom practice and better understand how they influence learning. As Smith (2009) summarized, learning lies in relationships between people, and there is an intimate connection between knowledge formation and activity.

Results

A full summary of the data gathered from participants can be found in Appendix 3C. However, selected findings are summarized below.

Pre-workshop questionnaire. The pre-workshop questionnaire was distributed by and returned to the facilitators, so it had a 100% response rate. Participants were told by the facilitator and in the questionnaire that they did not have to answer any questions they did not want to answer.

In the data gathered prior to the workshop, most of the participants (89.1%) indicated that their schools did use some form of end-of-program technical skills assessment, even if only a teacher-designed classroom assessment. Most participants indicated that their schools used end-of-program assessments for multiple purposes. For administrators, the top three purposes, endorsed by the most participants, were (a) to maintain a continuous improvement process (85.7%), (b) to make improvements to programs in areas in which scores are weak (85.7%) and (c) to help document school and program progress (78.6%). Among teachers, the top three purposes were (a) to maintain a continuous improvement process (70.4%), (b) to make improvements to programs in areas in which scores are weak (55.6%), and (c) to help students receive certification for the job market (51.9%).

Although most participants indicated that their schools used end-of-program technical assessment data, many also indicated that they themselves could use some improvement in using data skillfully, with teachers reporting a greater need than administrators. Figure 3.3 below shows the breakdown of self-reported skill level.

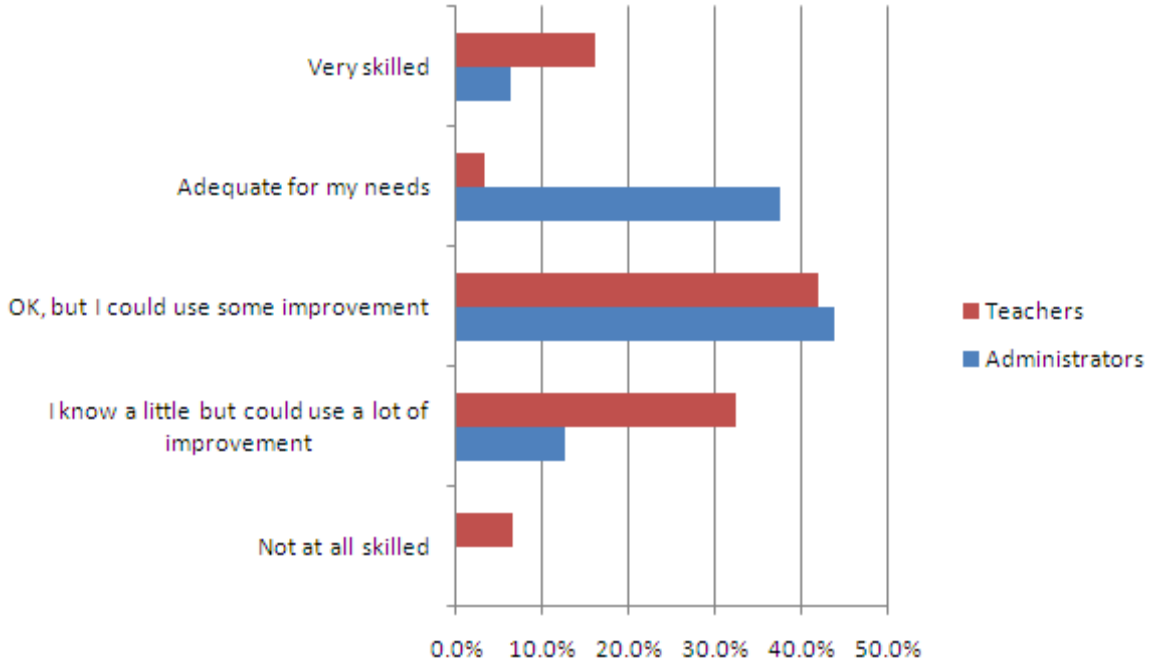


Figure 3.3. Average rating of the degree of skill respondents personally felt they have in using technical assessment data for classroom improvement.

On the knowledge assessment administered prior to the workshop, administrators did score slightly higher than teachers (68.6% compared to 60.9%). The pretest scores varied substantially from site to site, ranging from a low of 44.4% to a high of 72.2%.

Post-workshop questionnaire. At the end of the workshop, participants completed another questionnaire that gathered feedback on the perceived quality of the workshop content and effectiveness of facilitators, the perceived impact of the professional development on knowledge and skills related to use of standardized end-of-program technical skills data, and ways in which participants felt the workshop would be useful when applied in their schools. Participants also completed the knowledge assessment again. This questionnaire was distributed by and returned to the facilitator. One initial participant self-selected out of the project about one half-hour after beginning; not including that person, the post-workshop questionnaire had a 100% response rate.

In terms of overall quality of the workshop content and materials participants generally provided high ratings, with an overall average rating of 5.20 on a six-point scale. In general, teachers gave slightly higher ratings than administrators. When asked to rate various aspects of facilitator effectiveness, participants were also very positive, providing an average overall rating of 5.34 on a six-point scale, with teachers again providing slightly higher ratings. When asked to rate the ways in which participants expected the professional development would impact their organization, the top three, based on overall ratings, were (a) “how I plan instruction,” (b) “student learning outcomes,” and (c) “the way my organization uses data.”

On the knowledge assessment, a modest gain of about 8% was seen overall, with administrators and teachers showing similar gains. In general, the knowledge assessment contained two distinct types of items. The first type measured knowledge of assessment terms such as *mean* and

standard deviation, whereas the second type involved interpreting data provided in charts and tables and drawing conclusions about student and classroom needs based on those data. Overall, a gain was seen in the assessment terms items (a gain of 20% from pre- to post-workshop), whereas there was little change in the interpretation items. This may indicate that participants came in with a greater ability to interpret data than knowledge of the technical terms related to assessment.

Because the nature of this intervention was to make iterative improvements to product and process, many of the items included on the post-workshop questionnaire were open-ended and intended to solicit comments and suggestions for improvements; a great deal of attention was paid to the comments.

When asked what changes they anticipated as a result of the workshop, 6 administrators and 28 teachers provided comments. Administrators and teachers most commonly indicated that that they would look more closely at data and use data more in making decisions. Several administrators also planned to work more closely as a team within their schools when analyzing data. Many teachers indicated an intention to alter their lesson plans based on data (e.g., extending time, changing focus, altering classroom activities). Several teachers also mentioned an intention to review more or re-teach areas in which students were struggling and to alter teaching strategies where it seemed appropriate.

Participants were also asked for feedback on what they felt the key strengths were. For this section, 13 administrators and 26 teachers provided comments. Most commonly mentioned by both administrators and teachers was the inclusion of actual data on their current students as a part of the project. Teachers also highlighted gaining a better understanding of data and being able to set goals specific to their classes.

When asked for feedback on key weaknesses, 13 administrators and 21 teachers provided comments. The two most common comments were that more time was needed for the workshop and that the materials needed to be organized better (this comment was mostly from the first-round participants, and changes were made to the materials for the second round). Other weaknesses that were highlighted included the need for more activity in the workshop (e.g., long day of sitting, needs to be more exciting), that the workshop should take place earlier in the year, that more activities should be built in for administrators (most were teacher-focused), and that more discussion should be included on actual strategies for addressing student weaknesses seen in the data. Several administrators and teachers indicated that they saw no areas of weakness.

When asked for specific suggestions for improvement, 14 administrators and 16 teachers provided comments. Several indicated they saw no need for improvement, but of those who made suggestions, better organization of content and materials was highlighted, along with more time for the workshop and more focus on reviewing the school's actual data and discussing strategies and goals.

One final question in the post-workshop survey asked participants if they would recommend the workshop to others, and why or why not. Of the 15 administrators that responded, 14 indicated that they would and one indicated that he/she would not. The reason this person gave was the

lack of activities geared toward administrators. Of the 26 teachers that responded, 25 indicated that they would. The one who indicated that he/she would not indicated that it "still remains to be seen how this will impact the shops." Based on this feedback, it appears that, overall, participants were pleased with the content and process of the workshop.

Some evidence of the promise of the intervention for achieving the intended outcomes can be noted from verbatim feedback received from the facilitators after their workshops:

- "It went well and was well received by the teachers. I found that there was an overall understanding of the importance of using data but a lot of uncertainty about how to use the data. The teachers are anxious to really analyze their own data. We need to make sure we encourage them to use as much data as they have at first to really get to root causes of the achievement gaps."
- "The workshop was a great success and the feedback from the participants was extremely positive."

Additional evidence emerged from the educators themselves, as they posted comments on the sharing site to be discussed in the next section. One example is the following: "I am excited my program is a part of this project. I think the information I have already acquired from the pretest scores has given me valuable insight as to curriculum changes I need to make. This project will help me to see the changes that need to be made to better prepare my students for the world of work or higher education. Thank you for the opportunity to grow professionally and improve my program."

Interim questionnaire. Midway through the mentoring portion of the project, participants were mailed another questionnaire to gather feedback about the ongoing mentoring as well as any additional recommendations for the workshop they may have had in retrospect. Participants were also asked about their activities and progress on their goals at that point. Because this questionnaire was mailed to participants and returned directly to the data analyst, the response rate was lower, even after several reminders. However, the response rate was respectable, at 87%.

Participants were asked to provide their opinions about the mentoring/coaching portion of the project as well. In general, participants were still positive about the professional development and indicated that they were using it in their schools and making progress on their action plans. They also indicated that the professional development was having an impact on such tasks as how they planned instruction (an overall rating of 4.41 on a six-point scale), and how they monitored student progress (an overall rating of 5.53 on a six-point scale).

The participants indicated that they were comfortable working with their facilitators (an overall rating of 5.37 on a six-point scale), and that the mentoring was helpful in supporting continued learning and in implementing the action plan (overall ratings of 4.68 and 4.71 on a six-point scale). In general, they were satisfied with the amount of contact they had with their facilitators and with the methods of contact. Differences from state to state in some of the responses (e.g., the number and nature of contacts pursued by the facilitator) provided valuable information in

how to select and train facilitators in the future, as well as how to better structure the facilitation process, and this information will be incorporated in the next round of revisions.

When asked for suggestions for improvements to the mentoring portion of the project, 6 administrators and 11 teachers provided comments. The participants expressed a desire for more structure in the mentoring. More cross-school communication and more face-to-face interaction with the facilitators were also frequent themes, as was more structured guidance from the facilitators. Another frequent theme was the need to start the professional development earlier in the year to allow for more mentoring time and more time to enact the action plans. When asked about difficulties they had encountered in implementing the action plan, the most common constraints mentioned were lack of time to work on the action plan and lack of time to meet as a group.

Participants were also asked about successes they had encountered. Six administrators and 21 teachers provided comments. Several indicated that they had seen positive improvements based on the instructional changes they had made. Such instructional changes included reviewing areas of general weakness, finding new materials and resources to use with the students, adding to the curriculum or changing curriculum timing, and assisting or getting assistance for individual students to address weaknesses. Several also commented that knowing there was a study going on and seeing their pretest data seemed to motivate their students.

When asked about roadblocks, 8 administrators and 26 teachers provided comments. By far the most frequently mentioned roadblock was time—time to schedule the tests, time to implement the action plan, time to meet with facilitators, and time to cover all the material. Other roadblocks mentioned included the need for more student data and problems with having to re-teach material that the students had not retained.

The interim questionnaire also asked participants for any recommendations for improvement to the initial workshop. Eight administrators and 22 teachers responded. Suggestions included making the workshop longer, building in more time to work on action plans and goals, starting earlier in the year, providing more direction for what to do after the workshop, having more student data available, and ensuring that facilitators were sufficiently knowledgeable about the topic.

When asked about improvements to the facilitation process, 10 administrators and 21 teachers provided comments. The most common suggestion was more structure to the mentoring and more communication.

Although they saw areas that needed improvement, overall the participants saw value in the project, and indicated that they saw value in using technical assessment data for making instructional improvements. Many indicated that they believed they would continue to use assessment data for making such improvements after the project was over and that participating in the project had increased their desire and willingness to do so.

Suggestions from facilitators for improvement in the mentoring/coaching portion of the project include the development of a workbook that has structured tasks for each of the follow-up

sessions. Examples suggested were that schools within a state could be asked to discuss an issue, or the whole group could discuss an article they had read in common. Follow-up questions could be discussed to test retention of workshop content. Another suggestion was to include a process, form, and examples for tracking additional non-assessment data such as attendance and demographic information. Overall, more structure in the mentoring activities would be of perceived value to facilitators as well as to participants.

Final questionnaire. At the end of the project timeline, the participants were given one final questionnaire. This questionnaire, like the pretest and posttest questionnaires, was distributed by and returned to the facilitator in person at the final group meeting. In one case, an individual was unable to attend the final meeting so was given the questionnaire to complete and mail in. This participant did not return the survey, so the response rate for the final survey was 98% rather than 100%.

Overall, the participants indicated that they perceived their skill in using data had increased due to the professional development program (a mean rating of 4.72 on a six-point scale, as are all of the following means), that the skills had been applied in their classrooms (4.88) and that the program was helpful in planning for improved instruction (4.93). The highest ratings for the areas impacted were in planning instruction (4.70) and monitoring student progress (4.60). The participants were generally comfortable working with their facilitators (5.52), felt they had made adequate progress on their action plans (4.86), and felt that the other members of their team were working together effectively (4.93). Overall, the participants indicated that they saw technical assessment data as a valuable tool for making instructional improvements (5.22), and that they would continue to use data after the project was concluded (5.34)

As with the other questionnaires, the final questionnaire focused on open-ended questions related to suggested improvements and the strengths and weaknesses of the program. When asked about improvements to the facilitation process, 8 administrators and 16 teachers provided comments. The most common suggestions were more time for the mentoring, more contact with facilitators, and more structure to the mentoring portion of the project. Most felt the work they had done on their action plans was a success, but felt that more time was necessary to fully see the results.

When asked about roadblocks, 10 administrators and 24 teachers provided comments. By far the most mentioned roadblock was insufficient time to work on the project plans. When asked about successes, 10 administrators and 23 teachers provided comments. The most mentioned successes included perceived improvements based on spending more time on student weakness and changes to the curriculum. Increased student scores on the posttests were also highlighted.
The last component of the final questionnaire was a re-administration of the knowledge component. The overall mean score dropped somewhat from the posttest (67.6% compared to the posttest mean of 71.9%), but did not drop to the level of the pretest (63.7%). When the two types of knowledge items (knowledge of assessment terms and data interpretation) were examined separately, the drop could be seen to be due mostly to a drop in scores in the knowledge of terms items (a loss of 12%) whereas there remained little change in the interpretation items. Figure 3.4 shows the shift from pretest to posttest to final.

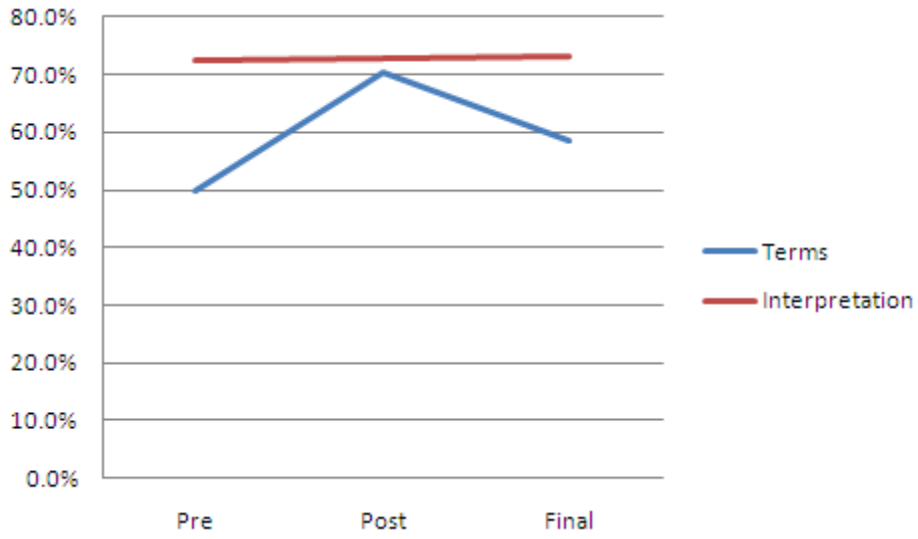
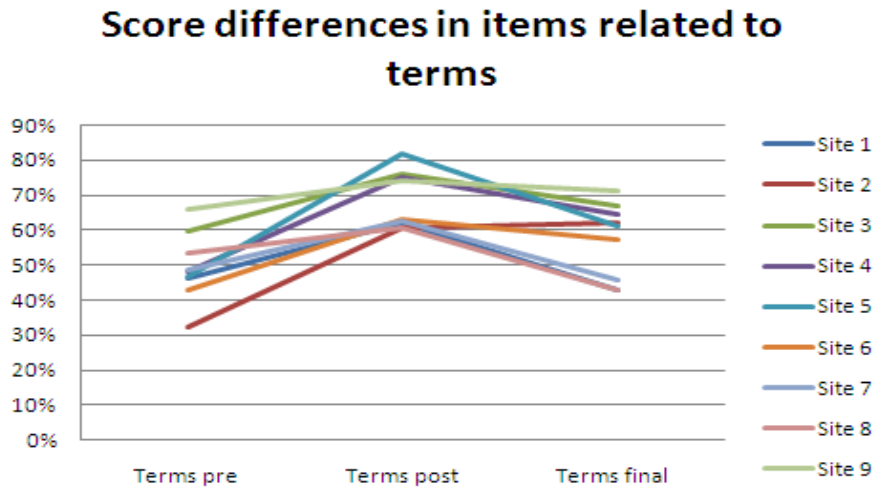


Figure 3.4. Pretest, posttest, and final percent correct on items related to terms and interpretation.

The gain and then subsequent drop in scores related to knowledge of terms may indicate that participants came in with a lower knowledge level and thus were able to gain more knowledge in the workshop. The subsequent drop may indicate a lack of retention that could be alleviated with more review and exercises related to terms built into the mentoring process. Although the above results may indicate that participants are coming in with suitable knowledge in data interpretation or are not gaining additional knowledge through the program, there may still be gains in ability to apply the knowledge to their particular situations and make targeted plans to address findings. This was not a part of the knowledge assessment.

However, it should be noted that, when site averages were examined separately, the interpretation of the situation was less clear cut. As can be seen in Figure 3.5, the same trend of pre-post gain, post-final loss for items related to terms was relatively consistent across sites. However, the situation with the items related to interpretation show more variance across sites. It is likely that other factors (e.g., amount of incoming knowledge, facilitator workshop delivery quality, facilitator mentoring quality, site-specific factors) are having an impact.



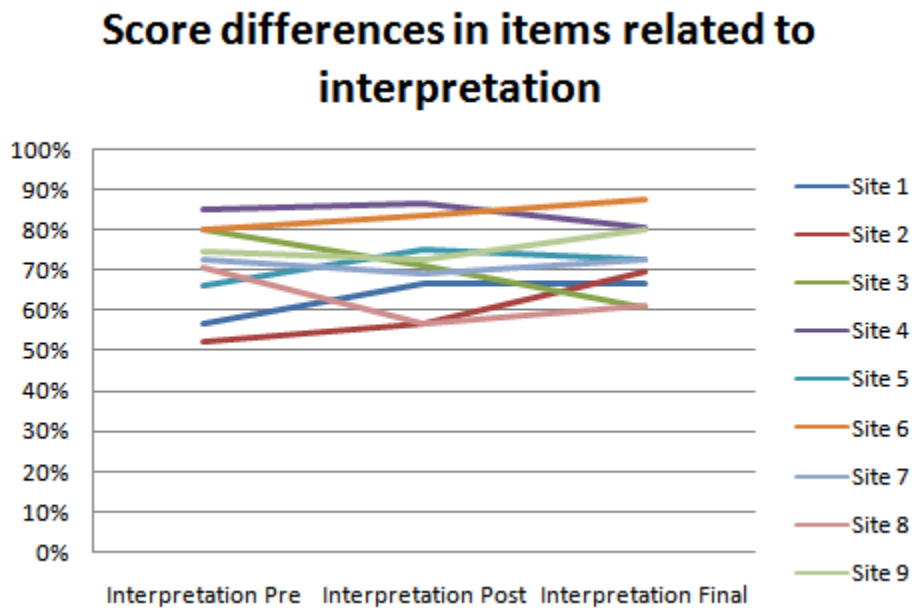


Figure 3.5 Pretest, posttest, and final mean percent correct by site for items related to terms and interpretations.

Discussion of Year 2

It was recognized that, in order for this intervention to operate as intended, it needed to be effectively implemented on several levels:

- First, the initial training had to be developed and delivered in a manner that improved participant knowledge of the use of data, provided them with the tools to transfer that knowledge to the school environment (such as through the development of an initial action plan), and enhanced their motivation to apply the knowledge to make instructional improvements.

- Second, participants needed to be willing and able to actively apply their knowledge, skills, and plans to their school environment in ways that were (a) relevant to the needs of their particular schools, programs, and students, (b) feasible given their particular circumstances, and (c) intended to and likely to result in instructional improvements that might lead to gains in student achievement.
- Third, the professional development had to be an ongoing process that began with the initial training but continued in the school setting via facilitator coaching and participant collaboration. The professional development also needed to actively address barriers to implementation as they arose.
- Fourth, the intervention had to show measureable gains in participant understanding and use of data in a school setting, and instructional improvements based on the use of data.
- Finally, the participants needed to show a motivation and intention to continue to apply their skills in the future.

With each of these conditions met, the intervention did succeed and can be expected to result in lasting, integrated changes in the use of standardized assessment data to inform instructional improvements and would also be likely to result in increases in student achievement. The findings resulting from this project will continue to contribute to improvement of practice in CTE. It seems essential that if technical assessments are to be taken by students for the purpose of measuring achievement, the resulting data should be used, not only for accountability needs, but also to assist educators in improving programs and individual instruction to encourage higher achievement.

Professional development to be offered in future years, as a result of having credible findings on which to base them, should be of benefit in assisting the field. It is anticipated that states will be likely to request such offerings, and that it will be possible to establish a train-the-trainer model to spread knowledge widely.

Discussion

The Year 2 pilot yielded a great deal of information on ways to improve the intervention as well as the intervention's areas of strength. Participants experienced a number of successes based on the intervention. Such successes included spending more time on areas in which students were weak and changes to the curricula based on test results. Many participants indicated that they saw individual and classroom improvements based on the changes made. Although student test scores were not a variable in the study, many teachers indicated seeing improvements at the posttest. Participants were also asked about barriers they encountered in the process, and overwhelmingly the most common barrier mentioned was lack of time – the compressed timeline for the project, as well as a lack of time to work on action plans.

Throughout the pilot, opinions and ideas for improvement were gathered from both participants and facilitators. Based on the feedback received, a number of additional changes and improvements are planned for the process and materials. These include, but are not limited to:

- Altering the timeline of the program so that the initial workshop occurs early in the school year and the mentoring time is increased.
- Possibly lengthening the initial workshop or moving certain elements into more structured mentoring activities.
- Incorporating more exercises into the workshop specifically for administrators.
- Developing more structure for the mentoring portion of the process, including a calendar with suggested timelines for facilitators, structured exercises and activities for facilitators to use with teams during the mentoring process.
- More scheduled meetings and contacts between facilitators and teams.
- More suggestions for inter-site activities and discussions for facilitators to employ where appropriate.
- More structured activities to encourage inter-school conversations via the sharing site.

In the following year, more review and revision took place using the pilot site participants from the current study as well as teachers from other programs in the pilot sites plus educators from other schools and states. The facilitators from the initial pilot study have played an ongoing role in continuing to refine the materials and process. In order to take the intervention to scale, it was important to first broaden the scope of the reviews that inform refinements. Although the intervention was iteratively improved during the year, some necessary adjustments in the design were of a variety that were not suitable for revision in midstream, such as allowing more time by starting earlier in the school year. Changes such as these were made to allow the intervention to function more as intended. It was also desirable to further review the refined intervention to ensure that it would be deemed likely to function similarly in additional clusters, with a broader variety of assessments, in various school types, and in a larger pool of states. Reviews of the improved materials by educators in new sites in the pilot states and new sites in new states and also by subject matter experts were conducted, thus using an alternate but in-depth process to verify the effectiveness of changes. Further iterative improvements were made as a result of these reviews.

Data-driven decision making in education is here to stay. NCLB is based on accessing and utilizing student achievement data. NCLB and Perkins IV both rely heavily on professional development to achieve their goals. Perkins IV specifies that standards-based technical assessments in CTE be administered and that each state implementation plan must describe how professional development will, among other charges, assist in accessing and utilizing data including occupational information, student achievement data, and data from assessments. If the spirit and not just the letter of both Perkins and NCLB are to be adhered to, it is critical that student achievement data are not simply gathered and reported, but also used to inform instruction and make classroom-based improvements that should ultimately lead to higher student achievement. These favorable outcomes depend on educators receiving effective professional development to acquire skills in using and interpreting data from standardized technical assessments.

This intervention addresses both those needs by providing educators with (a) the knowledge and skills they need to understand and use assessment data for instructional improvements in a manner that meets standards for effective professional development, (b) the tools and resources to apply those skills in their school settings, and (c) the coaching and motivation to work collaboratively to continue to use their skills in a focused and integrated manner. As educators

integrate data use into determining, making, and evaluating the effectiveness of instructional improvements, these improvements will be more effectively targeted toward the specific needs of their students, programs, and schools, resulting in higher quality improvements and a more focused use of resources. As instructional improvements become more targeted and effective, it is anticipated that student achievement is likely to improve, resulting in better prepared students entering higher education and the workforce and subsequently in long-term gains in workforce quality, productivity, and global competitiveness, goals important not only to the CTE field, but to the nation as a whole.

The fully refined professional development model developed by this project—CTEDDI (Career and Technical Educators Using a Data-Driven Improvement Model)—will be made available to states in NRCCTE Year 5 (2011-2012). CTEDDI will provide educators from participating states with professional development intended to increase their knowledge and skills in the use and interpretation of assessment data for the purpose of making instructional improvements. The professional development will be delivered by facilitators who will also serve as coaches for the educators for applying their initial training at their school sites.

Chapter 4

Where We Need to Go

It has been over a quarter-century since *A Nation at Risk* (National Commission on Excellence in Education, 1983) was published, but the pressure for educational reform that it started has not abated. The calls for higher standards and increased accountability have, if anything, become more pervasive and powerful. The Common Core State Standards, which appear likely to be adopted by almost all states, and the Race to the Top competition conducted by the U.S. Department of Education (2009), have increased the emphasis on test scores as the dominant measure of educational quality. CTE has been and will continue to be impacted by these pressures. As Kazis (2005) put it:

> There is no realistic way to significantly improve high school outcomes without tackling secondary career and technical education. CTE is too significant a segment of the high school enterprise, and its traditional role as a track [f]or the "non-college bound" means that a large proportion of the students who need the most support to achieve at high levels are enrolled in CTE programs or schools. The future of high school reform cannot be addressed without including vocational high schools and programs within comprehensive schools. (p. 4)

The Expanded Mission of CTE

The associations that represent CTE educators have embraced the need for an expanded mission, one that includes an increased emphasis on academics and preparation for postsecondary education. The NASDCTEc advocates at the national level on behalf of the officials responsible for how CTE operates in the states. The association recently published *Reflect, Transform, Lead* (NASDCTEc, 2010b), which states:

> CTE reflects the modern workplace. And since the majority of careers require a postsecondary credential, high-quality CTE programs incorporate rigorous academic and technical standards, as well as critical workplace skills such as problem solving, communication and teamwork, to ensure career and college success for its students. (p. 1)

To further advance the direction in which CTE is moving, NASDCTEc joined with ACTE, the largest association representing CTE educators, and the Partnership for 21st Century Skills to publish *Up to the Challenge* (2010). This report highlights the ways in which CTE content and pedagogy complement the Framework for 21st Century Learning developed by the Partnership and urges the incorporation of the Framework and CTE throughout education. The linkage with the Partnership is a concrete example of how the leadership for CTE is attempting to make the field a key part of high school reform, as has also been advocated by Brand (2003), Kazis (2005), and the National Governors Association Center for Best Practices (2007).

The University Council for Workforce and Human Resource Education (UCWHRE) represents most of the universities that offer four-year teacher education programs and award doctoral degrees in CTE. In 2005, UCWHRE published a book that examined the need for leadership in

CTE. One of the chapters in that book (Camp & Johnson, 2005) addressed the need for a broader theoretical framework for CTE that specifically includes the reinforcement of academics through contextualized applications.

The increased pressure on CTE to improve the academic skills of its students stems from a broad consensus that, as a society and an economy, we can no longer accept a large proportion of our young people leaving education without a sound academic base. In an economy characterized by rapid rates of change, workers must be able to continually learn and adapt. For those students who choose CTE, the contextualized application of academics provides an opportunity to learn skills that have not been acquired in previous classes. Cross (1992) identified the "pedagogic pluses" of what was then called vocational education as: (a) student involvement, (b) feedback between teacher and student due to the observable, easily assessable nature of the tasks taught, and (c) high standards based on external certification and advisory committees that provide an outside check on student performance. The National Research Council and the Institute of Medicine (2004) have summarized the research documenting how occupational content can be used to increase student engagement and motivation to learn.

But the challenge is enormous. For most of its history, CTE served the non-college bound by preparing them for employment upon leaving high school (Kazis, 2005). To ensure that the skills taught in the classroom were the same as those used on the job, CTE teachers were (and still are) required to have several years of work experience in the occupational areas they teach. There is no guarantee, however, that work experience teaches the full range of skills in any given occupation. NOCTI was originally established to determine if such workers actually knew and could perform the skills they were applying to teach. This requirement of being able to perform is an important qualifier because written assessments of occupational knowledge and skills have only modest correlations with assessments of actual performance (Nuttall, 1987). Nevertheless, the knowledge and skills of expert workers has remained the starting point for the development of occupational curricula. Instead of relying on individual teachers, information for curriculum development is usually gathered from workers by structured methods, such as surveys, job and task analysis, and the guided group discussion method DACUM, an acronym for Designing A CUrriculuM (Norton & Moser, 2008).

The occupational grounding of the CTE curriculum must remain paramount if students are to be prepared for employment, but technical learning must be supplemented with increased attention to the academic theories and constructs that support and reinforce that technical learning. Increasing the impact of participation in CTE courses on academic performance represents one of the main challenges facing the field. One drawback of the work experience requirement for CTE teachers is that the academic underpinnings of CTE teachers who enter teaching from their occupations are not like those of teachers who follow the traditional teacher preparation path. Those in the technical arena are focused on task completion, whereas those in education are focused on the process of learning and acquiring information. The trajectory of most regular secondary teachers includes high school completion, college completion, and teaching. The trajectory of many CTE teachers includes high school completion, work experience, and then entry into teaching. If secondary CTE is to carry out its expanded mission, ways must be found to assist CTE teachers to fulfill the expectations for the teaching of both technical *and* academic content that have been placed upon them.

Responding to the Challenge

The two NRCCTE projects discussed in this report address some of the professional development implications of these expanded expectations for CTE. The NOCTI project addressed the technical side by developing the CTEDDI professional development model (Career and Technical Educators Using a Data-Driven Improvement Model). CTEDDI is designed to increase the ability of CTE teachers and administrators to use data from technical skill assessments to improve program planning and instruction. The materials and procedures developed by NOCTI are based on an extensive review of the relevant literature and survey research that determined what teachers and administrators knew and wanted to learn. Initial drafts of the materials were field tested and the feedback from these tests was used to revise the model. The revised model has undergone additional review and iterative refinement, and planning has begun for a national roll-out of the model in 2011-2012.

CTE teachers are familiar with teaching to industry standards. Many programs have state or national licensing and certification bodies that set standards that program completers must meet. Table 2C.9 in Appendix 2C presents an extensive list of organizations that conduct certification and summative testing of occupational skills. The training provided by CTEDDI will enable CTE educators to use data from such testing to identify skills and concepts needing increased attention in their classes in order to bring all students to the level that they can pass the technical skills tests used in their occupational areas.

Using test results in this way is one of the core components of continuous quality improvement and strongly encouraged by the accountability requirements in Perkins IV. Martinez (2007) included accountability principles as part of the foundations upon which all CTE programs should be based. As the field has implemented these requirements, it has found many "broken" systems; among them, the inability to effectively track students from high school to postsecondary education to work; to report assessment or certification data consistently; and to benchmark acceptable standards (Kotamraju, 2010). Field testing of the CTEDDI model has helped to point out and correct flaws in local data collection systems. All indications from the U.S. Department of Education, such as the criteria for Race to the Top, imply that this emphasis on accountability will continue when the federal CTE legislation is reauthorized in Perkins V. CTEDDI can help local districts provide a solid response to the Perkins IV requirements for program improvement and upgrading of teachers' instructional abilities. It also can enhance data reporting and collection (via the Consolidated Annual Reports that all states must file) and will assist in providing evidence of longitudinal gains that indicate that CTE, in general, is having a positive effect.

The SREB project addresses the pedagogic skills needed by alternatively certified teachers and places a special emphasis on the integration of academic and technical instruction. Like the NOCTI model, the SREB induction model is research-based. The four concept papers in the Appendices to Chapter 2 summarize the research upon which the modules used in the induction model were based. These modules were iteratively field tested, and a test of the full model began with training that was conducted in the summer of 2010. The 10 teachers who participated in the summer training are receiving mentoring, coaching, and administrative support and are taking

part in an electronic community of practice during the 2010-2011 school year. Information obtained from this full-year test will be used for additional refinements of the model. The model emerging from these refinements will be experimentally tested during the 2011-2012 school year by randomly assigning some alternatively certified teachers to participate in the model and others to serve as a control group.

When the SREB model has been fully tested and revised, states will have available a scientifically verified approach to providing alternative certification. The evidence that has been reviewed in this report implies that the need for alternative certification, which is already high, will only increase. NASDCTEc (2010a) published a four-part analysis of trends in CTE based on data collected from a survey of all state directors. One of these analyses focused on the shortage of CTE teachers in the 16 career cluster areas. The areas with the largest current shortages at the secondary level are in STEM (Science, Technology, Engineering, and Mathematics); Health; Manufacturing; Agriculture, Food, and Natural Resources; and Architecture and Construction. The publication also cited two model programs for addressing these shortages: Both involve alternative certification of experienced workers recruited from business and industry.

The field tests conducted by both NOCTI and SREB replicated two findings often noted in the research on professional development:

- Teachers want learning experiences that they can directly apply in their classrooms. The NOCTI field tests provided teachers with test results from their own students, and this enhanced the usefulness of the training they received. The participants in the SREB tests explicitly requested more examples from their own content areas in the training materials, and the materials were revised to provide these for each participant.

- Teachers benefit from opportunities to interact with each other to reflect on and digest information that has been presented. Professional development is often thought of as something "done to" teachers, but the best professional learning occurs when teachers work together to improve their own lessons and methods (Darling-Hammond et al., 2009). The primary association of those involved in professional development has recently changed its name from the National Staff Development Council to Learning Forward to reflect a change in conceptualizing professional development from one in which teachers are recipients to one in which teachers are collaborators. The case studies developed by NOCTI on the use of assessment data to revise instruction illustrate the type of collaborative professional development that produces change in program planning and classroom instruction.

Our experience in these projects and our assessment of the relevant literature lead us to conclude that providing time for teachers to work together represents a critical prerequisite for the type of professional development that will be needed if CTE is to significantly increase the rigor of its offerings. If technical rigor is to be improved, teachers and administrators need time to learn and apply the techniques of using technical skills assessment data to improve instruction. If academic rigor is to be improved, ways must be found for CTE teachers to work with their academic counterparts to identify and explicitly teach the academics inherent in CTE curricula.

Unfortunately, at a time when teachers need to collaborate more than ever, it appears that they have less time to do so. A recent study by the National Staff Development Council (one of the last it published before changing its name to Learning Forward) implied that the amount of time teachers have to work together has been declining (Wei, Darling-Hammond, & Adamson, 2010). This study analyzed data from the 2000, 2004, and 2008 Schools and Staffing Surveys, conducted by NCES with nationally representative samples of schools. The 2008 survey indicated that teachers had participated in fewer professional development experiences of more than eight hours than they had in 2004. In the 2000 survey, 34% of the teachers agreed or strongly agreed that there was "a great deal of cooperative effort among staff members;" in 2004 this figure dropped to 17%, and by 2008 it was only 16%.

Time for teachers to work together to improve instruction is a relatively new concept in American education and differs from the prevailing image of "real" teaching: the autonomous teacher presiding in the classroom. This image stands in sharp contrast to practices in high-performing Asian and European countries in which teachers spend more time in lesson planning and collaboration with colleagues than in direct instruction (Darling-Hammond et al., 2009). Providing more time for collaboration has major financial implications and may be the primary constraint on wider adoption of this practice. A review of current practices in financing professional development concluded that most districts have little information on what professional development costs or the results it produces (Sawchuk, 2010).

As the economic effects of the recession that began in 2008 continue, resource constraints on state and local educational agencies are likely to make it even more difficult to provide the time needed for effective professional development. The funds that are available must be used effectively, and this implies fewer, more highly targeted, and longer professional development experiences. CTEDDI and the SREB induction models are being carefully developed with extensive feedback from field tests and will result in approaches that are likely to maximize the return on the time invested in them.

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APPENDICES - CHAPTER 2

Appendix 2A

Concept Paper for Instructional Planning Module

Four modules provide the curriculum for the professional development experiences designed for the alternative certification induction model for CTE teachers. The purpose of this paper is to frame the content of the instructional planning module and describe literature and research that support that area of competence. Scientifically based research that informs what CTE teachers need to know and be able to do in planning instruction is rare. Consequently, much of the literature described in this paper is consistent with policy that drives CTE or with research and literature that reflect what is generally accepted as good practice.

"What do beginning CTE teachers need to know and be able to do to plan instruction effectively?" It is widely accepted that accomplished CTE teachers plan instruction in ways that help students master technical and academic knowledge and skills (National Board for Professional Teaching Standards, 1997). Figure 2A.1 illustrates a framework for the essential concepts that teachers need to know and be able to do plan instruction that leads to students college and career readiness. The first concept is the specific nature of the content that teachers need to understand to plan well. The second concept is the needs of students, including their talents, interests, aspirations, characteristics, learning styles, and learning needs. The third concept is the function and use of instructional planning tools such as unit plans, lesson plans, curriculum maps, and course syllabi. Finally, this section will address two related areas of competence for instructional planning: reflective practice and the skill of working with others to plan effectively.

Teachers Need to Know Their Content

A deep understanding of content and the concepts, principles, and skills within that content is critical for teaching. The Interstate New Teacher Assessment and Support Consortium Model Standards for Beginning Teachers (INTASC, 1992) state that a beginning teacher needs to "understand the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and create learning experiences that make these aspects of subject matter meaningful for students" (p. 14). As Shulman (1987) noted, "we expect teachers to understand what they teach, and when possible, to understand it in several ways" (p. 14).

CTE teachers must have a sufficient understanding of the career field to guide student learning. Recent policy developments in the field of CTE and a shifting emphasis on the role of CTE in public schools have increased the depth and breadth of that content. Accomplished career and technical educators command a core body of knowledge about the world of work in general and the skills and processes that cut across industries, industry-specific knowledge, and a base of general academic knowledge.

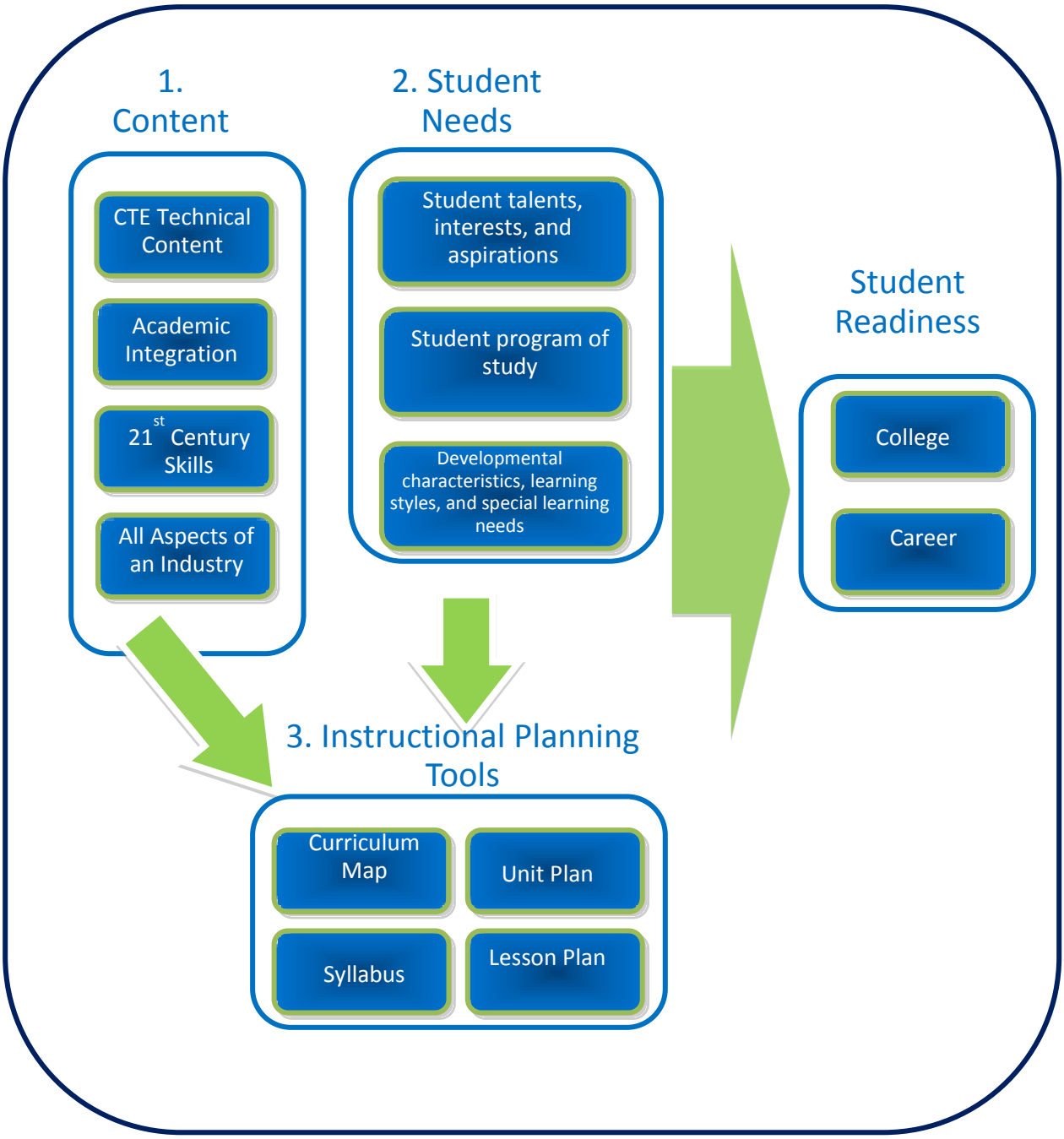


Figure 2A.1. Essential concepts in instructional planning.

CTE teachers draw on this knowledge to establish curricular goals, design instruction, facilitate student learning, and assess student progress (National Board for Professional Teaching Standards, 1997, p. 13). Historically, CTE teachers needed only know the specific skills of the occupation for which they were training their students, but the National Board for Professional Teaching Standards (NBPTS) suggests that a broader understanding of work in general and skills that cross industries is needed. Beginning teachers need an overall understanding of this content and how it has evolved.

***The new mission of CTE*.** These are times of significant change for CTE, largely due to major shifts in the demands of the American workforce. Eight of the 10 fastest growing occupations require some form of postsecondary education and the U.S. Department of Labor (2008) has indicated that this trend is likely to continue. About 72% of the increase in postsecondary education requirements is a result of higher skills demanded by employers for jobs that previously did not require any college (Carnevale & Desrochers, 2003). Furthermore, only 40% of manufacturers believe that high school graduates are prepared for entry-level positions (National Association of Manufacturers, 2005). A survey of human resource officials (U.S. Department of Labor, 2001) found that 81% rated recent hires as deficient in written communications and 72% found recent hires to lack basic writing skills such as grammar and spelling. The central question seems to be whether the workforce will have the required skill sets demanded by the 21st century workplace. Given these new requirements, traditional CTE programs that prepare students for entry-level jobs are no longer viable.

In addition to meeting the needs of the workplace, CTE is called upon to contribute to student achievement and high school completion. Nearly every high school student takes one CTE course and some students earn more credits in CTE than they do in mathematics or science (Silverberg et al., 2004). High school students who combine a substantial academic curriculum with several vocational courses do better than students who omit either one of these two components (Stern, 1999). The risk of dropping out for students who entered high school at a normal age was also found to decrease as they added CTE courses to their curriculum until they reached a ratio of taking one CTE course for every two academic courses (Plank, DeLuca, & Estacion, 2005). CTE students who graduate with technical skills also experience a labor market advantage (National Assessment of Vocational Education, 2004). CTE clearly plays a role in engaging students, supporting them in graduating, and linking them to their futures.

A major theme in the literature on CTE is the need for a strong link between academics and CTE studies, in part because there is little difference between the level of academic knowledge and skills necessary to enter the workplace and the level needed to go to college (American Diploma Project, 2004). Perkins IV, the federal law that reauthorizes funding for CTE, requires schools to develop challenging academic and technical standards for CTE programs and to provide challenging, integrated instruction. “When CTE courses also incorporate more academic rigor, research shows that student achievement significantly increases. These findings suggest that CTE should be an important aspect of a state’s broader high school redesign strategy” (National Governors Association, 2007, p. 1).

ACTE (2006) has suggested that the clear goal for CTE should be career *and* college readiness for all students. In a report issued by Jobs for the Future and the Aspen Institute (2005), Medrich called for CTE to combine academics with career-focused studies, weed out less compelling programs and weak courses, and focus on the fundamentals, including engaging curriculum and instruction and quality assessments. As beginning teachers enter the field and engage in their first year of instructional planning, a sense of the changing needs of the workplace, the demands of federal policies and school improvement efforts, and the role of CTE in the “big picture” of education is essential. Beginning CTE teachers need to understand how the new mission for

CTE—to prepare students for both the workplace and further education beyond high school—will impact the content they teach in their particular CTE programs.

Career clusters, pathways, and programs of study. The new mission for CTE implies the need for a broad framework of content for CTE courses. To provide a broad foundation of opportunity and to prepare high school graduates for further learning and the workplace, CTE content is best organized around occupational career clusters that include competencies necessary for a wide range of jobs within each cluster (NASDCTEc, 2006). Within each career cluster, there are opportunities to develop multiple career pathway programs of study (POS) that describe CTE and academic courses in a seamless series of learning experiences from Grade 9 through the postsecondary level. In these pathways, the CTE courses at the 9th- and 10th-grade level focus on transferable work skills, academics in context, and career exploration experiences. Grades 11 and 12 include the technical core of the career pathway, including the technical skills within the cluster, challenging academics, and work-based learning. Postsecondary pathway experiences include advanced technical skills, advanced academics, and worksite experiences (Hull, 2005). POS sequences lead to readiness for postsecondary and the workplace at the end of high school, including certification and industry-recognized credentials if appropriate, and provide a seamless transition from high school to postsecondary studies. Because students will likely change jobs many times during their work careers, the concept of a pathway within a career cluster provides students with a broad base of transferable knowledge and skills that crosses industries.

The States' Career Cluster Initiative (NASDCTEc, 2006) provides an in-depth, online resource for CTE teachers to use in instructional planning. Each cluster is outlined with cluster-level knowledge and skills and sample indicators of performance. Within each cluster, there are a varying number of career pathways, each with a knowledge and skills chart that describes what workers need to know and be able to do to demonstrate competence within a career pathway. Depending on the state in which the beginning teacher is employed, there may be state online resources that have adapted the career cluster framework or link the specific state CTE competencies identified for each program back to the State's Career Cluster Initiative model.

Industry-specific knowledge and skills. Because they often enter teaching from a career in business and industry, beginning CTE teachers are often most familiar with the knowledge and skills students need to master to be successful in a particular industry. Teaching industry-specific knowledge and skills requires a depth and breadth of understanding that usually is obtained from employment experiences, a professional school, or clinical internship. It involves knowing the workplace culture and expectations, applicable industry standards needed for certification or a credential within the field, and the kinds of industry assessments and employer exams used to measure the skills of the field. Industry-specific knowledge also encompasses trends, new findings, and technology.

Most states list industry-specific knowledge and skills to be taught in CTE programs in secondary CTE standards that specify what students are to master in each program. Although there is variability in the design of these standards from state to sstate, almost all states have either completed or are in the process of completing CTE standards (Castellano, Harrison, & Schneider, 2007). Similar to efforts to identify academic standards, CTE standards are the first step states take in creating a curriculum and assessment framework on which a system of

accountability is based. Because the Goals 2000 Act of 1994 funded the development of industry standards and Perkins IV requires local education agencies to use state-developed indicators to assess both CTE and academic performance, some states' CTE standards provide information on how the standards align to the state academic standards or national industry standards. The first step a beginning CTE teacher can take in outlining course content is to locate and study the knowledge and skills outlined in these state CTE standards.

Nationally developed industry skills standards, although they may be reflected in the state CTE standards described above, may also prove a good content resource for CTE teachers. Some industry associations serve as certifying bodies and publish the specific skills that students need to pass certification exams and earn a credential that is recognized throughout the field. The National Institute for Metalworking Skills (NIMS) is but one example. NIMS developed precision manufacturing skill standards and competency assessments and it accredits programs that meet its quality requirements. Over 6,000 U.S. companies recognize the NIMS standards, credentials, and accreditation process.[3] As beginning CTE teachers develop their understanding about the content they are to teach, examining the certification exams may prove helpful. Some states have even begun to use these exams to assess students' mastery of complex material that measures both academic and technical content (SREB, 2009). An awareness of national industry standards, the certification or credentialing process for individuals or programs, and the exams that measure performance are important for beginning teachers to consider as they make instructional plans.

Academic knowledge and skills. With the emphasis on academic skills outlined in the previous section on the new mission of CTE, beginning CTE teachers need to be familiar with the academic knowledge and skills students need to graduate from high school and be college- and career-ready. High school CTE programs are expected to provide a relevant context for applying academic knowledge and skills, thereby increasing student motivation to learn challenging content and persist to graduation and further learning beyond high school (Bottoms & Young, 2008).

The first step in identifying the academic knowledge and skills that need to be taught in CTE programs is to check the degree to which existing state CTE standards have referenced related state academic standards. Some states have completely aligned their CTE standards and curriculum resources to state academic standards. Similarly, industry skill standards may also include references to academic standards. In the States' Career Cluster Initiative mentioned earlier, academic knowledge and skills are integrated into the model so that each career cluster pathway includes English, mathematics, and science content related to the career field.

SREB established college and career readiness indicators in English (Murray & Bottoms, 2008) and mathematics (Southern Regional Education Board, 2010) that CTE teachers can use to focus on key knowledge and skills needed to make the transition to further learning and the workplace. The development of the indicators involved expert panels of curriculum and national test developers and teachers, an analysis of major curriculum documents include the ACT College Readiness Standards and national content standards, and the identification of a set of indicators by the expert panel. Sample learning activities and assessments were developed for each

[3] See https://www.nims-skills.org/web/nims/home.

indicator. In order to meet the demands of the new mission of CTE, teachers will need professional development in indicators such as these and assistance in how to use them to create intellectually challenging assignments and assessments that integrate academic and CTE content with the goal of college readiness.

***Workplace readiness skills*.** There is a growing understanding and delineation of a common core of general knowledge about the workplace and employability skills that all employers expect of their employees to be successful (Partnership for 21st Skills, 2009). These include work ethics, interpersonal relationship and communication skills, and leadership and management skills. The career cluster knowledge and skills frameworks of the States' Career Cluster Initiative include these skills. Beginning teachers need an understanding of how these skills are applied in the workplace.

Another emerging framework for workplace readiness skills are the 21st century skills (Partnership for 21st Century Skills, 2009), developed in an attempt to focus K-12 educators on the most important skills student needs to learn to meet the demands of modern life. Working with educators, employers, and government officials, a set of standards were identified within several categories. Life and career skills focus on competence related to flexibility, initiative, social skills, productivity, and leadership. Learning and innovation skills include creativity, critical thinking, communication, and collaboration. Information, media, and technology skills focus on information and media literacy. The standards also outline core subjects and interdisciplinary themes of civic literacy, global awareness, and financial literacy. Teaching the 21st Century Skills requires a variety of teaching strategies such as problem-based learning and cooperative learning. States are encouraged to launch initiatives to adopt and implement the 21st Century Skills in their K-12 school system and several states have already begun such initiatives. CTE teachers need an understanding of these skills, how they fit within the career and technical curriculum, and the contribution CTE can make to ensure that all students possess these skills.

All Aspects of an Industry refers to (a) the planning, management, financial, technical, and production skills and (b) the underlying principles of technology, labor issues, community, and health, safety, and environmental issues that students need to enter and succeed in a career field. An integral part of Perkins IV, All Aspects of an Industry explores the context in which technical skills are used. In addition to the specific skills needed for a particular occupation, the teacher who integrates All Aspects of an Industry shows students the big picture of the industry and helps students learn the technology, communication, health, and safety issues important to the industry as a whole. Beginning teachers who use the States' Career Cluster Initiative resources can find All Aspects of an Industry components integrated in the foundation knowledge and skills of the cluster model.[4]

Teachers Need to Know Their Students

Knowing the career field is not enough to be effective as a CTE teacher; teachers must know the students they are charged to teach. Beginning teachers need to "understand how students differ in their approaches to learning and create instructional opportunities that are adapted to diverse learners" (INTASC, 1992, p. 18). As the NBPTS (1997) noted, "accomplished career and

[4] See http://www.careerclusters.org.

technical educators personalize their instruction and apply knowledge of human development to best understand and meet their students' needs" (p. 9). As Lynch (2000) described it, this aspect of the knowledge base in education has "exploded enormously" (p. 73). Much more is known today about how young people learn, remember, perceive, transfer knowledge, and problem-solve.

Students have certain characteristics based on their developmental level—intellectual, social, and emotional—and specific learning needs that vary widely. Knowing students' stage of developmental understanding and the ways in which learning needs vary can help beginning teachers plan lessons more effectively. Adolescence is a time of rapid physical maturation, intellectual growth, and the development of skills to meet new social demands. Some of the key developmental changes occurring during adolescence include:

- The increasing ability to think abstractly—consider the hypothetical, look at multiple dimensions of the same situation, and reflect on themselves;
- More understanding of internal psychological characteristics—the development of friendships based more on perceived compatibility of personal characteristics;
- Distancing of relationships with parents and family; and
- Importance of social acceptance, peak of peer conformity. (Steinberg, 2007)

The students schools serve are becoming more diverse and will likely become more so as our nation becomes increasingly diverse (Tomlinson et al., 2004). CTE classrooms in particular have a rich history of including diverse groups of students. When planning, teachers should set high expectations and provide opportunities for all students to succeed, including boys and girls, students with special educational needs, students from all social and cultural backgrounds, students of different ethnic groups, and students from diverse language backgrounds. Teachers need to be aware that students bring to school different experiences, interests, and strengths that will influence the ways in which they learn. A first important step is in taking the time to get to know students through questionnaires, personal interviews, and observation. Teachers can also learn about their students by reviewing school records, test scores, career interest and skill inventories, graduation or career plans, and documents that outline modifications for students with special learning needs.

With careful observation, beginning teachers will notice that students prefer some methods of learning over others. These preferences, often referred to as learning styles, can help teachers plan instruction more effectively. Students may, for example, prefer to learn by speaking and listening; others by what they watch or see; some by touching; and others need to involve their whole body in learning. Dispositions for learning can also range along the dimensions of approaches to new information. Some students prefer learning that is spontaneous and intuitive; whereas others like to plan and organize their work, focusing on a logical progression and details that fit in to a larger schematic. A number of frameworks exist for categorizing these learning preferences (Felder & Silverman, 1988; Kolb, 1984) and inventories have been developed to identify students' learning styles. CTE teachers can use these assessments to accurately determine students' learning styles and use that information to plan lessons that more closely meet the needs of a students.

CTE teachers are also responsible for modifying their lessons to accommodate students with special learning needs. The Individuals with Disabilities Education Act, designed to ensure that students with disabilities have the opportunity to receive a free appropriate public education, requires an Individualized Education Program (IEP) for each student who has special learning needs. The IEP is a written statement that describes the educational program that is specifically designed to meet a child's individual learning needs. An IEP contains information on the child's achievement and performance, annual goals, support services, how the child is to participate in state and district assessments, and what instructional modifications will be provided. CTE teachers should consult with special education teachers to learn about how to best support the student in learning, including how to use modifications or accommodations such as providing more time, shortening the length of assignments, breaking up a large assignment into small parts, providing a different format for demonstrating understanding (i.e., verbal instead of written), and using tiered assignments that allow learners to work on the same knowledge or skills but with varying degrees of complexity, open-endedness, or abstractness.

CTE teachers should plan their approaches to teaching and learning so that all students can take part in lessons fully and effectively. Several key elements of planning for diverse learners include:

- Creating *learning environments* that value the contribution of all students and where students feel secure.
- Securing *students' motivation and concentration* by using teaching approaches appropriate to different learning styles, building on the interests and cultural experiences of the students, and planning and monitoring the pace of work so that all students have a chance to learn effectively.
- Providing *equal opportunity* for all students to participate and including materials that allow for a variety of interpretations and outcomes.
- Using *appropriate assessment approaches* that provide clear feedback and allow for different learning styles and ensure that students are given the chance and encouragement to demonstrate their competence and attainment through appropriate means.
- Setting *learning goals* that are attainable yet challenging, to support students' confidence in their ability to learn and to build on students' knowledge, experiences, interests and strengths to improve areas of weakness and demonstrate progression over time. (Tomlinson, 2001)

Teachers Need to Know and Use an Instructional Planning Process

Good instruction is purposeful and directed toward learning goals. Consequently, the process of instructional planning usually begins with identifying what students are to learn. There is a well-documented research literature on the importance of clear learning goals (Brophy & Good, 1986; Jones, 1992; Walker, 1985) and their appropriateness for the students (Druian & Butler, 1987; Kauchak & Peterson, 1987; McCutcheon, 1980; Peterson, Marx, & Clark, 1978; Natriello, 1987). CTE teachers are required to determine specific instructional goals from a variety of sources related to the career field—career cluster frameworks, industry standards, and academic standards. In addition, the teacher should consider district curriculum, state CTE standards, and industry standards. These instructional goals may deal with knowledge, skills, academic skills,

and workplace or employability skills. Good instructional goals must be stated clearly and be capable of assessment. The CTE teacher selects and sequences the goals according to the diverse students in the CTE program.

Once CTE teachers have established instructional goals, they are responsible for developing instructional plans. The importance of coherent instructional plans is well documented in the research literature. Students learn better when the instruction is logically sequenced (Armento, 1977; Smith & Sanders, 1981). The beginning teacher creates "lessons and activities that operate at multiple levels to meet the developmental and individual needs of diverse learners and help each progress" and "short-range and long-term plans that are linked to student needs and performance" (INTASC, 1992, p. 28). An accomplished CTE teacher "fosters experiential, conceptual, and performance-based student learning of career and technical subject matter and creates important, engaging activities for students that draw upon an extensive repertoire of methods, strategies, and resources. Effective practice is also marked by the ability to integrate career and technical and academic disciplines productively" (NBPTS, 1997, p. 39).

Instructional planning usually involves "chunking" like goals into units and then into daily lessons. An instructional unit includes a logical sequence of learning activities that will lead to students achieving the instructional goal and an assessment that provides evidence of the learning that is achieved. Each learning activity has a purpose in the unit as a whole and has a reasonable time frame. The learning activities in the unit should be selected so as to be suitable for the students' learning needs. Unit design also involves selecting appropriate materials and resources to support the learning goal.

The process of unit planning has been heavily influenced by the standards movement, which focused educators on helping all students achieve a well-defined set of outcomes from their learning. The concept of backwards design is based on beginning with the end, or in this case, the standards, in mind. Backwards design suggests a planning sequence in which the first step following the identification of learning goals is to develop the assessment that will be used to determine whether those learning goals have been achieved (Wiggins & McTighe, 1998). Once the acceptable evidence has been determined for the assessment, learning experiences and instruction are planned. This design concept has been detailed in a wide variety of formats, including SREB's *Planning for Improved Student Achievement: Ten Steps for Planning and Writing Standards-Based Units* (2007).

In addition to planning units of instruction, CTE teachers at the secondary level are also required to plan a course syllabus. Planning at the course level can increase the quality of CTE programs (Bottoms, Pucel, & Phillips, 1997). In SREB's *Designing Challenging Vocational Courses: A Guide to Preparing a Syllabus* (Bottoms et al., 1997), instructors are encouraged to: decide what knowledge, understandings and skills are needed for the career field; set high standards; use projects as a focus for learning; establish their role as a facilitator of learning; and assess continuously. The steps in the syllabus design process are to:

- Describe the course
- Clarify the instructional philosophy
- Determine major course goals
- Select and put into sequence major course projects

- Develop project outlines
- Decide on an instructional delivery plan
- Develop an assessment plan for the course (pp. 35-61)

In anticipation of the need to communicate CTE standards-based instructional plans to other teachers as part of the effort to integrate academic and CTE content, CTE teachers also use a process called curriculum mapping. Curriculum maps are based on the school calendar and outline essential knowledge and skills to be examined, processes and skills to be emphasized, and products and performances that are the assessment of the learning (Jacobs, 1997). Curriculum maps allow teachers to record the time it takes to teach particular content and to analyze those time frames in reference to other units of study and the whole curriculum of a course. The unique contribution of curriculum maps as a standards-based instructional tool for CTE teachers is that they provide a visual sequence of what is taught and when it is taught so that the information can be shared with other teachers. Such information is central to the process of identifying points in the curriculum where integration opportunities exist.

There is a well-documented link between teacher effectiveness, planning of learning activities, and selection of materials for learning (Clark & Yinger, 1979; Emmer, Sanford, Clements, & Martin, 1982; Everston, Anderson, Anderson, & Brophy, 1980; McCutcheon, 1980; Peterson et al., 1978). Beginning teachers can evaluate teaching resources and curriculum materials for their comprehensiveness, accuracy, and usefulness for representing particular ideas and concepts (INTASC, 1992). CTE teachers need to be aware of and understand how to access a variety of resources for instructional planning including school, district, or industry resources, experts from the community or career field, and commercial products. Effective CTE teachers select, adapt, and create resources that meet criteria for quality. Using multiple resources provides many avenues to student understanding.

Teachers Need to Be Reflective About Their Practice

Studies have documented the value of teacher reflection, both alone and in collaboration with other teachers (Borko, Lalik, & Tomchin, 1987; Borko & Livington, 1989; Borko, Livington, McCaleb, & Mauro, 1988; Colton & Sparks-Langer, 1992, 1993; Ellwein, Graue, & Comfort, 1990; Ross & Regan, 1993; Tabachnick & Zeichner, 1991). “The beginning teacher is a reflective practitioner who continually evaluates the effects of his/her choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally” (INTASC, 1992, p. 31).

According to the NBPTS (1997), “accomplished career and technical educators regularly analyze, evaluate, and strengthen the effectiveness and quality of their practice through lifelong learning” (p. 61). Thinking back on a teaching experience helps teachers understand what happened (effective and ineffective learning episodes) and how that experience can affect their future practice. Beginning teachers especially need to cultivate the skill of reflecting on teaching and the criteria that makes a lesson or unit successful.

Reflective practice includes several components. In one sense, the teacher purposefully uses classroom observations, classroom assessment data, and other information from the students to

revise and improve instruction. Reflection considers whether or not the students achieved the learning goal and why. Reflective practices can also include seeking out professional literature and resources for professional growth as well as drawing on colleagues for feedback, problem-solving, and new ideas. Basic questions to guide reflection include:

- What am I doing in the classroom?
- Why am I doing this?
- What is the result?
- Will I change anything based on the information gathered from answering the first three questions?

The NBPTS Career and Technical Standards (1997) suggest that reflection includes three important components: evaluating results and seeking input from a variety of sources; reflecting on one's own point of view; and continually refining practice through study and self-examination. As the fields in which CTE teachers work change over time, they need to stay abreast of new information and trends and demonstrate that they are continuing to pursue up-to-date knowledge.

Teachers Need to Collaborate with Colleagues and Other Stakeholders

There is clear evidence that higher student achievement is linked to collaboration (Goddard, Goddard, & Tschannen-Moran, 2007). The beginning teacher "fosters relationships with school colleagues, parents, and agencies in the larger community to support students' learning and well-being" and "participates in collegial activities designed to make the entire school a productive learning environment" (INTASC, 1992, p. 33). Working in collaboration with others is perhaps even more important for CTE teachers. The NBPTS states that "accomplished career and technical educators work with colleagues, the community, business and industry, and postsecondary institutions to extend and enrich the learning opportunities available to students and to ease school-to-work transitions" (p. 65).

CTE teachers partner with business, industry, labor, and the community in a variety of ways. Beginning teachers usually foster these partnerships through a program advisory committee. The committee is composed of members from business, industry, and the community who can provide assistance in creating a CTE program that meets the needs of the students and business and industry in the community. The teacher uses recommendations made by the committee to design, develop, operate, assess, and support the CTE program. These partnerships ensure that the CTE classroom is well aligned with the realities and demands of the workplace. Partners inform curriculum, the CTE facilities, and work-based learning opportunities.

CTE teachers collaborate with other educators to integrate academic and career and technical education. This partnership is critically important to the new mission of career and technical education. Bragg and Mills (2005) suggested that, given the current policy context and emphasis on accountability, integration efforts will predominantly occur with core academic curriculum areas—reading and writing (English), mathematics, and science, and to a lesser degree, social studies. Beginning CTE teachers need to be prepared to deal with a variety of integrated learning approaches (Bottoms & Sharpe, 1996). At the very least, beginning teachers will use single

course integration and embed academic concepts, ideas, or processes into their CTE instruction. This may require minimal collaboration. More collaborative integration approaches include joint planning across or within departments, team teaching, thematic projects or units, and organizational approaches as career academies. To get started in collaborating with academic teachers, CTE educators can:

- Review learning goals for CTE and academic programs and look for connections;
- Develop and implement an integrated learning plan, including a description of the projects, instructional strategies and assessments they will use to measure student learning; and
- Review, revise, and improve integrated learning activities (Bottoms & Sharpe, 1996, pp. 98-106).

CTE teachers collaborate with postsecondary partners to articulate courses and provide a seamless transition from high school CTE studies to postsecondary education and training programs. These partnerships are important because they enable students to leave high school with a clear focus and ready to learn at the college level without remediation (Bragg & Mills, 2005). It is important for today's students to have multiple entry and exit points into and out of the secondary and postsecondary educational system. Consequently, beginning teachers must have a grasp of the importance of dual credit or articulation agreements, industry certifications for CTE programs, and the relationship between two-year and four-year college and university programs in the career pathway in which they teach.

Appendix 2B

Concept Paper for Instructional Strategies Module

Beginning teachers need to understand and know how to use a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills (INTASC, 1992). Facing the challenge of preparing students for both college and careers, expert CTE teachers need effective strategies to actively engage students, boosting both motivation and achievement. Historically, many CTE programs were based on detailed, competency-based curriculum in which students practiced and repeated skills (Lynch, 2000). Such an approach is insufficient in preparing students for the 21st century workplace. Cognitive science asserts a theory of learning that points to a wider variety of instructional methods aimed at helping students learn new information based on their prior knowledge and effective instruction that helps students uncover existing knowledge, including misconceptions. This approach, referred to as constructivist teaching, results in classrooms where learning is:

- Constructed: Students come to learning situations with already formulated knowledge, ideas, and understandings. Students integrate new experiences and interpretations to construct their own personal meaning with this previous knowledge.
- Active: The student is the person who creates new understanding for her/himself. The teacher guides knowledge, but allows the students to experiment, manipulate objects, ask questions and try things that don't work. Students also help set their own goals and means of assessment.
- Reflective: Teachers should create opportunities for students to question and reflect on their own learning processes, either privately or in group discussions. The teacher creates activities that lead the student to reflect on his or her prior knowledge and experiences.
- Collaborative: The constructivist classroom relies heavily on collaboration among students because students learn about learning not only from themselves, but also from their peers. When students together review and reflect on their learning processes, they can pick up strategies and methods from one another.
- Inquiry- or Problem-Based: The main activity in a constructivist classroom is solving problems. Students use inquiry methods to ask questions, investigate a topic, and use a variety of resources to find solutions and answers.
  Evolving: Students have knowledge that they may later see as incorrect or insufficient to explain new experiences. As students explore a topic or problem, they draw conclusions, and, as exploration continues, they revisit those conclusions and modify them to support new knowledge or experiences. (Singer & Moscovici, 2008)

Consistent with the vision of CTE instruction outlined in the introduction to this paper, constructivist teaching requires the use of a few instructional strategies on which CTE teachers can focus. Each of the following parts of this section will describe one of these strategies, the rationale for including it among the most essential strategies beginning teachers need to know and be able to do, and key information that teachers need to know to implement that strategy effectively.

Project- and Problem-Based Learning

Project-based learning (PBL) is an instructional model that organizes learning around projects—complex tasks based on challenging problems or questions. Through PBL, students are engaged in design, problem-solving, decision-making, or investigative activities that give them the opportunity to direct their own learning and that result in a product or presentation (Thomas et al., 1999). Although projects may vary in duration and scope, recent definitions of PBL recognize that good projects are standards-focused, engaging students in "learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks" (Buck Institute for Education, 2003, p. 4).

In CTE, PBL is used to bring an authentic, motivating context to teaching career-related competencies. A CTE project may involve workplace simulations such as designing, assembling, testing, or evaluating a product; developing and/or implementing a plan to meet a local business need; or operating a business in the school or community (Bottoms et al., 1997). Projects usually require a series of steps and provide opportunities to make judgments and decisions when unexpected events occur, typical conditions found on the job. Most importantly, projects teach students to resolve workplace problems, fostering the development of the essential problem-solving skills needed for the workplace.

The varying nature and depth of PBL implementation complicates the research base on its effectiveness as an instructional method. Projects vary widely in the depth of the content covered, duration, and the degree to which they are student-directed. Teachers cite a variety of reasons for not using projects, including lack of time, resources, and technology. In spite of these limitations, Thomas' (2000) comprehensive review of research on PBL found some evidence that the approach enhances the quality of student learning when compared with other instructional methods. PBL has the potential to help students learn not only subject matter content, but the ability to put that content to use in real-life situations to solve problems and make decisions. This goal is particularly important in CTE classrooms because students are solving problems and completing projects similar to those they will face as they enter and advance in the workplace.

PBL teaches students complex processes and procedures such as planning and communicating and leads to higher-level cognitive development through active engagement with complex situations (Buck Institute for Education, 2003). Teachers report that PBL:

- Helps bridge the gap between "knowing and doing," or knowledge and thinking.
- Encourages the development of habits of mind associated with learning throughout life, civic responsibility, and career success.
- Assesses performance on content and skills using criteria similar to those in the work world, thus encouraging accountability, goal setting, and improved performance.
- Creates positive communication and collaborative relationships among diverse groups of students.
- Meets the needs of learners with varying skill levels and learning styles.
- Engages and motivates students who are typically unmotivated. (Buck Institute for Education, 2003, p. 6)

In order to successfully implement PBL and reap its benefits as an instructional strategy, Thomas (2000) offered a set of characteristics that should be present:

- *Projects must be central, not peripheral to the curriculum*. In a PBL instructional approach, projects represent the central learning concepts, knowledge and skills of the subject. In CTE, that means selecting projects that enable students to learn career competencies. Problem-based learning specifically draws problems and scenarios exclusively related to the career field (Bottoms et al., 1997).

- *Projects are focused on questions or problems that lead students to learn the central concepts and principles of a discipline*. Teachers are challenged to define projects so that the learning activities connect to the concepts and skills that the students are expected to learn. This can be accomplished with an essential question or, in the case of problem-based learning, an ill-defined problem. Thomas (2000) warned that PBL projects may be built around thematic units or the intersection of topics from two or more disciplines, but that is not sufficient to define a project. The questions that students pursue, as well as the activities, products, and performances that occupy their time, must be designed to achieve an important purpose.

- *Projects involve students in a constructive investigation.* An investigation is goal-directed, involving inquiry, knowledge-building, and resolution. In order to be considered as a PBL project, the activities that are central to the project must lead students to construct their own knowledge (new understanding, new skills). If the project activities are of no difficulty to the student or the project can be accomplished without the application of already-learned information or skills, the project is an exercise, not a PBL project.

- *Projects are student-driven to some significant degree*. PBL projects are not highly prescribed nor structured to be led by the teacher. Laboratory exercises and learning packets are not examples of PBL, even if they are problem-focused and central to the curriculum. PBL projects allow for more student autonomy, choice, and student accountability than traditional instruction and traditional projects.

- *Projects are realistic, not school-like*. Projects embody characteristics that give them a feeling of authenticity. In CTE, the projects are drawn from major activities exclusively related to the career field. They should represent the culminating activities of large units of study rather than narrow sub-skills or tasks. (pp. 3-4)

Problem-based learning is closely related to project-based learning in that both involve complex tasks that engage students in planning, gathering and evaluating information, analyzing situations and developing solutions. The difference between the two lies in the specific aspects of delivery. Problem-based learning begins with an ill-defined problem and asks the student to hypothesize how to solve it (Delisle, 1997), which cannot be said of all projects. Once the problem is defined, students access, analyze, and use data and information from different sources, revise the initial hypotheses as needed, and develop and justify solutions according to evidence and reasoning

(Barrows, 1986; Gallagher, Stepian, Sher, & Workman, 1995). The problem-based learning approach, used in medical schools to develop clinical reasoning, is outlined by Barrows and Tamblyn (1980) as follows:

1. The problem is encountered first in the learning sequence, before any preparation or study has occurred.
2. The problem situation is presented to the student in the same way it would present in reality.
3. The student works with the problem in a manner that permits his or her ability to reason and apply knowledge to be challenged and evaluated, appropriate to his or her level of learning.
4. Needed areas of learning are identified in the process of work with the problem and used as a guide to individualized study.
5. The skills and knowledge acquired by this study are applied back to the problem, to evaluate the effectiveness of learning and to reinforce learning.
6. The learning that has occurred in work with the problem and in individualized study is summarized and integrated into the student's existing knowledge and skills. (pp. 191–192)

Because it is driven by authentic situations, problem-based learning is both rigorous and relevant, engaging students in a highly participatory learning experience. Students become interested in the problem they are solving and are more motivated to learn. Through their active engagement in the learning process, students take responsibility for their own learning and are better able to define topics, access resources, and evaluate the validity of those resources (Gallagher et al., 1995; Krynock & Robb, 1996). Sungar and Tekkaya (2006) conducted a quasi-experimental study of two biology classrooms, one taught with teacher-centered, textbook-oriented traditional instruction and the other with problem-based learning. The students who received problem-based learning had higher levels of critical thinking, metacognition, and effort than the students taught with traditional methods. The biggest impact, however, was observed on the students' ability to self-regulate their own learning, actively sustaining their thoughts, behaviors, and emotions to reach their goals. Other studies have shown problem-based learning to improve critical thinking, communication, mutual respect, team work, and interpersonal skills (Achilles & Hoover, 1996; Gordon, Rogers, Comfort, Gavula, & Mcgee, 2001; McBroom & McBroom, 2001; Sage, 1996; Savoie & Hughes, 2004; West, 1992). Problem-based learning has significant potential to teach the kind of skills that CTE students will need to succeed in further learning and the workplace.

John Mergendoller of the Buck Institute for Education asserts (personal conversation, February 2009) that designing project- or problem-based learning presents a real design challenge to teachers, and certainly to CTE teachers entering the field under the challenges and limitations of an alternative certification program. The Buck Institute is currently using a project planning form that can be helpful. The goal of the form is to help teachers see project-based learning as an "envelope" into which all other strategies fit—to help students really learn how problems and questions can drive learning and help them take well-thought-out, effective action in response to real-life situations. Given the nature of CTE content, it is likely that most, if not all, units of study may be planned with a driving project or problem. If real workplace problems, questions,

or scenarios drive student learning, students are much more likely to reap the benefits of this strategy—problem-solving and higher order thinking skills, as well as the ability to regulate their own learning throughout life.

Cooperative Learning

The purpose of cooperative learning (CL), similar to the purpose of project- or problem-based learning, is to make each student a strong, independent learner. Students who experience teaching that allows them more control learn more and enjoy learning more (Ramsden, 2003; as cited in Hutchinson, 2007). According to Abrami et al. (1995; see also Abrami, Chambers, Poulsen, & Chambers, 2004) and Laverie (2006), evidence suggests that CL promotes student achievement and the development of social and interpersonal skills. Johnson, Johnson, and Smith (1991; as cited in Flowers & Ritz, 1994) synthesized over 375 studies on the effect of cooperative, competitive and individualistic efforts on student achievement and productivity. They found that students in cooperative learning settings performed better than students in either competitive or individualistic settings. They also noted that cooperative learning "resulted in more high-level reasoning, more frequent generation of new ideas and solutions (i.e., process gain), and greater transfer of what is learned within one situation to another (i.e., group to individual transfer) than did competitive or individualistic learning" (p. 212).

CL is a particularly important strategy for CTE teachers. Sutphin and Newsom-Stewart (1995) found that students enrolled in agricultural education identified activity-centered learning, opportunities for work experience, and the development of teamwork and life skills as reasons for enrolling in that CTE course. Students gravitate to active learning that engages them socially as well as intellectually, as illustrated in the popularity of Facebook and other forms of social networking among today's youth. CL may be particularly effective when integrated with project- or problem-based learning. Roger Johnson of the Cooperative Learning Institute asserts that CL is a process for doing things in classrooms—raising achievement, building self-esteem, encouraging positive attitudes, and building acceptance of differences in diverse classrooms—although project-based learning is a good content home for building cooperative team relationships (personal conversation, February 2009). CL can also influence classroom management in a positive way. The classroom environment is much more productive and positive when students are concerned about each others' behavior and learning. Peers may be one of the most important influences on each others' success.

As a teaching practice, CL can present unique challenges for both the practitioner and student. In order to implement CL effectively, teachers must plan carefully (Hutchinson, 2007).Despite the evidence that CL is an effective teaching practice, the use of CL varies widely among teachers—from 10% to 93% (Antil, Jenkins, Wayne, & Valdasz, 1998, as cited in Abrami et al., 2004). To add to the complexity, there are at least four types of CL: informal (with direct teaching), formal (to work through projects and assignments), base groups (long term academic and personal peer support groups) and cooperative controversy groups (to structure intellectual argument). One of the first challenges in effectively using CL is considering the goals of instruction and figuring out what type of CL to use. All four types are useful in different ways. For example the informal CL strategy improves direct teaching by interspersing short, active student conversations/review of the material being delivered during the direct

instruction. The following chart reflects the essential components of CL that teachers must use to implement any type effectively.

Essential Components of Cooperative Learning

1. **Positive Interdependence: "We all sink or swim together"**
   - Each team member's efforts are required for team success.
   - Each team member has a specific and unique contribution because of his/her resources, talents, and task responsibilities.
2. **Face-to-face interaction: "Students become translators"**
   - In cooperative learning teams, students promote each other's success by sharing resources and helping, supporting, encouraging, and celebrating each other's efforts.
   - Teachers structure teamwork so that students help each other by explaining how to solve problems, teaching one's knowledge to others, checking for understanding, discussing concepts, and connecting present and past learning.
3. **Individual accountability / personal responsibility**
   - Each team must be accountable for achieving its goals, and each member must be accountable for contributing his or her share of the work.
   - Each student is individually assessed and the results are given back to the team and individual to determine who needs more assistance and support for learning.
4. **Interpersonal and teamwork skills: "Social skills do not magically appear"**
   - Social skills must be taught just as academic skills are taught.
   - Leadership, decision-making, trust-building, communication, and conflict management are essential to team success.
5. **Team reflection: "How are we doing as a team?"**
   - Teachers need to structure teamwork so that team members discuss how well they are achieving their goals and how effectively they are working together.
   - Teams should describe what member actions are helpful and unhelpful and then make decisions about what behaviors to continue or change. This is an ongoing process of self assessment and peer assessment.

Teamwork / Social / Academic Skills

Must be modeled, taught, rehearsed, practiced, used, reinforced, and the skill must mean something. Teach students what it "looks like," what it "sounds like" and what it "feels like." Students will learn more and do better if they help their classmates, if they ask for help when they need it, and if they get an explanation with the help.

Teach students how to help each other – notice when a team member needs help; tell your team members to ask you if they need help; when someone asks for help, help them; don't give answers – give explanations; praise and encourage; and, check to make sure they understand.

Signs of Success

Students are experiencing success if:

- □ students drill each other on the material.
- □ answers are shared (explanations).
- □ materials are shared.
- □ heads are close together.
- □ students give their opinions easily and candidly.
- □ social skills improve – in teams and elsewhere.

Because the teacher plays an essential role in CL—structuring the classroom environment to facilitate learning in a group (Smith & McGregor, 1992)—there is considerable instructional planning that needs to occur to create CL lessons. Cooperative learning provides the "directions

for learning, where the focus is on the product of learning (Myers, 1991, as cited in Hutchinson, 2007, p. 358)—the accomplishment of an end goal or learning outcome that is closely controlled by the teacher" (Cooper & Robinson, 1998, as cited in Hutchinson, 2007; see also Rockwood, 1995). In other words, the teacher structures the environment, monitors the progress, and provides a theoretical foundation to enable students to reach the learning goals. The teacher moves from being the sole expert in the class to an external consultant in the learning environment with students being responsible for the achievement and implementation of their group objectives. This does not happen by accident, but is the result of teaching the CL concepts to students, practicing the habits of CL with effective feedback, and structuring the learning environment with appropriate activities and resources.

There is also the potential for teachers to play a more frequent and active assessment role in the CL classroom. When students work actively in groups, the teacher is free to observe and monitor groups, gathering data about what is going on and providing timely feedback to the class, the groups, or to individual students. This role provides the teacher with a "window into the students' minds" through close observation of learning that is taking place out loud in group conversation and interaction (Roger Johnson, personal conversation, February 2009).
The teacher is also responsible for facilitating frequent reflection on group functioning. To maximize the benefits of CL, groups need to regularly reflect on how well they are working together. This feedback loop is known as group processing. It is critical to enhancing group performance and is analogous to evaluation and team-building efforts that occur in industrial settings. Processing can be facilitated by an evaluation form on which each team member evaluates others on the criteria outlined in their group covenants and completes certain key statements (Towns, 1998).

Cooperative learning is a technique that has proven effective in many settings to improve student learning and social skills. It must be practiced in order to be proficient. Slavin (1991) noted that the widespread and growing use of CL:

> demonstrates that CL methods are practical and attractive to teachers. The history of the development, evaluation, and dissemination of cooperative learning is an outstanding example of the use of educational research to create programs that leave improved the educational experience of thousands of students and will continue to affect thousands more. (pp. 81)

Effective Strategies for Presenting Information

As CTE teachers use project- and problem-based learning integrated with the principles of cooperative learning, there will be instances when students need new information to further their learning. Although students will learn how to access sources of information on their own as part of project- and problem-based learning, sometimes the most efficient strategy for the CTE teacher is to present information to all students at once. When these opportunities occur, CTE teachers need strategies to present that information in ways that are effective, meaningful, and engaging to students. Beginning CTE teachers may have limited understanding of ways to present information, particularly if their own experience largely included typical methods such as lecturing, reading aloud together, and completing study questions at the end of the textbook

chapters. Consequently, they need to be aware of effective strategies for presenting information based on research and the collective wisdom of practitioners, such as:

- Following a series of steps in planning a lesson focused on the presentation of information, including:
  (a) establishing instructional set for a few minutes by simply introducing what it is students are to learn (objective),
  (b) describing why it is important to learn the information (relevance),
  (c) outlining how students will learn the information (what the teacher and the students will do), and
  (d) describing how the information will be assessed (project, problem to solve, paper, application, "homework," etc.).

- Using technology and presentation software and supplements to support nearly every presentation (i.e., direct instruction) where new information (i.e., direct instruction) must be provided. There are many technology applications available, including: PowerPoint, Excel, LCD panel, scanner, graphics and information downloaded from the Internet, digital cameras, videos, e-mail, web-based materials, and interactive white boards. Creating tutorials for students who need extra help, additional content, individualized study, or assignments can also be fairly easy using available software and Internet resources.
- Drawing on metacognitive processes such as reading technical materials with students, asking open-ended questions where they have to create or explore responses, working with them on technology applications, providing guided and independent practice, and having them summarize content they've read and put forth its implications for their employment or projects.
- Presenting relevance for nearly all points, such as examples from the community, clips from the newspaper, an analogy, rules or guidelines, case studies from the literature, illustrative material from textbooks, a math problem or science demonstration used in industry or medical fields, a scenario, a prediction ("a" should lead to "b"), or ask them to provide an illustration from their own experience.
- Acquiring a repertoire of classroom methods that facilitate learning through social interaction, often referred to as *scaffolding.* Illustrative examples include question and answer dialog, cooperative learning strategies (described earlier in this paper), small-group discussions, buzz groups, brainstorming, classroom workshop, teacher or peer demonstration of a skill or habit, student repetition of that skill or habit, games, debates, and tutoring.
- Checking frequently on learning. This can often be done through questions and answers, a "quick check" quiz, providing guided and independent practice, conducting and writing up an experiment or similar assignment, repeating or practicing a demonstration, solving work-related math problems, or any other context-related application of the content that was presented.

Integration of Academic Content and Skills

Perkins IV requires schools to develop career and technical education programs with challenging academic and technical standards and requires CTE instructors to provide challenging instruction that integrates academics with technical knowledge and skills. This policy context reflects the

needs of modern workplaces. A survey of human resources professionals indicates that "far too many young people are inadequately prepared to be successful in the workplace. At the high school level, well over one-half of new entrants are deficiently prepared in the most important skills—oral and written communications, professionalism/work ethic and critical thinking/problem solving" (Conference Board, 2006, p. 7). This survey alone highlights the importance of preparing CTE students to be academically successful while ensuring students possess technical knowledge and skills.

The current literature illustrates the importance of integrating CTE and academic studies in student preparation for high school graduation and readiness for postsecondary education and careers. "At the high school level, career and technical education programs provide the most effective learning opportunities. Not only are students applying skills and knowledge to real-world situations in their career and technical programs, but also they are drawing on knowledge learned in core subjects" (Daggett, 2005, p. 5). The SREB's High Schools That Work and Technology Centers That Work survey of 12th-grade students reveals that CTE students experiencing an intensive emphasis on integrating academic content and skills into CTE courses meet college- and career-readiness goals at a much higher rate than those who experience low or moderate emphasis on academic integration (SREB, 2008). A prominent recent research study conducted by the NRCCTE (Stone et al., 2006) placed a CTE teacher with a mathematics teacher to develop lesson plans with integrated mathematics. This study provided evidence that an integrated curriculum leads to higher test scores. CTE students taught a curriculum with integrated mathematics outscored the control group on two tests of mathematics ability.

The challenge in academic and CTE integration is to meet the needs of its CTE teachers who are eight times more likely than their academic counterparts to lack academic training in the form of a bachelor's degree or specific subject knowledge (NCES, 2000). In addition to this lack of academic preparation, there are other difficulties that plague integration efforts, particularly for beginning CTE teachers (Hoachlander, 1999). First, integration can result in a loss of focus if the objective is not clear. Second, integrating academic and career and technical curriculum depends on more than simply identifying work-related applications of academic knowledge and skill. It also involves ensuring the use of a variety of instructional strategies that are engaging to all students. Finally, constructing a rich, complex, cumulative integrated curriculum that simultaneously helps students master an academic discipline and apply it in a coherently defined domain of the work world demands time, expertise, and resources that are beyond the reach of most teachers.

A beginning CTE teacher can use several approaches to the integration of academic content (Drake & Burns, 2004). First, the CTE teacher can choose academic content to integrate into his or her own course, a transdisciplinary approach. An interdisciplinary approach can also be used in which the CTE teacher works with academic teachers to organize learning around common objectives across disciplines. A multidisciplinary approach calls for teachers to organize standards from each discipline around a theme. Drake and Burns (2004) described these approaches along a continuum. As teachers select approaches along the continuum, the transdisciplinary approach is least complex and requires the least time for collaboration whereas the multidisciplinary approach is most complex and requires the most time for collaboration.

Another alternative integration approach for beginning CTE teachers is to use a contextual approach, adding the academic content that is used within real-world career contexts. There is evidence that this approach, researched in a recent study on academic and CTE integration by the NRCCTE (Stone et al., 2006), increases CTE student attainment of academics without lowering achievement on CTE competencies. Whether teachers use one of the approaches suggested by Drake and Burns (2004) or a contextual approach with the academic content used in real-world contexts, there is a need to embed both literacy and numeracy in order to help students prepare for further learning and the workplace.

Embedding Literacy

Increasingly U.S. jobs — even the shrinking pool of blue-collar jobs — require and depend upon reading. A generation ago, jobs in factories, foundries, and mills commonly required no reading, and many other jobs (e.g., law enforcement, practical nursing, trucking) required reading in limited amounts, but this has changed. The problem occurs when students are not taught to read the texts they will encounter in the professional world. Researchers, such as Timothy and Cynthia Shanahan (2008), have become increasingly concerned that students are only learning reading skills that can be generalized in all reading situations. The research into "disciplinary literacy" is just beginning.

In a two-year study of the skills required for various disciplines, the Shanahans (2008) concluded that the high-level skills and abilities embedded in these disciplinary or technical uses of literacy are probably not particularly easy to learn nor are they often taught. The Shanahan study concluded that, as students move through school, reading and writing instruction should become increasingly disciplinary, reinforcing and supporting student performance with the kinds of texts and interpretive standards that are needed in the various disciplines or subjects. Although the study does not include CTE classes, the principles apply to all content areas.

Additional research concludes that many people learn better and faster, and retain information longer, when they are taught concepts in context. Sticht, Armstrong, Hickey, and Caylor (1987) found that teaching young soldiers who lacked even basic literacy skills to read in the context of their daily tasks not only increased their competency in those tasks but also improved their general reading skills—all in a relatively short time period.

ACT's (2006) study of skills necessary for the workplace and for college, as measured by ACT and WorkKeys, shows that skills transfer into both settings. The essential workplace skills are as follows:

- Understand main ideas, topic sentences, and the relationships among sentences in a paragraph
- Correctly use technical terms when describing the main idea and supporting details in a passage
- Recognize organizational structures of passages to identify pertinent details and recognize appropriate applications
- Select important details to clarify meaning
- Apply straightforward instructions to new situations

- Apply complex instructions that include conditionals to situations described in a passage
- Figure out the correct meaning of a word based on how the word is used
- Understand the definitions of acronyms defined in a passage
- Identify the appropriate definition of words with multiple meanings based on context
- Apply technical terms to situations
- Apply given information to new situations (pp. 4-5)

Although the skills can be defined, the strategies to assist students in gaining these skills are not as clear. In CTE classrooms, the problem is compounded by how the teachers view themselves as readers and their lack of training.

Through a series of interviews with 35 CTE teachers from 1997 to 2004, Darvin (2006) found that the instructors did not view themselves as readers. She concluded that the teachers used a wide variety of texts, but "differently." They saw themselves as poor readers because they did not have long-term comprehension, did not read entire books in a linear fashion, and did not read quickly.

All of the teachers in the study did use texts frequently to consult for information. Students moved frequently from text to task and back again in their authentic applications. Darvin referred to this practice as "situated literacy." She concluded that the purposes for reading in CTE classes are to gather information, construct meaning and apply knowledge to solve particular problems and create new ideas. Within that context, teachers must be adept at helping students process different kinds of texts.

Miller and Miller (2003) found similar situations in technical classes in college. Although instructors generally have a substantial depth of knowledge and a high degree of technical skill, they are not necessarily effective in the instructional role. The instructor, by nature of the job, must be able to assist a beginner. Sometimes the instructor's high levels of competence may interfere with instructional effectiveness rather than contribute to it.

As the Shanahan study noted, professionals use discipline-specific strategies that are not always easy to identify. ACT has identified the most important skills for the workplace. However, there is not yet a research base to identify specifically which strategies are most effective to teach these essential skills.

Embedding Numeracy

Consideration of current research highlights the fact that students today learn differently than their pre-technology counterparts, which has implications for the way in which CTE teachers should embed numeracy in instruction. Patricia Greenfield referred to these post-technology students as the "game generation" and her research identified specific cognitive skills unique to them. In addition to an increased ability to multi-task, they are more comfortable with visual-spatial skills, mental maps, and seeing the computer as a tool and learn through trial and error, observation, and hypothesis testing (Greenfield, 1984; see also Barkley, 2007). This type of learner requires alternatives to the strategies commonly seen in the traditional classrooms of the baby boomer generation. Prensky argued this need is due to replacement of the sequential or

linear thinking, predominantly seen in the baby boomer generation, by "parallel processing" (Prensky, 2000, pp. 2-17).

The traditional model of teaching mathematics emphasizes learning mathematical concepts in isolation. Teaching mathematics contextually involves providing students the opportunity to learn math concepts embedded within an application scenario. "The contextual approach recognizes that learning is a complex and multifaceted process that goes far beyond drill-oriented, stimulus-and-response methodologies" (Center for Occupational Research and Development [CORD], 1999, p. 1). This method of teaching and learning in context meets the need of the "game generation" to learn globally and incorporates multiple forms of experience so that students may find meaningful connections between application and abstract understandings.

A recent study by the NRCCTE found the Math-in-CTE model, which involves enhancing the mathematics naturally embedded in CTE curriculum, significantly improved student math achievement (Stone et al., 2006). CTE instructors typically understand how to use the mathematics of their career pathway, but are not trained on the mathematical theory behind it. For example, construction teachers consistently teach students to use the 3, 4, 5 angle concept to square up the corners of a foundation or wall frame but do not connect this procedure to the Pythagorean Theorem, which is the basis of why it works. In order to enhance embedded CTE mathematics and better help students to master these concepts, teachers must understand the connections, vocabulary, and theory of the math unique to their CTE area.

Unfortunately, students often cannot transfer knowledge from one situation to another because the CTE concepts and the math concepts are chunked, making it difficult to recognize and separate them (Karweit, 1993). True contextual learning must include a deliberate effort to connect what is learned experientially to not only other contextual examples but also to the theoretical principles behind these authentic activities (Fuchs et al., 2003). Without these connections to the abstract mathematics, students are unable to transfer their new knowledge to new situations or to their general math understanding (Boaler, 1993, 1998; Lave, 1988; Lave & Wenger, 1991). Therefore CTE teachers must understand the formal mathematical manipulation for math concepts embedded in their programs and avoid the use of methods that allow student to bypass abstract procedures and prevent their development of mathematical understanding.

Contextual learning requires teachers to become facilitators for learning math content through experiences and real-life applications that are already familiar to students. When students have no prior experience on which to scaffold, teachers must provide authentic activities and exploration where students work in teams to apply math concepts and transfer gained understandings to new scenarios (CORD, 1999). In order to truly teach the numeracy embedded in their CTE area, teachers must be aware of the "relationships of academic curricula to personal, societal, and especially occupational life" (CORD, 1999, p. 60).

Work-Based Learning

In an effort to connect learning in CTE programs with the real-world workplace, beginning teachers will be called upon to integrate work-based learning. Historically, work itself was the only way of preparing for work—learning from father or mother by performing more and more

complex work tasks over time. In apprenticeship programs, both formal and informal, or through on-the-job-training, skills were learned as a means of entering a profession over a period of several years and through many stages. But these methods have their own limitations and political implications. Various forms of work-based learning have emerged to reform the practice, either as a complement to school-based or classroom learning: in co-op education programs established in 1906; in the continuation schools envisioned by the Smith-Hughes Act of 1917; in the internships that followed the work-experience programs of the 1970's; and most recently in the School-to-Work Opportunities Act of 1994, which provided funding for programs that incorporated school-based learning, work-based learning and connecting activities to make the two consistent with each other (Grubb & Badway, 1995).

Biggs, Hinton, and Duncan (1996) asserted that major changes in the educational infrastructure are necessary to support and build a quality work-preparation system for the 21st century including work-based apprenticeship, career academies, school-based enterprises, and cooperative education. Lynch (2000) described a "new vision" for CTE in which the infusion of work-based learning contributes to mastery of industry standards.

The use of work-based strategies in CTE may take many forms. Work-based learning may begin as early as middle school or early high school with job shadowing (Brown, 2003) and includes a range of activities that go well beyond the traditional practice of cooperative education. Such experiences are identified and described in Table 2B.1.

Table 2B.1
Work-Based Learning Experiences

Approach	Characteristics	Strengths	Challenges
Job Shadowing	·Students observe people in a career of interest ·Usually a few hours to one day in duration	·Provides early experience in WBL ·Low time commitment by teacher and student	·Employer engagement ·Limited opportunity to engage in real work tasks ·Transportation for young students
Career Fair	A career awareness/ exploration event in which multiple business participants assemble at one particular site at the school to promote and share their respective occupations. Career fairs develop an awareness and understanding of the career fields.	Career fairs can be simple or complex involving one or more classes at a time. Provides opportunity to explore many local career options in a short period of time.	Coordination is required of teacher Limited information is gained by students No real hands-on application of knowledge.
School-based Enterprises	·Students produce goods or services for sale to customers	·Students apply academic knowledge to work ·Instructors maintain control of instructional activity	·Focus can shift to production rather than instruction ·Lack of understanding about how learning occurs in workplace
Career Academies	·School within a school ·Career field focus rather than specific job preparation ·Integrated career and academic instruction ·Includes necessary work skills ·Employer involvement	·Career focus may keep at-risk students in school	·scheduling conflicts ·Requires involvement of business/industry ·Requires collaboration and cooperation between academic and CTE instructors

Youth Apprenticeship	·Work-experience in industry ·Linkage between secondary and postsecondary education ·Collaboration among groups ·Requires modeling of tasks and coaching of students	·Creates a learning situation that emphasizes skills & knowledge required in the workplace	·Requires significant employer participation, workplaces are impacted ·Potential conflict between student & employer needs ·Potential legal issues for youth in certain industries ·Requires collaboration & cooperation between schools and employers
Clinical Work Experience	These experiences usually take place in medical settings Students have opportunities to practice the skills they have learned in the classroom.	A clinical is a structured practical application of previously studied theory. It is a combination of course work and part-time work experience.	Requires extensive teacher supervision and cooperative from health facilities.
Cooperative Education	·Traditional CTE program ·Written training agreements specify what students will learn & employer's responsibilities ·Students usually work in some combination of during and after school	·Students have part-time job ·Employers use as screening device for new employees	·Lack of coordination between school & work experiences ·Work may not related to competencies needed by student in CTE program ·Work becomes more important than learning skills
Internship	·One-time short-term placement directly related to career goal ·May be paid or unpaid	·Students gain practical, first-hand knowledge of workplace ·Form relationship with employer	·May be little communication about work experience ·Tend to occur at end of education program
Simulations	·Designed to comprise a more or less accurate representation or model of a real work experience ·Students interact in much the same way they would interact in the workplace.	·Feedback to student is immediate ·The instructor controls the content ·Help develop critical attitudes required for success in the workplace	·May tend to appear artificial to students ·Does not have the same criticality as employer-based experiences

Work Experience	·Designed to apply learned skills in an actual work setting ·May last 9-18 weeks in last semester of CTE course	·Provides actual work experience for student ·Instructor can observe student work in actual work-setting	·Requires instructor time to observe ·Requires close coordination with employers ·Transportation to and from work-site may pose challenge
Service Learning	Service learning combines community service with classroom instruction. It focuses on critical, reflective thinking as well as personal and civic responsibility.	Enhances already existing curricula. It offers teachers a tool that complements learning and increases educational relevancy. It combines academic learning with service activities that are structured to address real needs in the community. Offers youth a chance to solve problems and become involved in the community.	Requires cooperation from community Requires active involvement by teacher.

Sources. Table adapted from Rojewski (2002). Table structure and some content from Biggs, Hinton, and Duncan (1996). Additional content from Brown (2003), and Stone and Wonser (1990).

Authentic work experiences should be designed to provide students with a vehicle for gaining a deeper understanding of the knowledge and skills they are learning and an organized manner in which these skills may be practiced and perfected (Stasz & Kaganoff, 1997). These skills must be provided with coaching and support from the instructor. Well-designed work-based learning activities have the potential of shaping students who are not only prepared for the work of the 21st century but who have also actually seen, touched, and experienced it.

Appendix 2C

Concept Paper for Classroom Assessment Module

"What classroom assessment practices should beginning CTE teachers know and be able to do?" The first part of this section defines and provides examples of two types of assessment: summative and formative. These two constructs are important to providing on-going feedback to *improve* student motivation and learning as well as to measure what students learn. The second part of the section focuses on developing assessment tools that provide feedback and measure student progress on CTE program content: CTE knowledge and skills; academic knowledge and skills; and the workplace readiness skills essential to the 21st century workplace. These tools include teacher-made tests, rubrics and scoring guides, and portfolios. The next section discusses grading practices and how to report student progress. Finally, the context of standardized summative assessments of academic and CTE knowledge and skills that CTE teachers are expected to understand and interpret is addressed.

Types of Assessment

Assessment is the process of collecting, analyzing, and interpreting information to determine the degree to which students are meeting standards. There are a variety of reasons that teachers assess students, among them: to provide feedback to students during the learning process, to measure and report performance to students and to parents, to improve instruction, and to gauge readiness for further learning and the workplace. To the beginning CTE teacher, classroom assessment may seem like one of the simplest issues to be faced, but the way in which students are assessed, particularly the way in which students receive feedback during the learning process, is one of the most powerful tools for shaping student learning and motivation (Bangert-Drowns, Kulik & Kulik, 1991; Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Black & William, 1998; Crooks, 1988; Fuchs, 1986; Kuger & DeNisi, 1996; Natriello, 1987; all as cited in Marzano, 2006).

Consistently adhering to certain assessment practices throughout the learning process improves student achievement one-half to two standard deviations on high stakes tests with the largest gains being made by low achievers (Stiggins, 2005). Furthermore, the assessment methods used to provide feedback during learning can motivate students to persist in the learning process and reach learning goals (Stiggins, 2007). To achieve the maximum learning benefits, CTE teachers need to plan not only the summative assessments, those used at the end of the learning experience to determine what has been mastered, but formative assessments that provide on-going feedback throughout the learning process. To accomplish this goal, teachers will use a variety of assessment tools to determine how well students are meeting CTE and academic standards, as well as their progress toward competence in workplace skills for the 21st century.

Summative Assessment

Summative assessment refers to those assessments that occur after a learning event has concluded. There are many reasons for summative assessment. The one most often cited is to judge the success of a learning process at its completion (Cruickshank, Jenkins, & Metcalf, 2009). Classroom teachers can apply the concept of summative assessment to a unit of study or to the end of a course. Summative assessments take a variety of forms, such as the traditional paper-and-pencil tests; problem-solving projects, performances or products; or research papers and oral presentations. These forms can also be combined. For instance, an end-of-course examination may include a written paper-and-pencil test component and a performance component. A multi-week unit of study may culminate with a project that includes an oral presentation and a research paper. Because CTE content includes a variety of knowledge *and* skills, teachers need a variety of assessment tools to measure what students have learned. Paper-and-pencil tests, rubrics, and portfolios assessment tools can all be used for summative assessment.

Designing the summative assessment is one of the first steps in instructional planning once the CTE, academic, and workplace readiness standards have been identified. Traditionally, teachers have planned a summative assessment after planning a unit of study or course, but "backwards mapping," or planning instructional learning activities *after* the summative assessment is developed, assures better alignment between the written curriculum (what is to be learned), the assessed or "tested" curriculum (what is measured), and the taught curriculum (what the teacher emphasizes through learning activities during and outside of the classroom). To develop assessment tools that are well aligned with standards, the Educational Testing Service (2004) suggests that teachers reflect on several questions:

1. What are the CTE, academic, and workplace readiness standards students need to master in this course (or unit of study)?
2. What knowledge and skills from these standards is most important?
3. What kind of evidence would I need to determine whether or not students have mastered the most important knowledge and skills from these standards?
4. What are the assessment tools I will need to capture and measure this evidence?
5. How will I use this evidence in the future (e.g., to keep score, modify my own teaching, re-teach or use to improve lessons, chart the scores on the items or assessment over time)?
6. How will I report this evidence and to whom?

The answers to these questions provide information that can be used to develop a chart indicating the standards to be assessed, the type of evidence that is needed, and their relative weight on the assessment based on the importance of the content. This chart is called a *table of specifications,* a two-way chart that describes the standards to be covered by the assessment and the percentage of the total score that will be associated with each of the standards. The purposes of a table of specification are to ensure that fair and representative weight of the total assessment focuses on the key areas and weighs those different areas based on their importance. Tables of specification are designed based on the list of course standards, the amount of time spent on those topics, and

the emphasis given in textbooks, manuals, or curriculum guides. A template for a table of specifications is included in Table 2C.1.

Table 2C.1
Generalized Table of Specifications

Technical Standards:	**Weight in Total Assessment**	**Type of Evidence Needed**	**Assessment Tool**
Standard 1:			
Standard 2:			
Standard 3:			
Academic Standards:			
Literacy Standard:			
Numeracy Standard:			
Science Standard:			
21st Century Skills:			
Standard 1:			
Standard 2:			
Standard 3:			

The concept of a table of specifications can be applied to a whole course, a unit of study or a specific assessment such as one paper-and-pencil test or a rubric to assess a performance. With more experience and feedback, teachers may expand the table to include greater detail about the types of items, the cognitive levels for items, and various levels of acceptable performance and then classify items into various paper-and-pencil and authentic and performance assessment strategies.

Another way to think about the composition of summative assessment items or tasks is to consider the level of cognitive complexity required to complete each item. The ideal assessment, according to Marzano (2006) consists of three types of items or tasks, each with a different level of cognitive complexity:

- Type I items or tasks—address basic details and processes that are relatively easy for students
- Type II items or tasks—address more complex ideas or processes
- Type III items of tasks—require students to make inferences or applications that go beyond what was taught in class

To construct Type I items the teacher would ask and answer the following question (Marzano, 2006): "About this measurement topic, what are the basic details and processes students should understand or be able to do fairly easily if they were paying attention in class?" In an agriculture mechanics class, the teacher might provide a list of topics and ask the student to provide a brief explanation of each term. For example:

> A short weld used for temporarily holding metal in place is called a _____ weld.
> A. spacer

B. temporary fusion
C. tack
D. temporary braze

Although each term represents a very complex idea, the item may be answered with a general understanding of detail or process. Type I responses would require a basic physical demonstration of a skill or competency in an expected scenario or environment as taught in class.

To construct Type II items, the information must go beyond simple recall of vocabulary items, demonstration, or characteristics. Type 2 items require students to produce information. To construct a Type II item, the teacher would ask: "About this measurement topic, what are the more complex ideas and processes students should understand and be able to do if they were paying attention in class?" (Marzano, 2006). For example, in a logistics course, the student would be asked to demonstrate the steps required to complete an order fulfillment process as follows:

> Using the facilities picking process, the participant will complete two order picks, entering the designated information/data on the forms provided.

Type II items ask the student to demonstrate knowledge or skill in a more unpredictable or unusual setting that would require information outside classroom instruction.

To construct a Type III item, the teacher would ask and answer the following question (Marzano, 2006): "About this measurement topic, what inferences and applications might students be able to make even though they go beyond what was taught in class?" For example the teacher might ask, "Describe how you would select wood for framing a house in a very humid climate." For Type III items, in a performance based assessment, the student would be asked to demonstrate the skill or process in very unpredictable situations. In an auto mechanics class, students may be asked to troubleshoot and diagnose a problem in a gas engine. What makes the process unpredictable is the way in which the instructor inserts "problems" or "bugs" that the student must diagnose.

Developing a scoring scale. Given that an assessment contains the three types of items identified previously, Marzano (2006) suggests that it is relatively easy for a teacher to translate patterns of responses into scaled scores and then grades. Table 2C.2 provides an example of a simplified scoring scale

To score the simplified scale, the teacher reads each students' responses to each item marking the responses as correct or incorrect using a simple system like a "plus" sign for correctly answered questions, and a "zero or negative sign" for incorrectly answered questions and items which received no response. With time and experience a teacher may develop a more nuanced scoring scale with partial scores and additional conditions. This system allows the teacher to quickly grade assessments using the same criteria, which provides more uniformity of assessment across classes.

Table 2C.2
Simplified Scoring Scale

Topic Score on Scale	Description of Place on Scale
4.0	In addition to Score 3.0 on performance, in-depth inferences and applications that go beyond what was taught
3.0	No major errors or omissions regarding any of the information, steps or processes that were taught in the classroom
2.0	No major errors or omissions in the simpler details and processes but major errors or omissions regarding the more complex steps or processes
1.0	With help, a partial understanding or some of the simpler details and processes and some of the more complex ideas and processes
0.0	Even with help, no understanding or skill was demonstrated

Developing Paper-and–Pencil Tests as Summative Assessments

Teacher-made tests remain the most common form of classroom assessment in schools today (Brookhart, 2004). Various studies estimate that K-12 teachers construct as many as 54 tests or assessments in a given course in a given year and spend nearly one-third of their time in development and maintaining assessment activities (Green & Mantz, 2002; Marso & Pigge, 1991). They can be used to measure knowledge and understanding of any of the three types of content in CTE programs: CTE knowledge; academic knowledge; and knowledge of essential workplace skills such as 21st century skills.

Because students will be exposed to the paper-and-pencil-type assessment format on college entrance and placement exams as well as on employer or industry-credential exams, it is important for students to regularly respond to paper-and-pencil test items as they learn CTE content. CTE teachers can access a variety of sources for sample test items such as textbook materials developed for teachers, item data bases, or released items from college readiness or employer/industry exams. Although teachers may draw test questions for a variety of sources, assembling items into a well-constructed teacher-made test has several advantages over standardized, textbook company-produced, or even local and state curriculum developer-produced exams. First, classroom teachers can key test questions to the very specific objectives and content they have taught, rather than to general content that "most" teachers teach for this subject" (Cruickshank et al., 2009). Secondly, they often can provide more detail and specificity then may be typical with standardized or company-produced "general" tests. Thirdly, they can be targeted specifically to the learners in this classroom and thus facilitate some accommodation for the varying and special needs of students.

In spite of these advantages, teacher-made assessments are often poorly constructed and thus often provide inaccurate information (Cruickshank et al., 2009; Green & Mantz, 2002; Stiggins, 2006). To improve test development, teachers should be cognizant of two universal concepts of good test construction:

- Validity – Do the test, test items, and assessment as a whole measure what they are supposed to measure; that is, the most important content or concepts that were taught and that the student must know?
- Reliability - Do the test, test items, or assessment receive essentially the same score over time (i.e., consistently) and produce scores that are not affected much by chance?

To design a paper-and-pencil test, even if using items from a resource or data base, CTE teachers can use a table of specifications described earlier to ensure that the number and type of items on the test correspond to the standards for the unit and their relative importance. Although the most common items are multiple choice questions and short answer or essay questions, paper-and-pencil tests can also include items in which the correct answer is matched to its description, statements which may be determined as true or false, and statements in which a blank must be filled in with an answer. Table 2C.3 illustrates the most common options of test items. Based on the listing of standards in the table of specifications, the teacher selects appropriate types of exam items. For example, if a standard involves analysis or application of information and is significantly important in the unit, the teacher may choose to create an essay question that is 25% or 30% of the total exam. If the standard involves remembering a sequence within a technical process, matching or short answer may be an appropriate type of question, with a small amount of the total exam devoted to that content.

Table 2C.3
Types of Paper-and-Pencil Test Items

Multiple Choice	Uses a stem which presents a problem or asks a question with 4-5 alternative responses.
True-False	Presents statement which asks students to identify it as true or false.
Completion	Presents items that require students to supply missing words from a statement or write a short phrase that answers a question posed in a stem.
Matching	Presents a list of stems, often called descriptors, in the left column and a list (usually longer) of alternatives in the right column.
Short Answer or Essay	Stem, question, or statements that require written response which can range from a few sentences or paragraphs to several pages.

Formative Assessment

Formative assessment begins at the onset and continues through the learning episode, providing feedback to students to help them correct misconceptions, understand mistakes, and reinforce their progress. It helps teachers determine how well their students are learning and how effective their instruction has been. Feedback through formative assessment strategies allows the teacher to adjust instruction and improve students' performance before any final (i.e., summative) assessment of learning is conducted. The purpose is to use many different assessment methods to provide students, teachers, and parents with a continuing stream of evidence of student progress

in mastering the knowledge and skills required for course completion, mastery of standards, and/or certification or licensing. Table 2C.4 illustrates the variety of formative assessment techniques that CTE teachers can use to provide feedback to students on their progress in meeting CTE and academic standards.

Table 2C.4
Formative Assessment Techniques for CTE Classrooms

Project Plans—Goals, Timelines, Checklists	Drafts of Papers or Projects
Checklists—Performances or Work Completed	Quizzes
Homework Practice	Practice Presentations
Journals, Learning Logs, or Documentation of Work-in-Progress	Interactive Notes or Representations of Content such as Graphic Organizers
Classroom Checks for Understanding such as Exit Slips, Hand Signs, One-Minute Papers describing what was learned and what questions still remain	Classroom Questions, aloud or in writing

The ultimate goal of formative assessment is to assess for learning (Stiggins, 2005) in contrast with the assessment of learning accomplished through summative methods (Wilen, Hutchison, & Bosse, 2008). According to Stiggins (2007), assessment for learning begins when teachers clearly describe for students the goals or standards for learning and show models of exemplary work. The students' role is to strive to understand what success looks like and to use feedback from a variety of assessments to discover where they are now in relation to where they want to be and how to do better next time. Various researchers have outlined principles of assessment for learning to include:

- Aligning learning goals with assessment methods and knowing achievement targets before instruction begins
- Informing students about these targets and the nature of the assessments that will be used to measure them
- Using a variety of assessment methods that accurately reflect student achievement
- Involving students in the assessment process
- Providing frequent feedback to learners that gives students a clear picture of their progress on learning goals and encourages them to improve
- Modifying instruction based on assessments. (Stiggins, 2005, as cited in Wilen et al., 2008)

Developing Assessment Tools for CTE Content

CTE teachers address three major types of content: CTE knowledge and skills; academic knowledge and skills; and the 21st century skills essential knowledge and skills for workplace success. This wide variety of content requires a variety of assessment tools, each of which can be used in formative assessment during a unit of instruction or in summative assessment at the end of a unit, marking period, or course. In this section of the paper, we will provide a framework for

designing assessment tools and explain the use of three specific tools: rubrics that lend themselves well to the performance of skills; paper-and-pencil tests, which are typically used to measure knowledge and understanding of content; and portfolios that document student progress over time.

Once this reflection has taken place, the teacher can: (a) choose from a multitude of assessment strategies and (b) design a table of specifications. Table 2C.5 provides examples of commonly used teacher-developed assessment strategies in the category of authentic assessment of performance.

Table 2C.5
Examples of Assessment Tools for Authentic or Performance

Checklists	Written instrument that lists the specific elements deemed necessary for desirable performance, product, or presentation; teacher checks if each element is present.
Rating scales	Lists the specific elements required of a product, performance, or presentation, but allows teacher to make a judgment of its quality.
Rubrics	Illustrates with detail and description the various elements required for performance, product, or presentation.
Portfolios	A collection of samples of student work that demonstrates accomplishment and achievement; may include video or audio tapes to illustrate.
Other authentic tasks	Depending on objectives and expectations, an interesting array of "other" assessments have been reported by teachers: field interviews, work samples, student peer or self written evaluations, observational notes, competitions, employment-based assessments.

Using Rubrics to Assess Quality and Provide Feedback

Though the original definition of rubric meant "marks in red" (Finson & Ormsbee, 1998, p. 80) or as Marzano Pickering, and McTighe (1993) stated, "the use of red earth to mark something of importance," today a rubric is viewed as an assessment tool. Rubrics define the criteria by which a student's work should be judged. Therefore, the rubric becomes a scoring tool indicating "what counts" (Goodrich, 1997; Montgomery, 2000, as cited in Jackson & Larkin, 2002). Scores are awarded based on predetermined criteria set forth in the rubric. In the CTE classroom demonstration of performance is an important issue for students meeting standards. Performance tasks are the backbone of a performance assessment (Marzano et al., 1993) system and rubrics are an important tool for performance assessment. Rubrics can be used to measure CTE knowledge and skills, academic knowledge and skills used in context or as part of a performance, and essential workplace competencies such as 21st-century skills and habits of success. They are well suited to the measurement of projects, presentations, performances, or problem-solving tasks.

Descriptions of performance for each level are contained within the rubric and indicate gradations of quality from high to low. Depending on the type of rubric used, grades are awarded

by the total score only or by separate pieces being judged and then totaled into a final score. Teachers, parents, and students can view the work from both formative and summative assessment perspectives. The rubric scale usually runs from 1 to 4, with 4 describing the highest level of performance. Usually one level of a rubric is considered the acceptable level of performance. In a four-point rubric a 3 is considered an acceptable level of performance (Marzano, et al, 1993). More specifically, a scoring rubric consists of a fixed scale and a list of characteristics describing performance for each of the points on the scale. Table 2C.6 illustrates a rubric for a process or skill. Because one overall score is given for the process or skills, this is described as a holistic rubric.

Table 2C.6
General Rubric for a Process or Skill

4	The student can perform the skill or process important to the industry standard with no significant errors with fluency. Additionally, the student understands the key features of the skill or process.
3	The student can perform the skill or process important to the industry standard without making significant errors.
2	The student makes some significant errors when performing the skill or process important to the industry standard but still accomplishes a rough estimation of the skill or process.
1	The student makes so many errors in performing the skill or process important to the industry standard that he or she cannot actually perform the skill or process.
0	No judgment can be made about the student's ability to perform the skill or process.

An alternate rubric form is an analytic rubric. This provides a description of levels of quality for different areas of criteria related to judge a product or performance. A particular product, such as a research paper, may have several areas of criteria including: substantive content, organization, grammar and conventions, and sources. Instead of just the one overall score that a holistic rubric yields, four different 1 through 4 scores would be judged for each of the criteria, which could be added together or weighted differently into a total score. Table 2C.7 provides an example of an analytic rubric for a brochure project. A CTE teacher may assign such a project to embed research, writing, and communication into CTE content.

Table 2C.7
Analytic Rubric for a Computer Technology Course Brochure Project

CATEGORY	**(4) Excellent**	**(3) Good**	**(2) Almost**	**(1) Not Yet**
Attractiveness & Organization (Organization)	The brochure has exceptionally attractive formatting and well-organized information.	The brochure has attractive formatting and well-organized information.	The brochure has well-organized information.	The brochure's formatting and organization of material are confusing to the reader.
Content - Accuracy	The brochure has	The brochure has	The brochure has	The brochure has

(Ideas)/Process is Clearly Explained	all of the required information (see checklist) and some additional information	all of the required information (see checklist).	most of the required information (see checklist).	little of the required information (see checklist).
Writing - Mechanics (Conventions)	All of the writing is done in complete sentences. Capitalization and punctuation are correct throughout the brochure.	Most of the writing is done in complete sentences. Most of the capitalization and punctuation are correct throughout the brochure.	Some of the writing is done in complete sentences. Some of the capitalization and punctuation are correct throughout the brochure.	Most of the writing is not done in complete sentences. Most of the capitalization and punctuation are not correct throughout the brochure.
Graphics/Pictures	The graphics go well with the text and there is a good mix of text and graphics.	The graphics go well with the text, but there are so many that they distract from the text.	The graphics go well with the text, but there are too few.	The graphics do not go with the accompanying text or appear to be randomly chosen.
Sources	There are many citations from a variety of sources accurately listed on the brochure.	There are some citations from a variety of sources accurately listed on the brochure.	There are a few citations accurately listed on the brochure.	Incomplete citations are listed on the brochure.

Although rubrics can be time consuming to develop, they ultimately streamline the teachers' assessment time by standardizing the expectations for quality performance. Students may submit higher-quality work for final assessment because the expectations are clearer and that can mean less time necessary for assessing the work. To save development time, teachers can access many ready-made examples of rubrics and templates for development that can be tailored to specific projects or assignments. These examples and templates can be found in various formats both on-line and in texts such as Marzano et al. (1993). When starting from scratch, Goodrich (1997) lists the following steps in developing a rubric:

Step 1: Look at Models	Show students good and poor examples of student work for particular task. Help students identify characteristics of each.
Step 2: List the criteria	Use the characteristics to generate a discussion about what is considered quality work.
Step 3: Articulate gradations	Describe the best and worst level of quality on the of quality continuum and then fill in the middle levels of quality
Step 4: Practice on models	Have students use the rubric created in Step 2 and 3 to assess the examples of good and poor work in Step 1.

Step 5: Use self- and peer assessment	Stop students occasionally as they are working on a task to have them and their peers assess the work.
Step 6: Revise	Encourage students to revise their work based on the feedback they receive in Step 5.
Step 7: Use teacher assessment	Assess students' work by using the same rubric they have used to assess their own work.

There are several major benefits to rubrics (Jackson & Larkin, 2002). First, the students know before beginning an assignment what the expectations of performance will be. The expectations may be assigned by the teacher or may be determined with the help of the students through class discussion. Rubrics are easily modified to reflect the expectations for special needs students. Ultimately, the students understand of the assessment criteria and their importance. The product or performance is strengthened when students are involved in using rubrics (Ward & Murray-Ward, 1999, as cited in Jackson & Larkin, 2002).

Secondly, students can monitor their own progress as the assignment progresses. When students understand how to use rubrics, they can focus on what is considered important. Students become aware of the quality of work through judging their own and their peers' assignments against the standards set in the rubric. The rubric becomes a tool of formative assessment, to provide feedback and guide the learning experience or project. The rubric can also be used as a final checkpoint before turning in a project.

Finally, the rubric focuses the final assessment for the project and provides clear justification for the grade assigned to the work. Once the final product is submitted, summative assessment is accomplished as the rubric is used to award a final grade. The rubric serves as a tool for communicating expectations for success in the final product among teachers, parents, and students.

Portfolios

Student portfolios are an effective way to document student learning and evaluate student progress over time. A student portfolio is a purposeful collection of student work that tells the story of the students' efforts, progress, or achievement in relation to standards. When students actively participate in the selection of portfolio content and reflection on what they have learned, the portfolio is a powerful assessment tool (Meyer, Schuman, & Angello, 1990). Effective portfolios:

- *Are purposeful.* Without purpose the portfolio is just a collection of student work. The portfolio can be used to show the process the student used to develop a project such as a pre-engineering project notebook or it can be used to demonstrate skills in building a truss or structural repair of an automobile to demonstrate end of course or program competence against industry standards. The purpose must be clear.
- *Require student reflection.* Self-reflection of the student in selecting the content of the portfolio is the one thing that makes a portfolio instructional.
- *Outline criteria for judging merit.* When a decision is made to include an item in a portfolio the decision is based on some criteria. The sharing of criteria is a great way

to recognize strong performance, provide instruction to students in identifying quality work, and using criteria to learn and improve performance.

- *Provide guidelines for selection of work.* Guidelines provide direction for what to include in a portfolio and should be aligned with purpose and learning standards.
- *Involve the students in the selection of work.* The true instructional value comes when students use criteria and self-reflection when making decision about what they want to show about themselves and why.

Assembling a portfolio cannot be done without applying criteria to judge the quality of the work that is selected. The portfolio should never be seen as work "outside" the learning standards of the course (Arter & Spandel, 1991). If the portfolio is assembled based on criteria directly connected to the learning standards, the selection of the materials can paint a picture of student effort, growth and achievement. This is the very essence of assessment (Arter & Spandel, 1991). Thus the portfolio can be used to improve achievement, a value over and above merely assigning a grade or monitoring learning.

Grading

After collecting various assessment data throughout a course, CTE teachers will be expected to assign a grade that reflects each student's performance. Grading is one of the areas of teaching responsibility where there is the biggest gap between research and practice (Guskey & Bailey, 2001). Most teachers often reflect back on what they experienced as students and use grading strategies they perceive as fair, reasonable, and equitable (Guskey & Bailey, 2001). Consequently, grading practices are often based on personal experiences rather than lessons from research. If the central purpose of education is to promote student learning, then decisions about how to grade must be made with that overall purpose in mind. Guskey (2000) states:

> Grading requires careful planning, thoughtful judgment, and a clear focus on purpose, excellent communication skills, and an overriding concern for students. Such qualities are necessary to ensure grading policies and practices that provide high quality information on student learning in any standards-based learning environment. Grading and reporting should always be done in reference to specific learning criteria or standards, rather than an average or class curve grade.

Although there are no right or wrong ways to design grades, Marzano (2000) suggests grades should provide information or feedback to students and parents and that the best reference for grading is content-specific learning goals or a criterion referenced approach. Teachers should identify what they want their students to learn, what evidence will be used to verify that learning, and what criteria will be used to judge the evidence. Teachers must clarify their standards and their grading criteria. Grades based on specific learning criteria and standards have direct meaning and serve well to communicate student progress in learning to the standards.

To align grades with standards, CTE teachers can use the table of specifications described earlier in this section. The table for a course grade would include a list of the major standards for the course, including technical, academic, and workplace readiness. Based

on the relative importance of each of these types of standards in the course, these three categories of CTE content—technical knowledge and skills, academic knowledge and skills, and career readiness knowledge and skills--could be assigned a relative weight in the overall course grade. For example, technical standards and the assessments they measure might be 40% to 50% of the course grade; performance on academic knowledge and skills related to career and college readiness, 20% to 30% of the grade; and workplace readiness or 21st-century skills such as teamwork, work ethic, and accountability, 20% to 30% of the grade.

To provide effective feedback to students, teachers must develop a system for keeping track of the data related to each standard, so that both the teacher and the students can track progress throughout a marking period and over the course of the school year. Developing this system requires a careful consideration of the way in which assessment data are kept in a grade book. Traditionally, teachers keep grades in a two-dimensional format with the students names down one column and a series of scores on various assignments and assessments in the row corresponding to each student's name. According to Marzano (2000), the most effective way to provide feedback through grading is by recording grade information in a three-dimensional format based on categories or topics related to the standards. For example, the assessment scores for a CTE unit may include tests, homework, projects, or performances. The assessment for a project might include a score for technical skills, for teamwork (a career readiness skill), and for academic knowledge (writing, for example). A grade book that is based on categories of the standards allows the teacher and student to track the progress of the student toward proficiency in each specific category measured rather than recording a single score for a project.

This type of record-keeping goes beyond the typical point system in which each assignment or assessment is given a relative amount of points and the total points are averaged to determine the marking period grade. The point method makes sense if the teacher addresses only one topic, such as financial literacy in a family and consumer sciences class. What is wrong with the point system that has been used for nearly a hundred years? Nothing if all that is assessed are multiple choice, or other test items in which a correct/incorrect response is scored. The problem is that essay items, oral presentations, portfolios, and performance of skills or procedures do not lend themselves to a correct/incorrect grading scale. Thus, it becomes very difficult to accurately provide feedback to students on their progress specific to certain standards.

To effectively keep track of grade data when multiple areas of standards are assessed requires the use of grading columns in a grade book based on topics related to the standards. The data in each category is recorded and then an overall total or score is determined in each category before it is calculated in the grade for the marking period. An example of a grade book based on categories of the standards is found in Table 2C.8. Based on the type and nature of each specific assessment, the part of the score relating to that category would be recorded in each column or left blank if that category was not part of the particular assessment.

Table 2C.8
Grades Recorded by Categories of the Standards

	Assessments for the Marking Period (Examples): A. Quiz #1 B. Homework Sept 18, Math Problems C. Performance Task D. Project				
Student's Name	**Assessment**	**Category 1: Technical**	**Category 2: Academic**	**Category 3: 21st Century Skills**	**Category 4: All Aspects of an Industry**
	A	Score	Score	N/A	N/A
	B	N/A	Score	N/A	N/A
	C	Score	N/A	Score	Score
	D	Score	Score	Score	Score
Portion of Grade for Each Category		Grade	Grade	Grade	Grade

The method of computation for grading based on categories is called the power law of learning. It is based upon the belief that learning increases as skills and knowledge are acquired and applied. It implies that learning is not equal from the beginning of the course to the end therefore grading should adjust to account for the change in learning from beginning to end (Marzano, 2000).

The simple or presumed simple, task of grading and setting up a grade book requires additional examination of local policy, educational philosophy as the instructor, and classroom application. Whatever method is selected for grading, the beginning teacher should be very familiar with local school district policies to make certain the grading scheme selected is within approved grading policies for the school district. If the end purpose of assessment and grading is to provide feedback to students and parents and to guide learning, the more applicable assessments and grading are to the actual learning taking place, the more powerful the result.

In addition to determining a procedure for assigning a marking period grade based on standards, CTE teachers will also face day-to-day decisions about what to grade and how to assign scores for assignments and assessments. The difference between failure and the honor roll often depends on the day-to-day grading policies of the teacher (Reeves, 2008), rather than whether or not the students have actually met standards. For example, some common grading practices are so ineffective they can be termed "toxic" (Reeves, 2008):

- *Use of zeroes for missing work.* Despite evidence that grading as punishment does not work (Guskey, 2000) and the mathematical flaw in using a zero on a 100-point scale (Reeves, 2004), many teachers use this policy, believing it will motivate students or

serve as punishment for bad behavior. Grades are ineffective as punishment and should not be used as a weapon for misbehavior.

- *Averaging all scores throughout the semester.* This formula assumes that learning early in the semester is of the same level and quality as that later in the semester and often penalizes the student for early learning mistakes in the form of lower grades.
- *The "semester killer."* The use of the single project, test, lab, paper or other assignment that makes or breaks a student and disregards learning that is accomplished throughout the semester. This practice puts 18 weeks of work at risk based on a project that consumes a small amount of time within the semester.

CTE teachers will also need to think through their role in asking students to re-do work that is not to quality, and how the re-doing of that work will impact grading. Part of grading in CTE classrooms is recognizing that the goal is to prepare students for the workplace. One way to emphasize the importance of quality is to ask students to revise work that is of poor quality. Not accepting or grading work from students until it has reached a level of workplace quality provides an opportunity for the students to use feedback and understand the characteristics of quality work. In doing this the teacher must create an environment where students are not permitted to submit substandard work without being asked to revise (Scriffny, 2008). Through revising work, students will develop an accurate sense of what quality work looks like, which builds the self-sufficiency that is in demand by industry.

Understanding the Larger Context of Student Assessment

Schools, school districts, and states use many different methods to see how well individual students are doing. CTE teachers will benefit from an understanding of how schools, districts, and states use assessment data. Interpreting this data helps them understand the broader school context in which they work and prepares them to participate in building-level discussions about assessment data and how it is used in overall school improvement. At the local, state, national, and even international level, summative assessments yield information that is used to evaluate schools, programs, and/or a student's standing relative to his or her peers or to a particular level of performance that may be necessary for graduation or entry into college. There has been wide-spread emphasis on these types of tests, also referred to as standardized tests, fueled by rising expectations for student learning. All 50 states require some form of summative, standardized testing to assure the public and taxpayers that students have learned that which the state values as important, typically in such academic content areas as math, science, language arts, and history. The results on the student's test yields a "score" and these scores become a determinant for some future decision making.

Summative assessments can be used to compare and rank students in school, make high-stakes decisions about grade or course failure, or to advance in higher level courses, such as advanced algebra or trig (Morrison, 2009). Nearly all states now use some standardized tests in core academic subjects to determine if students have mastered sufficient content matter to warrant receipt of a high school diploma. Another use of summative assessment is to compare the scores of one group against those of another or within a larger cohort, say 11th graders on math in XYZ High School compared with those in the district as a whole and those in the state.

The score on standardized tests may also be a factor for admission to a particular college or university, and some employers examine the results of student's scores on standardized tests to make decisions about employment or placement within their firm. The mantra being currently touted relative to high school graduation is to use testing to determine students' college or career readiness. In fact, and as a condition for receipt of federal funding via Perkins IV, states are required to assess students' attainment of challenging technical skills proficiencies that are aligned with postsecondary program or industry-recognized standards. CTE students are expected to have mastered state-recognized academic knowledge and/or industry-recognized and technical skills that "prepare them to enroll in a community college, four-year college, or university; pursue advanced career training in a public or private proprietary institution; enter an apprenticeship program; obtain employment; or enlist in the military" (Derner, Klein, & Hilber, 2008, p. 1).

It is strongly recommended that new teachers examine the testing systems being used in their school district and in their state to assess or measure both students' readiness for college and readiness for careers. There will be plenty of information on the websites of the various testing companies or agencies to inform teachers about the academic knowledge and/or technical skills being assessed. The purposes for and uses of the exam(s) will usually be described. Often sample questions are provided. A perusal of this information should inform the new teacher of the academic and technical expectations that underpin the assessment. The teacher can then incorporate into his or her lessons for CTE students the technical knowledge and skills that are deemed important to licensing, certifying, or credentialing in the occupational area, as well as the related academic content to underpin the technical skills. The following two sections contain information about the nature of tests that are currently being used throughout the country to assess high school students' readiness for college and readiness for careers.

College readiness. To determine college readiness, most schools in most states examine summative data from one or more of four primary sources: students' completion of all course requirements in that state's college-prep high school curriculum; their cumulative grade point average; references and/or a description of school and community activities; and their scores on standardized tests from one of two national testing agencies, either the ACT or the College Board's SAT. The ACT test assesses high school students' general educational development and their ability to complete college-level work. The multiple-choice tests cover four skill areas: English, mathematics, reading, and science. An optional writing test measures skill in planning and writing a short essay. The SAT assesses critical thinking and problem solving skills in three areas: critical reading, mathematics, and writing.

There are some postsecondary institutions, primarily two-year technical and community colleges that use college-readiness summative tests to assess students' potential for college, place them in appropriate college-level courses, and/or connect them to resources such as developmental studies or remedial programs, should they need assistance to enhance their success with college-level studies. Examples of three such tests or testing systems are as follows:

- CLEP (College Level Examination Program, administered by the College Board) – a series of exams for testing examinees' college-level knowledge acquired through course work, independent study, cultural pursuits, travel, special interests, military service, and

professional development. CLEP exams are available in business, composition and literature, foreign languages, history and social studies, science, and mathematics.

- COMPASS (administered by ACT) – a computer-adaptive college placement exam that evaluates a potential college students' skill levels in reading, writing, math, and English as a second language.

- Wonderlic – a 12-minute, 50-question assessment often used to assess the aptitude of prospective students for postsecondary career and technical programs and specialized job training programs.

Career readiness. The assessment of career readiness is not as clear cut nor does it have the history of research, development, and wide-spread use in schools comparable to the college-readiness assessments identified with the College Board or ACT. Perkins IV requires that technical skill measures be valid and reliable and focused on "career and technical skill proficiencies, including student achievement on technical assessments, that are aligned with industry-recognized standards, if available and appropriate" (as cited by Hyslop, 2009, p. 27). States are being encouraged by the federal government to report technical skill measures for CTE concentrators by using a state-established technical skill assessment or with a third-party industry-recognized certification or credentialing exam. There are a few states such as Arkansas, North Carolina, Oklahoma, Utah, and West Virginia that have developed and are using end-of-course and end-of-program technical assessments, but most states intend to rely on third-party or industry-recognized certification (Derner et al., 2008).

In a review of state websites and publications about measures of career readiness for career and technical education and other students, there appears to be three major sources of technical skills assessment: certification exams, industry certification, and state occupational or professional licensing. Some of these may only be available or possible for CTE students in postsecondary programs and/or for those who are in secondary-postsecondary articulated or dual enrollments programs; that is, they may require graduation from high school before a certificate or license is awarded. The following is a brief description of some of the types of summative assessments that are available to measure career readiness:

- *Certification exams*. If passed successfully, certification exams are used to recognize an individual's attainment of validated skills. The exams may include off-the-shelf technical skills assessments or customized written tests or performance assessments used to determine whether test takers have achieved a set of generic work readiness skills or more specifically-defined technical skills within a discrete occupational area.

- *Industry credentialing*. Typically defined as completion of an industry certification program with any number of courses (i.e., 2-4) leading to endorsement for employment in a specific occupation such as certified nursing assistant (CNA) or in food service operations (ProStart). In addition to successful completion of the coursework, students will usually complete an assessment from an agency such as the NOCTI or the National Restaurant Association.

- *Occupational Licensing*. Used to certify that an individual within a state is qualified to engage in a given trade or profession. Upon submission of appropriate documentation, the individual is issued a license that certifies him or her to practice that occupation or profession within that state. Typically a written and/or performance assessment is required before a license is granted.

Examples of organizations that have engaged in research and development of skill assessments for use in career and technical education programs are included in Table 2C.9. Examples of the occupational skills for which they provide summative assessments (e.g., written and/or performance or job skill tests) are also included.

Table 2C.9
Organizations with Standardized Assessments

Organization	**Examples of Occupational Skills Assessed**
Adobe Systems Incorporated	Adobe certified associate
Air Conditioning and Refrigeration Institute	Residential air conditioning and heating certification
American Design Drafting Association	Drafting
American Hotel and Lodging Education Institute	All levels in the hospitality industry, ranging from front desk representative and restaurant server to certified hotel administrator
American Welding Society	Entry-Level welder
ASE/AES/SkillsUSA Partnership	Technician testing in automobile, truck, or collision repair
A*S*K Business Institute	Finance, fundamental marketing concepts, fundamental business concepts, entrepreneurship
Brainbench	Network administration, systems administration, software development, Web administration, desktop publishing, AutoCAD
Cisco Systems	Wireless LANs, Java programming, network associate, PC hardware and software technician
CompTIA	A+ certification
Delmar Thompson Learning/Home Builders Institute	Residential construction, electrical, house wiring
Dental Assisting National Board, Inc.	Certified dental assistant
Department of Health, Office of Emergency Medical Services	EMS first responder, emergency medical technician
Electronics Technicians Association	Computer service technician, electronics technician, satellite dish installer, data cabling installer
Electronics Technicians Association, International	Student electronics technician
Environmental Protection Agency	EPA technician

Graphic Arts Education and Research Foundation	PrintED certification
HVAC Excellence	Heating, electrical, air conditioning technology
Manufacturing Skill Standards Council	Certified production technician
Microsoft	Certified professional, office specialist, certified application specialist, systems administrator
National Center for Construction Education & Research	Carpentry, construction, masonry
National Center for Competency Testing	Beginning and advanced bookkeepers; several specialized medical fields such as medical assistant, medical office assistant, and ECG, phlebotomy, patient care, surgical, and pharmacy technicians; medical insurance and coding specialists; and postsecondary instructors
National Institute for Automotive Service Excellence	Automotive technician
National Institute for Metalworking Skills	Machining
National Restaurant Association	Sponsors a two-year curriculum, called ProStart, for high school CTE students in food service operations and management, mentoring, and a national certificate of achievement for students who successfully complete the program and Year 1 and 2 exams
National Retail Federation	Customer service, sales
NOCTI - National Occupational Competency Testing Institute	Written and technical performance skill assessments in over 170 occupational categories or jobs ranging from agricultural mechanics, banking, construction, dental assisting, electronics, floriculture, graphic communications technology, and on through the alphabetical listing up to welding and workplace readiness
Novell	Certified Novell administrator
SkillsUSA	Automated manufacturing technology, advertising design, photography
WorkKeys, from ACT	Foundational skills assessments measure different applied job skills in areas of communication such as business writing, listening, reading for information, and writing; problem-solving in applied technology, applied math, locating information, and observation; and in the interpersonal skill area of teamwork.

	ACT also provides a national career readiness certificate for those who successfully complete exams on locating information, applied mathematics, and reading for information

Appendix 2D

Concept Paper for Classroom Management Module

"What classroom management practices should beginning CTE teachers know and be able to do?" This section begins with an explanation of the importance of effective classroom management and its relationship to student achievement, as well as the way in which classroom management is effected by teachers' beliefs. The essential role of preventive practices in effective management is described followed by a discussion of the importance of understanding school policies and legal issues. The second part of this section outlines ways to implement a classroom management plan in CTE classrooms beginning with the first weeks of school then moving on to rules and procedures, disciplinary interventions, and ways to address the particular challenges of lab management. Finally, ways to support student success are outlined, specifically communicating with parents, providing extra help, implementing career and technical student organizations, and serving as a student adviser.

Understanding the Importance of Classroom Management

Classroom Management and Student Achievement

A strong research base in education supports the conclusion that it is the intersection of high-quality instruction with an effective teacher that is a critical factor to enhance student achievement. Further, more than 30 years of research indicate that classroom management is a critical component of teacher effectiveness. Solid, student-engaging instructional strategies coupled with effective management of student behavior are the two critical sides of the classroom management coin (Phi Delta Kappa, 2006b).

Classroom management, in its most basic form, can be defined as the provisions and procedures necessary to create and maintain a classroom community in which teaching and learning can occur (Cruickshank et al., 2009). This definition suggests classroom management extends far beyond merely making and enforcing rules to the quality of the student-teacher relationship itself. From a meta-analysis of 100 studies, Marzano, Marzano, and Pickering (2003) reported that teachers who had high-quality relationships with their students had 31% fewer discipline problems, rule violations, and related problems over a year's time than did teachers who did not have high-quality relationships. The effect of the teacher-student relationship was not just on student behavior. Significantly greater rates of student engagement and higher achievement scores occurred in classes where effective classroom management techniques were used compared to classes without effective classroom management. Marzano and Marzano (2003) pointed out that effective teacher-student relationships are characterized by three components:

1. exhibiting appropriate levels of dominance, defined as establishing clear behavior expectations and learning goals and exhibiting assertive behavior;
2. exhibiting appropriate levels of cooperation characterized by a concern for the needs and opinions of others where the teacher and student work as a team, and
3. being aware of high-needs students and having a repertoire of techniques to meet their needs. (p. 64)

For many new teachers, the effective management of the classroom and related disciplining of students looms as a very challenging, sometimes daunting concern. A survey conducted by the U.S. Department of Education concluded that less than 20% of first-year teachers consider themselves well prepared to deal with classroom management and discipline. Teachers who come to the profession through alternative licensing feel even less prepared than their traditionally prepared peers for the core tasks of teaching, such as meeting the needs of diverse learners, and constructing a positive learning environment (Darling-Hammond et al., 2002). Further, a Public Agenda survey concluded that 30% of teachers do not consider many other teachers as effective classroom mangers (Phi Delta Kappa, 2006a). Fortunately, teachers can be taught to be effective classroom managers. According to Marzano et al. (2003), good classroom managers are those teachers who understand and use specific research-based techniques that direct their behavior which, in turn, changes the behavior of students to greater engagement with the content and activities and results in improved achievement.

Teachers' Beliefs about Student Learning

Any discussion of classroom management needs to begin with a self-assessment of fundamental beliefs about student learning. When teachers believe that all children can learn and that it is their job to ensure that they do so, the students in their classes achieve at higher than expected levels (Corbett, Wilson, & Williams, 2002). Beginning teachers need to spend some time thinking about their own views about students and how students learn and can be taught to learn more, their perspectives and acceptance of the diversity that typically exists in public school classrooms, and how to establish a classroom environment that maximizes learning and minimizes distractions.

Saphier (2005) described three messages that seem to be part of the day-to-day and minute-to-minute classroom interactions when teachers hold the belief that effort makes the difference in learning: (a) "This is important." The content, knowledge and skills students are learning will be important to them now and in the future; 2) "You can do it." All students have the intellectual capacity to do rigorous work and meet high standards; and (c) "I won't give up on you" (p. 90). If students do not succeed the first time, the teacher will provide extra time and support and help the student persist to mastery of the content. Table 2D.1 contrasts these effort-based beliefs and practices with the actions teachers take when they hold the more traditional (and incorrect) view that student success is based solely on ability.

Table 2D.1
Ability-Based vs. Effort-Based Beliefs and Practices

Ability-Based Beliefs and Practices	Effort-Based Beliefs and Practices
Students who are perceived to have the highest ability receive the highest marks and are given the most challenging assignments. Students perceived with less ability receive less challenging assignments and lower expectations. Any academic deficiencies students have are attributed to low ability.	Effort makes a difference. Academic achievement can be grown. It is not how smart the student is, but how hard he or she works that determines success. All students are held to high expectations and offered opportunities to complete challenging assignments.
Time is the constant in learning, so students that fail to finish assignments, score well on tests, or learn key concepts by the "due dates" receive failing marks with no second chances.	Students learn at different rates and may not reach proficiency at the same time. A mistake is not an inability to perform, but a learning opportunity. For that reason, students may re-do work and retake tests.
Students have the responsibility to motivate themselves to learn. If they do not believe they can do well in school, they probably won't.	Students can be motivated to come to the belief that their effort is worthwhile, even if they do not believe it at the time they enter school.
Feedback to students is limited, often occurring only in the form of a numerical or letter grade.	Students are provided with extensive and specific feedback through the learning process to make corrections in their understanding and continue to learn.
Teachers assume that students have the skills needed to be successful students by the time they get to high school.	Teachers explicitly teach students how to exert effective efforts in learning—study skills, time management, problem solving, and note-taking.

These effort-based beliefs and the actions that are based on them have been found to motivate students who have typically struggled in school and close achievement gaps (Saphier, 2005). Fundamentally, the teachers who hold these beliefs and seem to get the best from their students, course after course, year after year, establish a classroom and lab environment that motivates and encourages all students to do their best; get to know their students—their learning styles, cultural backgrounds, career interests, education plans and aspirations, perspectives, and development needs; and manage their class and laboratories so that time is efficiently used, important tasks are given sufficient attention, transitions are well planned, and interruptions are kept to a minimum (Kellough & Carjuzaa, 2009; Kellough & Kellough, 2007). Thus, the effective CTE teacher plans lessons based on knowledge of the diverse needs of all of the students, with the conviction that all will learn the content and skills that are expected, and organizes and plans the classroom and activities accordingly. Planning includes attention to prerequisites (i.e., ensuring that students have the knowledge and skill necessary to move on), pacing, transitions, monitoring activities, systematic reviews, and feedback.

Planning also refers to the teacher giving some thought to what some authors refer to as the *silent* (or hidden) *curriculum*, referring to important behaviors and skills that are expected of students in schools and of all of us at workplaces and in communities. This is the nonacademic curriculum, sometimes referred to as competencies in the affective domain, and it needs to be modeled and implied in the management procedures used by the teacher. This might include, for example, competencies such as "respect for others," "listening while others are responding," "courtesy," and "following directions." For CTE programs, the silent curriculum is best defined through the life skills outlined in workplace readiness standards such as the 21st Century Skills (Partnership for the 21st Century, 2008). These student outcomes are the skills, knowledge, and expertise students should master to succeed in work and life in the 21st century. The "Life and Career Skills" category of the 21st Century Skills framework outlines specific essential outcomes to be targeted and taught through effective classroom management, such as

- Flexibility and Adaptability: Deal positively with praise, setbacks and criticism
- Work Independently: Monitor, define, prioritize and complete tasks without direct oversight
- Interact Effectively with Others: Conduct yourself in a respectable, professional manner
- Guide and Lead Others: Use interpersonal and problem-solving skills to guide and lead others toward a goal
- Collaborate with Others: Demonstrate ability to work effectively and respectfully with diverse teams. (Partnership for the 21st Century, 2008, pp. 4-7)

Beginning teachers can start by making a list of the skills they expect from students, posting them in a prominent place in the classroom or lab, and then planning to teach those competencies within the context of academics and technical skills and discuss them frequently with students. Introducing these skills to students by discussing them as concepts and breaking them down into specific descriptions of what they look like when practiced helps students gain a clearer understanding of the behavior they are trying to master. For example, collaborating with others involves specific abilities to manage emotions, understand conflict, and know the difference between being aggressive and assertive. Once the teacher has articulated the desired behaviors to students, modeling, practicing, and assessing those skills needs to become an integral part of day-to-day classroom practice. Contextualizing these complex competencies required or expected in the workplace helps to reinforce their importance to the total development of the student.

Teachers who clarify, model, and assess the essential workplace knowledge and skills of the "silent" curriculum effectively, implement a well-planned and validated sequence of instruction, and work well with students add to the credibility of the profession and have more positive feelings about themselves as persons and as educators. Several authors have pointed out that effective teachers rarely have difficulty coping. Hosford (1984) summed it up well:

> Effective teachers manage well. Coping is rarely an issue. The students are so busy at task-related activities, following sensible routines, and striving toward clearly understood objectives that situations with which teachers must "cope" seldom have an opportunity to

> arise. Through management skills, superior teachers achieve what has commonly been labeled "preventive discipline" in the professional literature. They are not automatically superior teachers. They plan, worry, and work hard. I have never known superior teachers who "took it easy." But the secret to their success—what sets them above the good teachers who also work, plan, and worry—is their process of management. They have learned (and firmly believe) that process affects product; that how they manage their classroom significantly affects the climate, motivational and goal achievement in their classrooms. In short, their knowledge base includes a thoughtful understanding of the importance of the Silent Curriculum. (p. 145)

Regardless of how well teachers plan lessons and activities and given the nature of adolescents (and some adults), in all likelihood teachers will still encounter issues with classroom management. The key is to try to plan ahead to keep serious disruptions and behavioral problems to a minimum and avoid potential catastrophes.

Planning an Inviting, Personalized Environment in the CTE Classroom

The old adage, "an ounce of prevention is worth a pound of cure," describes well the prevailing view on minimizing classroom problems. Teachers need to carefully consider the classroom environment they wish to create. Early studies in education showed clearly that the classroom environment has a powerful impact on students' behavior, learning, and motivation (Cruickshank et al., 2009; Lewin, Lippitt, & White, 1939). There are essentially two sides to consider: the physical environment and the psychological environment.

Physical environment. Teachers can begin by planning and arranging the physical environment well before the students arrive. To set the stage for preparing students for the 21st century workplace, a CTE classroom should resemble an attractive, well-organized, and inviting workplace comparable to the career field. Students need to see the room or lab as a safe, comfortable place for positive social and academic experiences. Studies have shown that an attractive, well-organized classroom environment leads to more positive attitudes, better grades, and more receptive students. Conversely, unattractive classrooms have been linked to frequent absenteeism, discomfort, fatigue, and complaints from both parents and students (Cruickshank et al., 2009).

For CTE classrooms and labs, equipment and computers should be up-to-date and neatly arranged; tools and supplies should be available and easy to access. Textbooks, manuals and workbooks, and other resources should be easy to identify and locate. Chalkboards, bulletin boards, display units, motivational and other posters, and other identifiers should be fresh and attractive and changed periodically, say at least once a month. State-of-the-art technology (e.g., SmartBoard, LCD panels, teacher computer station) should be available and prominent. All of this should be encased in a room in which the teacher uses color, light, temperature, soft tones, flooring, and other aesthetic elements to create an attractive, interesting classroom or lab.

The physical arrangement should allow the teacher fluid access to and around all stations, seats, cubicles, or tables at which the students will work and study. Seating arrangements, too, need to be planned in advance. Ideally, the desks, tables, or equipment will allow the teacher (with the

help of students) to align seating arrangements with the methods of instruction. That is, classroom equipment provides the capability for students to work in small groups, in a circle for larger-group discussions, at independent study, or designed for large-group interaction such as tables in a "u" shape or lined up occasionally in rows. No single arrangement is ideal for all classes, learning situations, or individuals. In general, studies have shown that wide walkways are best to accommodate teacher and student movement. Wide walkways are especially imperative for some students with special needs, such as the wheelchair-bound and ADHD students.

Psychological environment—personalization. . As Dr. James Comer (2001) has suggested, that no significant learning occurs without a significant relationship. There is an emerging consensus in school reform literature that a personalized learning environment contributes to student success (Annenberg Institute for School Reform, 1994; Darling-Hammond, 1994; both as cited in Klem & Connell, 2004). "Personalization" means that the teacher strives to know his or her students well, respects them, and supports them. In CTE classrooms, the teacher also represents an early contact the student has with a career field of interest. This provides a unique opportunity for the teacher to serve as a career mentor and be a powerful motivational factor in a students' success in school and potentially in the workplace.

As a workplace mentor, the teacher can model the tone and manner that resembles a well-run business by taking actions that reflect those of a positive, supportive, manager on site to teach and train business associates. Much like the workplaces of today, research shows that many disciplinary problems can be prevented with better teacher-student relationships. This doesn't mean being overly friendly or a big brother or sister to students. It means showing concern for the needs and opinions of students and showing them that you want to work with them to accomplish learning goals, much as a manager does at a job site when training an employee.

Students are, however, not yet adults in a real-world workplace. Although it is important to give them an understanding of how a real-world workplace operates, personalization for a secondary CTE teacher also means being aware of the students' developmental needs, interests, learning styles, and hopes and dreams. It means relating to students by listening to them, making eye contact, and giving them complete attention during interactions (Canter, 1996). To achieve a personalized classroom environment, teachers need to purposefully seek information from their students in the first few weeks of school and use that information to plan instruction. This information includes the students' career goals, learning preferences, course schedule, part-time work commitments, school activities, and family members' names and contact information.

Personalization also includes being culturally aware and responsive to students. A culturally responsive teacher respects diversity and celebrates students' cultural backgrounds rather than attempting to override or negate them (Lieber, 2002). Teachers should make an effort to welcome diversity by learning about their students' cultures, highlighting the accomplishments of people from different cultures, observing and learning about students' cultural experiences, and considering students' cultures and language skills in developing lessons. For example, effective teachers speak respectfully of students and are aware of words and actions that the students, especially those from cultures different than those of the teacher, may find offensive or disrespectful.

There are many ways for teachers to show they care about students. Greeting students each day with a smile as they come into the classroom and lab, much as good employers greet their employees at work, allows teachers to connect with students and to notice students who may be unready to focus on the learning activities ahead. Once teachers get to know students as individuals, they can recognize special events or celebrations in their lives; for example, a promotion at work, a birthday, an accomplishment at school, a job well done on a project or assignment in another class, etc. When students feel that their teachers care about them, they are more intrinsically motivated to learn and to assume responsibilities in the classroom (Grolnick, Ryan, & Deci, 1991).

Understanding School Policy and Legal Issues

Before the students arrive for the first day of school, it is incumbent upon the new teacher to learn of any laws and school policies that govern issues that relate to student management in the school. Most schools or school districts have policies in place that outline the steps or procedures that teachers and school leaders are to follow related to student conduct and violations that are either against the law or school policy. Individual classroom policies, rules, or procedures must be consistent with those established by law and by the district's school board or the school council. Laws and policies are usually spelled out in a faculty handbook or student code of conduct booklet. It is expected that teachers and students know, understand, and abide by these policies and rules.

The specificity in the manuals will depend on state and local laws and school district and individual school policies. There probably will be "rules," based on laws that govern crimes such as the use of illicit drugs or tobacco by minors, bringing guns and knives onto school property, terrorist threats, and theft. The manuals may also inform teachers and students about their legal rights, such as the right to refuse police searches of their pockets or purses, cars, lockers, and book bags without probable cause and the right not to be questioned by police without an attorney present. There may also be policies, procedures, and punishments that are to be followed regarding many other student conduct violations. They may, for example, cover absences, tardiness, leaving school early, bullying, harassment, disrespect to adults or peers, fighting, extreme rudeness, obscene language, breach of security, use of cell phones and electronic devices, etc. Regardless, it is important that teachers be schooled themselves in the school's policies on student conduct and understand the procedures that are to be followed should a violation occur. However, when reviewing rules with students in class, the focus should be on the few rules that are specific to the classroom, based on curriculum and workplace expectations, rather than the myriad of policies of the school or district as a whole.

Implementing an Effective Classroom Management Plan for CTE

Before School Begins

Beginning teachers can use the time before the new school year starts to get a jump on their classroom management plans. By thinking through the importance of creating a positive learning environment, getting set with the curriculum and lesson plans, acquiring knowledge of school

district and school policies, establishing classroom procedures and "rules," and getting the classroom or lab in shape, new teachers are well on their way to start the year. Lieber (2002) suggested several specific ideas for teachers to do before the school year begins that can help create a collaborative, personalized learning environment. Teachers can:

- Write letters to parents or guardians to mail before school, post on the school or class website, or to send home with students on the first day of school. The letter should be one page and describe what the course is about, the teacher's hopes and dreams for students, assignment and homework expectations, what might be challenging about the class, and what steps students can take if they are having difficulty meeting the requirements. This is the place to emphasize that effort, attitude and participation really count.
- Design an assessment and record-keeping system that is standards and student friendly. The teachers should consider the kinds of assessments to use, particularly those for important to overall success in the workplace such as literacy, numeracy, teamwork, problem-solving and other 21st century skills.
- Stock up on basic learning tools and supplies. Active engagement strategies require supplies such as newsprint, markers, tape, note cards, folders, boxes, post-it notes. Tools such as a timer and digital camera may also be helpful.
- Give some thought to the arrangement of chairs and desks so that it is easy for all students to learn each other's names.
- Make the classroom "ours." Teachers can post goals, routines, and procedures around the room, make a place for posting student questions, the daily agenda, and discipline rules. A space to keep homework assignments and study guides is also helpful. Finally, teachers and students will benefit from wall space devoted to displaying student work. (pp. 207-224)

Rules and Procedures

Before the school year begins, teachers can also develop the rules and procedures that will prevent major disruptions and poor behavior. Through a meta-analysis of classroom management research, Marzano et al. (2003) concluded that classroom rules and procedures significantly minimize classroom disruptions. They noted the following general categories in which teachers typically use rules and procedures:

- General expectations for behavior
- Procedures for beginning and ending the class period
- Transitions and interruptions
- Materials and equipment
- Group work
- Seatwork and teacher-led activities (p. 18)

Although it is not necessary to develop rules and procedures in all of these categories, the first category is frequently one that new teachers include in a classroom management plan. These general classroom rules should guide conduct and behavior in a variety of contexts. Possible general expectations for behavior include:

- Respect others
- Respect property
- Bring materials to class
- Be in assigned seat at the beginning of class

In addition to sharing behavior rules, teachers have the option of explaining the concepts underlying these rules. Concepts such as:

- *Unkind words or actions will not be tolerated (Examples of put-downs or disrespectful behavior may be provided).*
- *Behavior is respectful when it does not create a disruption or endanger you or anyone else in the classroom*

The instructor may also communicate their own philosophy and anticipated behaviors. Examples might include:

- *I will react without anger or haste to problem situations.*
- *I will provide consequences for inappropriate behavior that support your making better choices in the future.*
- *I will deal with inappropriate behavior in ways that will not demean or humiliate.*
- *Equal is not always fair. Consequences will be designed to fit the situation, and they may be different even when problems appear to be the same.*

Once developed, the goals are usually posted in the classroom and communicated to the students and their parents in a course syllabus. It is also possible for the teacher to engage the students in the development of the classroom rules, which may increase student understanding and sense of ownership.

In addition to the general expectations outlined in class rules, CTE teachers may also develop procedures for beginning and ending the class period. The first few minutes of the class typically set the tone for the whole class period, so ensuring that students know what to do upon entering the class, how and when to take out equipment and materials, and what to do it they are late to class minimizes disruptions and gets students focused on the learning activities right away. Secondary students may also need guidelines for how to ask permission to leave the room. Because most CTE teachers have classrooms with equipment and lab areas, guidelines for use of the equipment may also be part of the classroom management plan.

First Weeks of School

Teachers must now implement these proactive measures and maintain them throughout the year. The following are guidelines for establishing a positive learning environment and preventing classroom problems, beginning with the very first day of class.

On the first day of class:

- Greet the students as they enter the classroom or lab with a smile, a handshake, and a welcoming statement to your program or course.

- Introduce yourself, perhaps with a bit of information about your occupational experience, licenses and certifications, colleges attended, etc.

- Assign students temporarily to a seat. Usually alphabetic arrangement works fine for the beginning days of class.

- Hand out a syllabus. Review the goals and objectives of the course. Highlight for the students major content, projects, and outcomes they can envision by completing the course requirements and any summative assessments that are required or offered. What can they expect to learn and what skills will they be able to do as a result of participating in this course?

- Point out the "silent" curriculum procedures that are posted in the classroom and/or on a PowerPoint.

- Assign the students to write a 3-5 page autobiography, asking for information such as a personal history, contact information (i.e., e-mail), any special accommodations needed, course schedule, likes and dislikes as related to school, school and community activities, hobbies and interests, reasons for taking this course, part-time and summer employment, plans for college and career, and any other information they would like the teacher to know. This may also take the form of a survey instead of a writing assignment.

- Circulate as the students begin their writing assignment.

Continuing on during the first and second week of classes:

- Always, always start class on time. Be prepared. Have an opening activity that students are to do immediately upon entering the classroom.

- Quickly learn and use students' names.

- Establish instructional set each day with a brief introduction of the objectives and activities for the day. Discuss expectations and what the student is expected to know and do as a result of the day's instruction and activities.

- Review during the first few days the plans for the course, expectations, envisioned outcomes, and the silent curriculum. Solicit input from students, especially about the silent curriculum.

- Explain assessments that will be given, their purposes, and your role in helping them to achieve success.

- Discuss, particularly, workplace expectations for students enrolled in this unique program of study and who are preparing to be employed in related occupations. Expectations should include academic, technical, and affective competencies as well as the way in which occupations or jobs are organized in typical workplaces (e.g., through teams, independent problem solving, customer service, use of tools and equipment, the "rules" of employment, etc.).

- Discuss any unique elements or components of the CTE curriculum, such as co-curricular student organizations, equipment safety, computer security, and use of power and tools.

- Implement any routine that you wish to have followed throughout the year, such as handing out supplies and materials, getting the materials and equipment ready for the day's work, rearranging classroom equipment or seats, clean-up, etc. It is good to discuss with students more appropriate or convenient ways to rearrange the classroom or lab.

- Clearly communicate and model classroom rules or procedures.

- Start immediately with having students complete assignments, write in a journal, begin projects, solve a problem, operate equipment, use tools, or other activities as appropriate to the curriculum and its objectives. Observe students as they work and practice in your classroom. Provide attention, help, and reinforcement as needed.

- Hold students accountable, right from the beginning, for assignments, participation, cooperation, following routines, and acceptable behavior. Take action immediately if their actions are not acceptable by phoning parents, expecting all work to be turned in, and asking students to re-do work that is not to quality.

- Draw on the autobiographies the students wrote during the first day or two of class and use the information appropriately. Never violate confidentially. But do point out how content and classroom activities will help students achieve their goals.

- If possible, hold a brief conference with or interview each student to discuss important or interesting items in his or her autobiography.

- Communicate with parents or guardians, via e-mail, phone, or letter. Attach the syllabus to written correspondence. Establish a web site and e-mail for communication with students, parents, and colleagues.

- Provide positive reinforcement where warranted from the start and re-teach when it appears the student(s) is not learning the academic, technical, and/or silent curriculum.

Dealing with Inappropriate Behavior

In spite of the best planning to prevent disruptions and misbehavior, beginning teachers need to be prepared to deal with situations in which students are acting inappropriately. There are four categories of disciplinary behaviors (Stage & Quiroz, 1997):

1. Reinforcement
2. Punishment
3. No immediate consequences
4. Combined punishment and reinforcement

According to Marzano et al., (2003) reinforcement involves recognition and reward for positive behavior or for the timely cessation of negative behavior. Practices classified as punishment involve some type of negative consequences for inappropriate behavior, such as isolated time during class or after school or restriction of privileges. Interventions that are classified as "no immediate consequences," as the name implies, involve some type of reminder when an inappropriate behavior appears imminent. For example, a student who typically engages in rowdy "horseplay" in a welding lab should be reminded before going into the lab what the appropriate behavior should be. Finally, the combined punishment and reinforcement involves recognition or reward for appropriate behavior in conjunction with punishment for inappropriate behavior. Teachers should strive for a healthy balance of these interventions so that none are used exclusively for all students.

Often, a school has adopted an approach or policy on discipline that all teachers must use. However, it is usually up to the teacher's judgment as to when each intervention is to be used. Two of these interventions most frequently used in schools are Think Time and Assertive Discipline.

Think Time (Nelson & Carr, 1999, as cited in Marzano & Pickering, 2003) is a highly structured program with three basic goals:

1. To provide consistent consequences across all teachers in the school when students engage in disruptive behavior
2. To provide students with feedback for their disruptive behavior and to allow for planning to avoid future incidents
3. To enable teachers and students to cut off negative social exchanges and initiate positive ones. (p. 33)

Basically, in a Think Time classroom, students are given a quiet, isolated place to analyze their behavior and can return to the full classroom environment when they demonstrate they are aware of the behavior that led to the assignment of isolation and understand the appropriate alternative behaviors expected in the classroom and are willing to adopt those behaviors.

Assertive Discipline (Canter & Canter, 1992, as cited in Marzano & Pickering, 2003) is widely used and based on traditional behavior modification approaches in which misbehavior results in specific consequences. The approach makes a sharp distinction between rules and directions.

Rules are in effect all the time whereas directions vary from activity to activity. Students' off-task behavior is distinguished between disruptive and non-disruptive. If a student is off-task but not disrupting anyone, the teacher redirects the behavior without consequence. The approach also emphasizes appropriate behavior with negative consequences kept at a minimum.
Assertive Discipline involves five steps.

1. Establish a positive climate for discipline
2. Practice assertive behavior
3. Establish clear limits and consequences
4. Follow through on consequences
5. Implement a system of rewards or positive consequences for positive behavior (Marzano & Pickering, 2003, p. 34)

As pointed out in the section of this paper on rules and procedures, the more clear and succinct the established classroom rules, the easier it is to communicate those expectations to students. Helping students be responsible for their own behavior through consistency and following through with discipline is part of the role of the CTE teacher in helping students attain the skills, both technical and interpersonal, to be successful in their future careers. The more opportunities that can be taken to communicate expectations for behavior to parents and students and consistently apply the classroom rules and consequences, the easier it will be to maintain classroom control and utilize positive interventions more often.

Disciplinary Interventions and Consequences

One of the most successful strategies a beginning teacher can master in classroom management, is the ability to minimize and defuse disruptions and inappropriate behavior when they are first observed and before they become real problems (Lieber, 2009). This involves the ability to redirect unproductive group talk with actions such as moving into close proximity of students who are having a sidebar conversation, knowing how to quickly acknowledge an occasional juvenile remark and move on without breaking the flow of the lesson, and prompting students with reminder questions to listen to others or to tone down hostile or argumentative statements. Lieber reminds beginning teachers that "adolescents will often go out of their way to say and do things that are provocative just to see how (teachers) will react and what (they) will do" (2009, p. 195). The ability to defuse that behavior before it escalates into a major class disruption involves considering the student, the choices in the nature and timing of the teachers' response, and whether the response will occur in front of the class or in a private moment later in the class period. Teachers can develop their own tool bag of responses that successfully maintain the delicate balance between continuing the class without interruption and stopping to correct inappropriate behavior. These tools can include everything from a brief, but directed look at the student, a quick acknowledgement of "I hadn't thought of it that way," or a brief reference to the life skill that needs to be developed and an invitation to self-correct.

Beginning CTE teachers need to be prepared for problem behaviors which will require a higher level of intervention. Making a list of these behaviors is a good starting point (Lieber, 2009). They may include noncooperation and nonparticipation, student-to-student aggression, impulsive outbursts, and student-to-teacher aggression. These incidents can result in angry confrontations

for the student and for the teacher if left unchecked. The teacher's role is to defuse and de-escalate these confrontations and power struggles by using as few words as possible to calm the situation, name the consequence of the behavior, and make a quick end to it. Trying to talk with the student immediately in front of the class often only escalates the situation.

One-on-one conferences with students are an essential part of intervention. Time for these conferences can be at the end of class when other students are working on a final reflection activity, during lunch or prep periods, or before- or after-school sessions. Phone calls and student conference times are also possible. Conferences begin with describing the behavior that occurred and asking an open-ended question to prompt the student's perspective. Focusing the student on replacing negative behavior with the desired behaviors brings the conference to it's desired end: a behavior plan, learning contract, or checklist of desired behaviors that can be used in the upcoming days or weeks of class to support successful change in behavior (Lieber, 2009). Accountable consequences , different from the concept of punishment, are specific actions chosen to help students take responsibility for their behavior by correcting their mistakes or repairing the damage they caused (Lieber, 2009). These consequences promote shared responsibility: the student acknowledging and working on the development of positive behavior and the teacher supporting the student in making that behavior change. Beginning teachers need to develop at least three levels of consequences for supportive intervention:

- Tier 1 involves immediate teacher responses to interruptions and redirecting minor problem behaviors.
- Tier 2 addresses chronic unwanted behaviors and problem behaviors that can't be resolved quickly. These consequences include conferences, mandated work sessions for individual practice or completion of work, owed time, time-outs, referral to the dean, case conferencing with other staff such as counselors, or contracts with daily checklists and feedback.
- Tier 3 consequences involve automatic schoolwide responses that directly involve the principal, dean, or counselor. (Lieber, 2009, p. 13)

Lab Management

Bonfidini (1993) indicated that teacher preparation is a key element in eliminating student discipline problems. Yet managing students in a laboratory setting is more challenging in many ways than managing students in a traditional classroom setting. Preparation problems for the CTE teacher are compounded because instruction takes place in a complex learning environment which includes classroom, laboratory and often worksite learning. Teachers who fail to prepare classroom instruction properly have increased discipline problems. Administrators confirm that improperly maintained laboratories reduce the instructor's effectiveness and quality of student learning. Individual classroom management is the responsibility of the teacher; failure to properly prepare the physical environment and instructional time will decrease the probability of student problems.

The laboratory setting creates unique challenges in creating rules and safety procedures than may not fit within the general disciplinary or dress codes of the school. Numerous legal cases have appeared in courts associated with dress and appearance codes. The courts again reaffirm the

need for reasonable rules relating to student dress. Failure to follow specific dress or grooming requirements has been upheld by courts when clear and necessary reasons have existed for establishing the regulation. Requiring students to wear or not wear specific clothing for safety reasons can be enforced. Many states have eye safety laws that require students to wear proper protective equipment. Students can logically be expected to wear hairnets, helmets, and other health and safety equipment in certain CTE courses and related student activities. Loose or baggy clothing, unbound long hair, or earrings could pose potential safety concerns in classrooms with moving mechanical parts, animals, or machinery such as saws, welding machines, or manufacturing equipment. The CTE teacher must consider these potential safety concerns and communicate them clearly in course syllabi and discipline plans.

Examination of the yearly instructional plan is the first step in developing classroom management that includes laboratory management. Tailor the instructional plan to include the following elements:

1. Assigned time sequence for student activities
2. Identification of specific learning units to be taught, including safety and equipment use
3. Listing of desired student performance objectives
4. Instructional strategies for guiding the student through the learning process connecting classroom and laboratory learning experiences
5. Listing of necessary classroom and laboratory materials, equipment, and supplies
6. Procedures for laboratory maintenance
7. Student and program evaluation

Properly developing each of these items will eliminate many of the potential catalysts that create student discipline problems. The first item on the list is planning for the efficient use of instructional time. Realizing that time is a factor in establishing student and personal objectives can lead to better classroom organization, and consequently, less off-task and disruptive behavior. When laboratory time is well managed, it sends the message that that time is critical to developing the skills required for college and career. The process of selecting activities for CTE students can be an important factor in reducing idle time. The teacher should work through an activity before assigning it to a class. This should help determine the time factor required by the activity, taking into account the grade and ability of students.

Having all necessary support elements available and ready to go, such as (a) plans, (b) instruction sheets, (c) references, (d) safety instruction, (e) audio visuals, and (f) materials and supplies, will enhance student success and further help to reduce discipline problems. In a laboratory classroom, the need for materials and supplies cannot be over emphasized. Failure to obtain sufficient planning and timely ordering and delivery of student materials available will create classroom problems. In many school systems, the teacher may face the problem of insufficient funds and lack of needed materials. Funding challenges require great efficiency in utilizing materials that are available. The teacher should conduct a financial audit of the yearly educational plan to determine if student activities can be accomplished within the financial framework. If the answer is negative, adjustments can be made to the plan or the teacher could seek additional help from advisory committees or local business partners.

Laboratory maintenance is the teacher's responsibility; that responsibility should be accepted without expecting others to control the environment. Although many support systems are available to assist in maintenance, the teacher who establishes his or her own maintenance control system and involves the students in implementing that system will reduce management problems in the laboratory.

Providing Support for Students to Succeed

Communication with Parents

According to McEwan (2000), the more teachers inquire into and discover the particular and special qualities of their students, the easier it is to sustain atmospheres of trust and respect within their classrooms and with parents. The key to effective communication with parents is taking a real interest in the student and communicating that caring and concern to parents.

Maintaining contact with parents takes time and effort, but it is well worth it. Understanding the role that parents play in supporting their children's efforts goes a long way to ensuring the students are successful. Remembering the following can make it easier to work with parents:

- All families have strengths
- Parents can provide important perspectives about their student
- Parents as partners with a teacher can result in greater support for students

Teachers and parents have shared goals. Both are committed to the development and education of children. To communicate that shared sense of purpose, teachers can show respect for parents in tone of voice, expressions, and body language and express the intent that they wish to be a partner in the education of the child. The impressions a parent has of the teacher will dictate the parent's willingness to support the expectations of the learning environment and any disciplinary interventions that may be required.

CTE teachers have unique opportunities to form early relationship with parents. As suggested earlier in this paper, writing a letter of introduction can be a great way for parents to understand the teacher's intent to make them partners in their students' success. Inviting parents to an open house in the classroom and providing an orientation to the program is a great way to set expectations and also take advantage of natural curiosity because CTE is a very different learning environment from an academic classroom. Inviting parents to see work done by their students or having students take or email photos of projects are effective ways to involve parents in celebrating their children's progress.

To develop a working relationship with parents, CTE teachers can engage parents in reviewing students' work as often as possible. Parent nights, on which parents assist children with the CTE laboratory work or demonstrate finished work, are an effective means of informing parents of the kinds of knowledge and skills students are learning, as well as the conduct required of students to be successful in further learning and the workplace.

Teachers will be successful with parents when they communicate good news more often than bad. Notes and phone calls about how students are meeting learning goals are welcome communication to parents. The CTE teacher has a unique opportunity to know students better than other teachers in the school because the CTE course deals with students' career aspirations and dreams and the teacher of that course is in a mentoring role. This is a key relationship that should be communicated with parents and forms a supportive environment not only for the student, but also for the teacher.

Extra Help

As suggested earlier in this paper, believing that all students can learn is a fundamental understanding for successful teaching. This belief drives teachers to set high expectations for all students. But setting high expectations is not, in and of itself, sufficient for all students to achieve those expectations. Some students will need more time and support than others. Consequently, effective teachers plan to provide extra help to students who do not meet those expectations on the first try. Several concepts are fundamental to providing effective extra help.

- All students are capable of quality work.
- Extra effort may be required to meet standards.
- Effective extra help motivates students to do their best.

In order to be effective, extra help must be offered early, frequently, and regularly. It must be easy to access. The system of extra help must be closely planned and monitored, or it will not be effective in helping students reach their goals. CTE teachers should be prepared with procedures for immediately working with students when work is not completed or does not meet standards. One of the most effective strategies is to require students to re-do that work, correcting mistakes and clarifying misconceptions so that the skill or concept is mastered. Re-doing work is more than simply repeating an assignment. Teachers need to plan for re-teaching opportunities, either in the classroom while other students are working on different learning activities or in extra help or after-school time periods if they are available. Students need help in managing re-do opportunities through clear timelines for the re-doing of the work, progress and feedback reports, and celebration when the work reaches standards.

CTE teachers need to develop specific procedures they will use to intervene when a student's grade falls below the proficient level, such as making a phone call home or sending an alert form to parents to inform them about the extra help prescribed and what the student needs to do to bring up the grade. Involving students in keeping track of their own progress toward meeting standards will help them be aware of their need for extra help and be proactive in seeking it. If poor work persists, the CTE teacher may seek the help of the student's guidance counselor to see if poor performance is a problem in other courses. If so, a conference with the student, his or her parents, and the counselor can be used to develop a success contract for improved performance.

Career and Technical Student Organizations

Career and technical student organizations (CTSOs) play a major role in establishing a classroom environment in which the students are partners. CTSOs prepare young people to become

productive citizens and to assume roles of leadership in their communities by practicing those leadership roles in the CTE classroom. These organizations provide a unique program of career and leadership development, motivation, and recognition for secondary and postsecondary students enrolled, or previously enrolled, in CTE programs.

Educators have found that the CTSO is a powerful instructional tool that works best when it is integrated into the CTE curriculum. The CTE instructor provides organized curriculum-oriented activities that help students gain career, leadership, and personal skills that maximize employability and the ability to become productive citizens in the workforce, home, and community. Preparing for contests requires extra effort and often extra help from peers and teachers in learning content to a deeper level than students may have first attained. Using the motivation of competition along with extra support and encouragement can have an effect on student learning. CTSOs themselves provide excellent resources for teachers to accomplish the integration of the organizational structure and learning activities that successfully drive implementation.

CTE Teachers as Mentors in an Advisory Program

Although much of creating a well-managed classroom is about the student-teacher relationship and particularly in a CTE classroom, about the teacher serving as a career mentor, the CTE teacher may work in a school in which there is a formal program for teachers serving as advisors or mentors to students. In *Things That Matter Most in Improving Student Learning* (Bottoms, 1998), a teachers as advisors program is identified as one of the strategies school use to make a difference in student achievement. Many teachers believe that advising students about enrolling in academic and CTE courses in high school is a school counselor's responsibility. The fact is that most high schools do not have enough counselors to provide students and parents with ongoing information and advisement about education and career opportunities. The CTE teacher is in a unique position of having direct knowledge from industry and from their own experience to (a) advise students and parents about the need to take more difficult academic and CTE courses, (b) relate the courses to various careers and postsecondary studies, and (c) offer ways that parents can help students reach their goals.

Research indicates (Finn, 1989, 1993) that students who are not connected to an adult, who do not have a goal beyond high school and who are not in some extracurricular activity are less likely to finish high school. Every student deserves to have a caring adult who advocates for them and guides them into adulthood, to help every student form goals with parent involvement and connect students to some activity and group beyond the classroom. Some of the steps a teacher-advisor can take to support students are:

- Call parents when students are absent
- Involve parents in supporting their children's education
- Ensure students' work is meeting course standards
- Connect students to extra help
- Advise students on academic and CTE coursework for success in college and career
- Collaborate with school guidance and counseling staff for support and options for referral for problems

There is an emerging consensus in the school reform literature about the conditions that contribute to student success (Annenberg Institute for School Reform, 1994; Darling-Hammond, 1994; as cited in Klem & Connell, 2004). These conditions include:

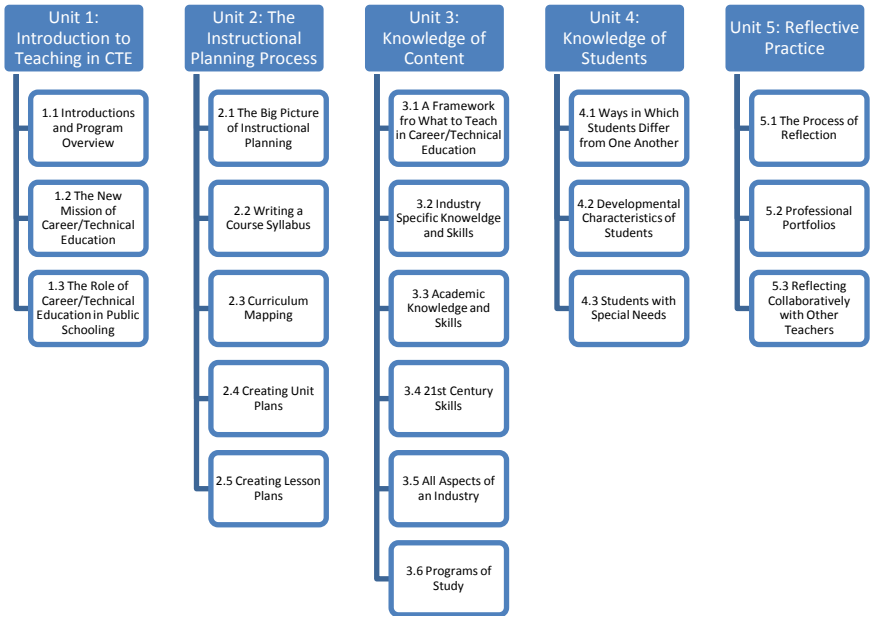
- High standards for academic learning and conduct
- Meaningful and engaging pedagogy and curriculum
- Personalized learning environments

For students to take advantage of higher expectations and more advanced curricula, they need support from the people with whom they interact in school (Lee, Smith, Perry, & Smylie, 1999; both as cited in Klem & Connell, 2004).Teachers and schools that provide these supports are more likely to have students who are engaged in and connected to school.

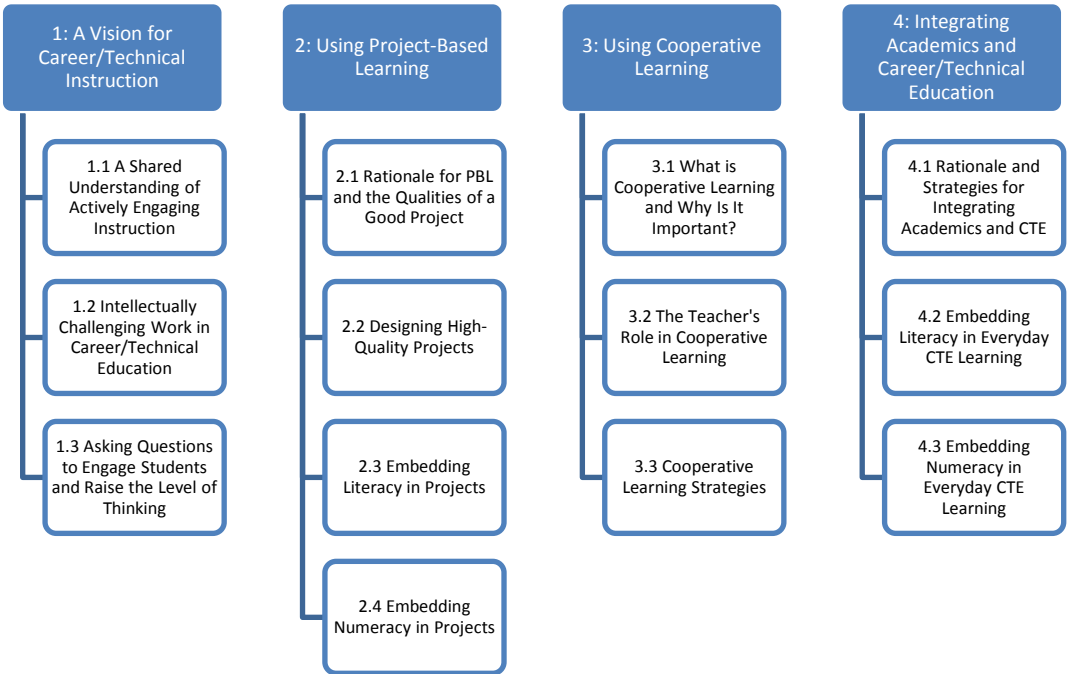
Appendix 2E

Flowcharts of Module Units and Lessons

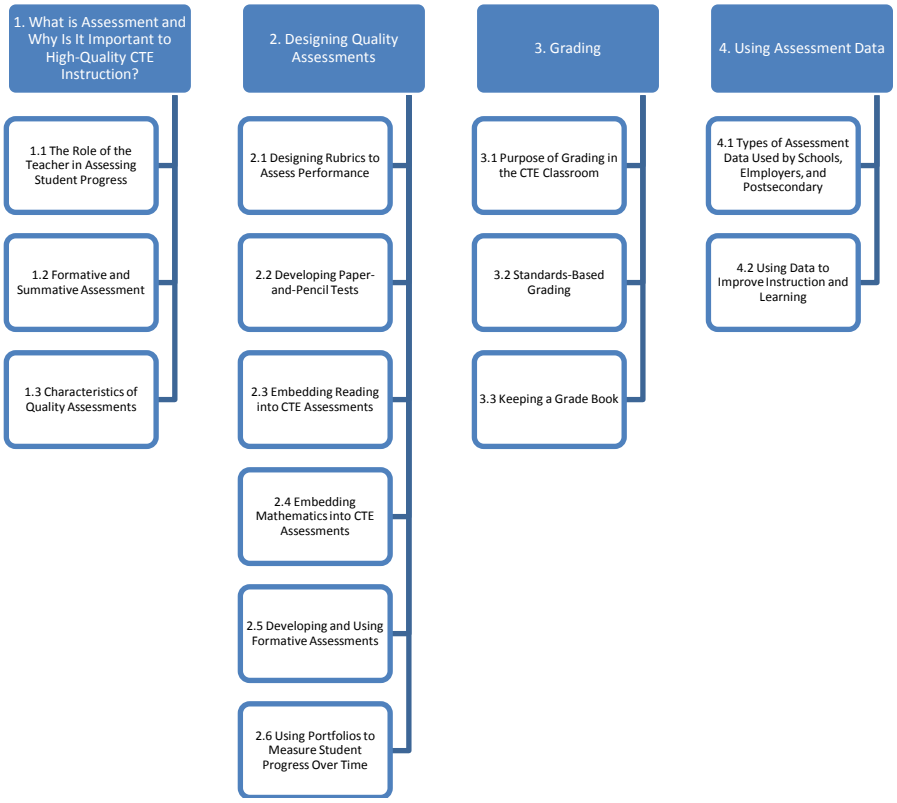
Units and Lessons in the Instructional Planning Module



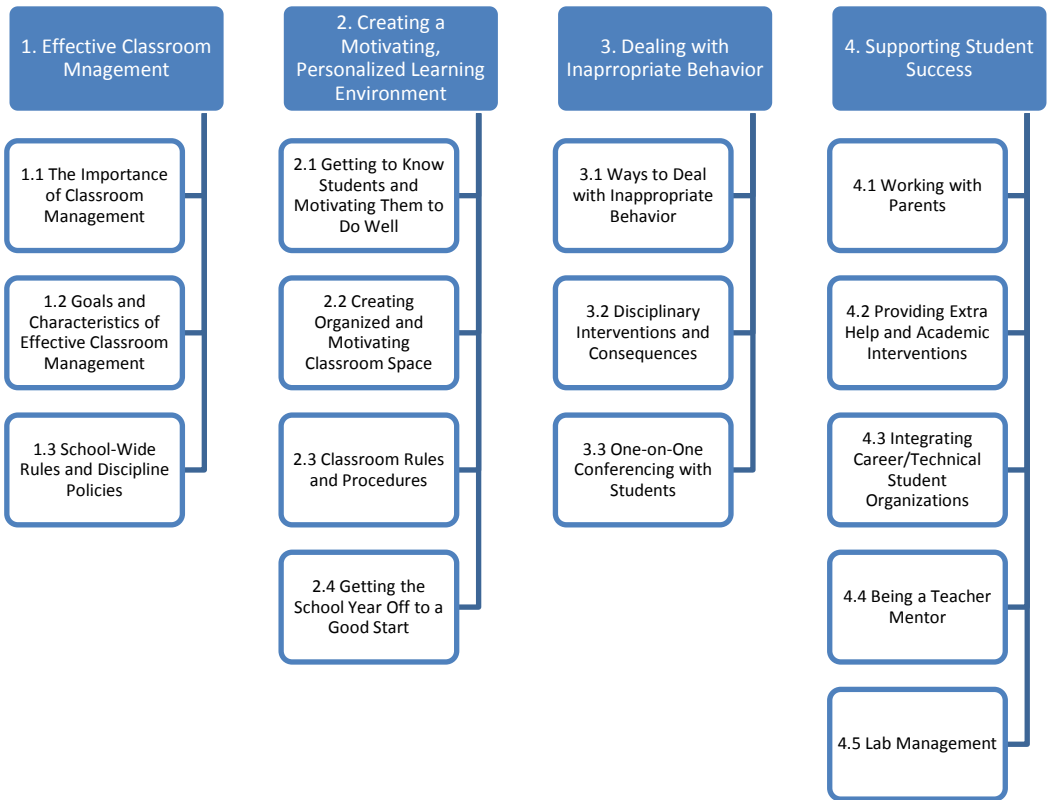
Units and Lessons in the Instructional Strategies Module



Units and Lessons in the Classroom Assessment Module



Units and Lessons in the Classroom Management Module



Appendix 2F
Teacher Self-Efficacy Scale Results

Table 2F.1
Pre-Post Teacher Self-Efficacy Scale (TSES) Sub-Scale Analysis by Paired Samples t-Test

TSES Sub Scale	Pre	Post	Change	Statistics	
				p	*t*
Efficacy in Student Engagement	6.40	6.86	0.46	.030	2.35
Efficacy in Instructional Strategies	6.49	7.13	0.64	.004	3.33
Efficacy in Classroom Management	6.60	7.23	0.63	.004	3.29

Tables 2F.2
Item-by-Item Pre-Post Responses on TSES Sub-Scales Analysis by Paired Samples t-Test

Efficacy in Student Engagement Sub-Scale Item	Pre	Post	Change	*p*
How much can you do to get through to the most difficult students?	6.63	6.84	0.211	
How much can you do to help your students think critically?	7.00	7.16	0.158	
How much can you do to motivate students who show low interest in school work?	6.00	6.42	0.421	
How much can you do to get students to believe they can do well in school work?	6.89	7.16	0.263	
How much can you do to help your students value learning?	6.47	6.95	0.474	
How much can you do to foster student creativity?	6.16	7.21	1.053	0.003
How much can you do to improve the understanding of a student who is failing?	6.21	6.68	0.474	
How much can you assist families in helping their students do well in school?	5.84	6.47	0.632	

Efficacy in Instructional Strategies Sub-Scale Item	Pre	Post	Change	*p*
How well can you respond to difficult questions from your students?	7.16	7.37	0.211	
How much can you gauge student comprehension of what you taught?	6.37	7.21	0.842	0.019
To what extent can you craft good questions for your students?	6.37	6.89	0.526	
How much can you do to adjust your lessons to the proper level for individual students?	6.26	6.89	0.632	
How much can you use a variety of assessment strategies?	5.89	7.00	1.105	0.002
To what extent can you provide an alternative explanation or example when students are confused?	6.95	7.53	0.579	
How well can you implement alternative strategies in your	6.26	6.79	0.526	

classroom?				
How well can you provide appropriate challenges for very capable students?	6.63	7.37	0.737	

Efficacy in Classroom Management Sub-Scale Item	**Pre**	**Post**	**Change**	***p***
How much can you do to control disruptive behavior in the classroom?	6.63	7.00	0.368	
To what extent can you make your expectations clear about student behavior?	7.11	7.84	0.737	0.018
How well can you establish routines to keep activities running smoothly?	7.11	7.21	0.105	
How much can you do to get students to follow classroom rules?	6.58	7.42	0.842	0.003
How much can you do to calm a student who is disruptive or noisy?	6.32	6.95	0.632	
How well can you establish a classroom management system with each group of students?	6.32	7.11	0.789	0.001
How well can you keep a few problems students from ruining an entire lesson?	6.37	7.05	0.684	
How well can you respond to defiant students?	6.37	7.26	0.895	0.003

Appendix 2G
Focus Group and Instructor Debrief Protocols

Focus Group Protocol 1

1. What is the first word that comes to mind when someone asks you how your first year as a CTE teacher went?

2. Think back over this school year. What day or event are you most proud or fond of?

3. Talk about the kinds of training – both topic and format – that you would design if you were to prepare new CTE teachers, like yourself, for the classroom.

4. We know that success in the classroom is influenced by many factors. Take a look at this list we've just distributed. Which of these would you say is the factor that most influences *your* success in the classroom? [Raise hands]
    a) Having the right knowledge and training
    b) Having a supportive principal or instructional leader
    c) Having a colleague who acts as a mentor
    d) Having other new CTE teachers with whom to share stories
    e) Something else

5. What aspects of [factor] do you feel contribute to your success?

6. Imagine you've been invited to a meeting of the State Administrators Association attended by superintendents, principals, and tech center directors. You are giving a breakout session for schools and tech centers hiring new CTE teachers this fall. What will you tell them they should do to help those teachers be successful with students?

7. What should new CTE teachers be expected to be able to do in terms of instructional planning? Here is a list of new teacher competencies from INTASC. We will go through them one by one and I will ask you to rate each one as necessary and reasonable (Green card); necessary but unreasonable (Yellow card); and unnecessary and unreasonable (Red card).

8. What kinds of support do you think would help to make the yellow card items more reasonable?

9. Regarding the workshop you attended today: what aspect or topic discussed today do you most wish you had at the beginning of the school year?

10. Finally, of all the things we've discussed tonight, what do you feel is most important for the developers of CTE teacher training?

Focus Group Protocol 2

1. What is the first word that comes to mind when someone asks you how your first year as a CTE teacher went?

2. Some of you may have heard of Twitter, a social networking phenomenon that involves people posting tidbits like a status update in 140 characters or less. What would you tweet about the training you've been attending? In other words, if you only have 5-8 words, what would you say?

3. Let's talk about some specific characteristics of this training. Please use your red, yellow, or green cards to indicate whether you thought each aspect was right on (green); just OK (yellow); or needs major revision (red):
    a) Vocabulary used by the instructor or in materials
    b) Clarity of the message communicated by instructor or in materials
    c) Sequence of topics
    d) Pace of instruction
    e) Quality of examples given
    f) Differentiation/accommodation of your individual needs

4. Tell me about a time during the workshop today when you didn't understand something in the materials or that the instructor was saying.

5. How do you think you will use the materials from this training when you return to your classroom?

6. If you think you won't use these materials or the content you learned in the training, tell me why.

7. What aspects of this training could you do without?

8. What do you wish was included in this training that wasn't covered?

9. Did you feel you had enough time to explore the concepts in this training?

10. Think back to the time during the training that you were working on [an artifact]. What do you feel you learned through that process? What additional support will you need to use that artifact in your classroom?

11. Describe the process of developing [the artifact]. Was it helpful? Was it frustrating?

12. Finally, of all the things we've discussed tonight, what do you feel is most important for the developers of CTE teacher training?

Daily Instructor Debrief Protocol

1. How closely would you say today's training met with your expectations and plans?

   1 (Not at all) 2 3 4 5 (Exactly)

2. What did you do that deviated from what you planned?
   a. What did you see, hear or learn to determine that a change was needed?
   b. How did you change the planned activity?
   c. How did the change work out?
   d. What would you do differently next time?
   e. What materials can/should be developed to support this adaptation?
   f. Is this adaptation likely to be something a future instructor will need to make?
   g. Should the module be changed, or should this adaptation be added as an option?

3. What would you like to change about the module materials based on your experience today?

4. What aspects of today were most successful? Why do you think so?

APPENDICES – CHAPTER 3

Appendix 3A

Results of Year 1 Five-State Survey, Summary of Survey Responses[5]

Section I: Use of Assessments

1. Do your CTE students take an *end-of-program* technical assessment (that specifically measures his/her occupational/technical skills and knowledge)?

	Administrators	Teachers
Yes	89.6%	92.3%
No	10.4%	7.7%

2. Which of the following best describes the assessment they take? (Check all that apply.)

	Administrators	Teachers
Teacher-designed classroom assessment	37.5%	25.6%
State-developed standardized assessment	31.3%	30.8%
National standards-based assessment	62.5%	51.3%
Certification test or licensure exam for business or industry	62.5%	38.5%
Other	4.2%	7.7%

3. How well do you feel the end-of-program assessment matches the content of your program(s)? (Teachers, check one. Administrators, check all that apply.)

	Teachers	Administrators
Very well	28.2%	18.8%
Satisfactory	59.0%	52.1%
Not very well	5.2%	25.0%
Not at all	0.0%	2.1%
Not sure	0.0%	6.8%

4. Aside from formative assessment, which one of the following best describes the testing process for your program(s)?

	Administrators	Teachers
Pretest and posttest	20.8%	48.7%
Posttest only	25.0%	28.2%
Some programs use a pretest and posttest, others posttest only.	43.8%	15.4%

5. For what purposes does your school use technical assessment data (check all that apply)?

	Administrators	Teachers

[5]In cases where survey percentages add up to less than 100%, this is due to some respondents electing not to answer the question.

To help determine whether or not a student graduates	12.5%	25.6%
To recognize high-achieving students	41.7%	41.0%
To maintain a continuous improvement process	77.1%	71.8%
To include in the school's overall process for accreditation	45.8%	43.6%
To include as a part of teacher evaluations	20.8%	17.9%
To help document school and program progress	66.7%	59.0%
To make improvements to programs in areas in which scores are weak	70.8%	64.1%
To make improvements to instruction of individual students who are weak	41.7%	43.6%
To report to outside bodies such as the District, State Department of Education or the Federal government	75.0%	64.1%
To report to reform organizations, such as High Schools That Work	14.6%	17.9%
To give credit for program completion	31.3%	41.0%
To help students receive certification for the job market	68.8%	64.1%
To determine student grades	27.1%	41.0%
Other	2.1%	0.0%
Not sure	2.1%	5.1%

6. Does your school use technical assessments that include integrated academics scores in addition to technical scores?

	Administrators	Teachers
Yes	22.9%	35.9%
No	50.0%	10.3%
Not Sure	16.7%	46.2%

7. How are the *academic* data used? (Check all that apply)

	Administrators	Teachers
To help determine whether or not a student graduates.	6.3%	12.8%
To recognize high achieving students (e.g., special designation on diploma or some other form of recognition).	8.3%	15.4%
To maintain a continuous improvement process.	20.8%	30.8%
To include in the overall process for accreditation by the regional agency.	6.3%	10.3%
To include as a part of teacher evaluations.	2.1%	2.6%
To help document school and program progress.	18.8%	20.5%
To make improvements to programs.	14.6%	23.1%
To make improvements to instruction of individual students.	14.6%	20.5%
Data are reported to outside bodies such as the District, State Department of Education, or the Federal government.	8.3%	10.3%
To report to reform organizations, such as High Schools That Work	4.2%	5.1%

To give credit for program completion.	10.4%	10.3%
To determine student grades	8.3%	23.1%
Not sure	0.0%	0.0%
Other	0.0%	0.0%

8. Who either has the assignment or volunteers to facilitate data-based decision making within your school? (Check all that apply.)

	Administrators	Teachers
A teacher	47.9%	20.5%
An assessment coordinator	14.6%	17.9%
An IT coordinator	2.1%	7.7%
A curriculum coordinator	18.8%	5.1%
A data analyst	4.2%	0.0%
An administrator	77.1%	61.5%
Other	12.5%	5.1%
No one has the assignment or volunteers to do this	4.2%	7.7%

9. What services do the coordinator(s) or facilitator(s) provide to help support the use of technical and/or academic assessment data by administrators and teachers? (Check all that apply.)

	Administrators	Teachers
Collects and shares information about the test content	58.3%	30.8%
Matches content of tests with standards	22.9%	2.6%
Matches content of tests with curriculum	33.3%	5.1%
Collects the data into one form	39.6%	25.6%
Summarizes the data at a classroom or program level	56.3%	41.0%
Summarizes the data at a school level	54.2%	35.9%
Communicates the results to teachers	66.7%	59.0%
Assists teachers and/or administrators in interpreting the results of the data	54.2%	48.7%
Other	2.1%	5.1%

Section II: Use of Assessment Data

10. Which statement most accurately represents the amount of student assessment data you receive?

	Administrators	Teachers
Do not receive assessment data	4.2%	7.7%
Too little to be useful or informative	14.6%	15.4%
The appropriate amount	66.7%	66.7%
Too much to deal with or use effectively	4.2%	7.7%
Other	10.4%	2.6%

11. Who provides this data to you?

	Administrators	Teachers
An administrator	14.6%	25.6%
Teacher(s)	4.2%	0.0%
Another school person (e.g. data analyst, curriculum coordinator, IT coordinator, assessment coordinator)	29.2%	46.2%
The assessment vendor company	29.2%	10.3%
A district representative	0.0%	0.0%
A state department representative	4.2%	0.0%
A consultant	0.0%	0.0%
I provide it for myself	8.3%	5.1%
Other	6.3%	5.1%

12. When you receive a report of technical assessment data, does it have an analysis of results by objective /skill in addition to overall scores?

	Administrators	Teachers
Yes	52.1%	66.7%
No, but I wish it did.	39.6%	20.5%
No, and I don't need that.	4.2%	5.1%

13. When you receive a report of technical assessment data, are the data broken down(or easily broken down) by class and groups of students?

	Administrators	Teachers
Yes, they are broken down.	50.0%	69.2%
No, but I can easily break them down by looking at the spreadsheets.	18.8%	10.3%
No, but others who handle the data are willing to break them down by teacher or administrator request.	12.5%	5.1%
No, they are only provided in a summary form and cannot be broken down.	12.5%	2.6%

14. Do you do data analysis on your own, or with colleagues?

	Administrators	Teachers
I don't do data analysis	10.4%	23.1%
By myself	27.1%	48.7%
With 2-6 colleagues	47.9%	17.9%
With 7-10 colleagues	2.1%	2.6%
With more than 10 colleagues	8.3%	0.0%

15. Who analyses data with you? (Check all that apply.)

	Administrators	Teachers
Teachers in own program	39.6%	12.8%
Teachers in other CTE programs	22.9%	5.1%
Teachers in academic programs	12.5%	2.6%
Administrators	56.3%	7.7%
School assessment coordinator	29.2%	5.1%
District assessment coordinator	0.0%	0.0%
Data experts	4.2%	0.0%
Assessment experts	2.1%	0.0%
Test vendor representatives	2.1%	2.6%
Other	8.3%	0.0%

16. Do you use technical assessment data to make or request instructional decisions, either for individual students or for a class as a whole?

	Administrators	Teachers
No, but I would not be likely to use them	6.3%	5.1%
No, but I believe I should be using them	22.9%	23.1%
Yes	68.8%	69.2%

17. How often during the school year?

	Administrators	Teachers
More often than twice	33.3%	17.9%
Twice	18.8%	15.4%
Once	18.8	38.5%
Never	0.0%	0.0%

18. Please explain the process you use to make or request instructional decisions
Administrators

- Look for the weak points and try to build those areas up in instruction.
- We match local curriculum to NOCTI Assessment blueprints.
- The processes are identified in a management processes manuals which provides a written procedure and process map. These processes are audited twice a year by a team of auditors. The auditors are professional staff members. An external audit is held once per year. For these audits corrective actions, continuous improvement, and corrective actions are developed. The administrator or staff member responsible for each process is required to respond and revise the process to be in compliance with the audit recommendations. A minor infraction, if not corrected, can move to a major infraction. Major infractions are dealt with by the Director.
- I compare the data with my learning guides as a cross walk. I revise my learning guides accordingly.

- Teachers use practice assessments for industry certifications and from that data we determine students' strength and weaknesses and make instructional changes.
- Technical assessments given at the end of the year are autopsy reports. The scores cannot help students leaving the class, but can help with curriculum revisions for areas that were weak. Our internal academic pre testing allows for instructors to adapt curriculum and support for students who need it. We implement assessment for learning and these strategies help with changing the instruction as needed for individual students. End of program tests, like NOCTI are not helpful for current student instruction.
- Administrators, Guidance Counselor, Special Populations Coordinator and Test Coordinators review and analyze data. The Assistant Director and Guidance Counselor meet individually with program instructors to analyze data further and make instructional decisions/
- Fall goal setting and spring program evaluations
- Formal written requests.
- Check data and talk with instructors.
- Based on assessment data, requesting modified delivery of curriculum may occur--allowing more time for student(s), might even result in asking a teacher to improve their technical skills.
- I use this information to place other students in the DATA program.
- Collaboration with administrator, counselor, instructors
- Teacher analyzes the data with administrator and counselor. Make proposal to the director. Decision would be made at the end of the school year before the start of the next school year with everyone involved.
- Industry driven by the advisory board.
- it is a cycle. Look at data, make changes to instructional practices, implement changes, collect data, and then start process all over again.
- I look more at the student placement and completion percentages than at individual assessment scores.
- Team of CTE, academic, and special education teachers and administrators
- We use short cycle assessments and review the data almost weekly

Teachers

- I look for common areas that students scored poorly and then I review my lessons for that theme. Monitor and adjust.
- Match percentage of time spent in class to results on assessment and base my request on areas in which students scored the worst.
- Revise curriculum to meet the instructional needs and objectives.
- I review data from that school year's exam and make the appropriate adjustments in next years curriculum.
- Data analysis and dialogue with administrator/ assessment coordinator
- If students as a group, do poorly on a particular area I try the next year to increase the content instruction
- Look for areas of poor skills and suggest methods or needed equipment to improve scores.

- Review the student scores.; 2. Determine what areas students are struggling.; 3. Adjust instruction to meet student needs.
- The Craft Advisory Committee helps the teacher make these decisions.
- I use test results to determine weak areas.
- Additional instruction is based on deficient areas on technical assessments
- State 6G pipe welding Certification every May. The number of graduating students and how well they did make most decisions.
- Student performance.
- If there is a competency that I teach and I need materials or equipment to help teach the students better I discuss this with my administrator as well as my O.A.C committee.
- Collaboration with other CTE teachers and curriculum specialist
- We usually request a meeting with the administrator of our building and have a meeting regarding the material. It usually takes place a day or two after the request.
- I adjust instructional methods used based upon success and the rate of success of individual students on technical assessments.
- Program faculty with input from Advisory Board
- I use test results to determine weak areas.
- If students as a group, do poorly on a particular area I try the next year to increase the content instruction
- Check to see where students need help and try to make changes for the next year.
- I align my program with the NOCTI tasks that are tested during the students senior year. I am relatively free to make the decisions that I deem appropriate. I share my plans and request input from my OAC regarding relevance of curriculum and sequence of
- Collaboration with other CTE teachers and curriculum specialist

19. Who directs/leads you in this process?

	Administrators	Teachers
Teachers for their own CTE program	16.7%	35.9%
A teacher leader	0.0%	0.0%
An instructional leader	2.1%	0.0%
The school principal	8.3%	7.1%
The CTE director	16.7%	7.1%
The school assessment coordinator	4.2%	3.6%
The curriculum coordinator	0.0%	7.1%
The school IT coordinator	0.0%	0.0%
An advisory board member	4.2%	0.0%
Other	8.3%	7.7%
No one does this.	10.4%	10.3%

20. How did you learn to use technical assessment data to make instructional decisions? (Check all that apply.)

	Administrators	Teachers
During teacher or administrator training	31.3%	17.9%
Professional development programs while a teacher	10.4%	15.4%
Mentoring with someone skilled in using the data	4.2%	5.1%
Self-taught	18.8%	30.8%
I do not feel I know how to use technical assessment score data.	0.0%	2.6%
Other (please explain)	6.3%	0.0%

21. What changes have you made or requested in instruction of the class as a whole on the basis of analysis of the data (check all that apply)

	Administrators	Teachers
Requested that business advisory committee members help address problem areas	35.4%	28.2%
Requested additional supplies or equipment	39.6%	35.8%
Asked for additional support and ideas from other teachers/administrators	45.8%	25.6%
Discussed curriculum relevance and alignment with standards and assessments with peers	45.8%	28.2%
Discussed appropriateness of the assessment with other teachers in your area or with administrators	45.8%	25.6%
Re-evaluated textbooks and learning materials based on the results of assessment	29.2%	43.6%
Added more projects and exercises in areas in which the group scored low	45.8%	48.7%
Changed lesson plans to place more emphasis in areas in which the group scored low	47.9%	56.4%
Other	0.0%	0.0%

22. What are examples of changes you have made or requested in *individualized instructional strategies for particular students* as a result of the data analysis? (Check all that apply.)

	Administrators	Teachers
Provided students with additional assistance during class in area in which they performed poorly	52.1%	66.7%
Provided poorly performing students with materials on test-taking skills and strategies	39.6%	35.9%
Teamed up low-performing students with students who performed better in those areas	25.0%	38.5%
Provided high-performing students with additional, more challenging projects and/or readings	27.1%	28.2%
Emphasized students' strengths to motivate them	33.3%	51.3%

Other	10.4%	5.1%

23. If you have made or requested changes to your instruction or curriculum based on data, how effective have you generally found them to be?

	Administrators	Teachers
Very effective in improving student learning and test scores	12.5%	23.1%
Somewhat effective in improving student learning and test scores	43.8%	33.3%
Ineffective—student learning did not improve and neither did test scores	0.0%	0.0%
Seemed to improve student learning, but test scores did not improve	2.1%	14.3%
Improved test scores, but do not think it improved student learning	0.0%	0.0%
I am unsure	8.3%	5.1%

24. Do the administrators and teachers meet together to discuss using technical assessment data to make instructional decisions?

	Administrators	Teachers
Yes	64.6%	43.6%
No	6.3%	28.2%

25. How often?

	Administrators	Teachers
Twice a year or more	47.9%	23.1%
Once a year	14.6%	17.9%
Once every two-three years	0.0%	0.0%
Less than once every three years	0.0%	2.6%
Other	2.1%	0.0%

26. About how many hours per year of released time are provided for teachers to work on data analysis or interpretation to make data-based judgments and decisions?

	Administrators	Teachers
10 or more hours	14.6%	5.1%
7 to 9 hours	8.3%	2.6%
4 to 6 hours	4.2%	10.3%
1 to 3 hours	12.5%	17.9%
None	31.3%	33.5%

27. About how many hours per year do you provide for yourself to work on data analysis or interpretation to make data- based judgments and decisions?

	Administrators	Teachers
10 or more hours	47.9%	33.3%
7 to 9 hours	8.3%	2.6%
4 to 6 hours	4.2%	12.8%
1 to 3 hours	8.3%	20.5%
None	2.1%	2.6%

28. In addition to standardized technical assessment data, what other types of data do you collect/use to facilitate data-based decision making?

	Administrators	Teachers
Student academic scores	10.4%	7.7%
Student performance in classroom activities (e.g., projects, quizzes, discussions)	20.8%	43.6%
Transcript data, such as grades, grade point average, courses completed	6.3%	0.0%
Program dropouts	2.1%	3.6%
Factors such as community environment, CTSOs, student special needs, student background, attendance, behavior etc.	22.9%	17.9%
Other	8.3%	7.1%

29. If you do not use data-driven decision making, please explain why.
Administrators

- As an administrator, making "instructional" decisions usually falls on the teacher. I use data for other purposes.
- We make decisions for our core classes based on assessment data, but we frequently do not have much assessment data from our vocational classes beyond what our local teachers provide. I know that our vocational coordinator had a few students take a standardized test this spring based on the classes they had been enrolled in, but that was the first of that kind of testing I've been aware of in 5 years as principal.
- I am a Counselor. The Administration reserves these decisions not to include the Counselor.
- We use in certain programs but not in all.
- We are beginning to use it but need more professional development and data sources to become more proficient in it utilization.
- It takes time to analyze data and I don't have the time needed to do it.
- We DO use data-decision making but do not receive technical data (e.g. related to Woods, Welding, etc. Instead we use more academic area testing (reading, math, science, writing), some of which is related to the tech areas (e.g. Reading for Information) and some of which is not
- We make decisions for our core classes based on assessment data, but we frequently do not have much assessment data from our vocational classes beyond what our local teachers provide.

- We are in the beginning stages of data-driven decision making. We established Teacher Data Teams in the 08-09 school year and have begun reviewing data from the STAR test and from TSAs.
- Not enough time to analyze or collect information to analyze
- Teacher, program and students have been performing at an acceptable level. Instructor discusses with me any concerns in individual student learning.
- The technical exams provided by the state department are many times not up to date with material instructed. Assessment is too varied in source, nature and content to accumulate

Teachers

- Students learn what the industry needs as well as the community as well as individual goals of the student.
- I just taught my first year in the school/program and collected the date. I will use it to better structure my curriculum for next year.
- Based on the "Standardized Test" - I do not put any validity in it. I have not seen the test, they won't let us(teachers) see the test and based on some of the questions my students ask me upon returning, some of the questions are not relevant, up to date or are too in depth for students.
- Most tests are not program-specific.
- Currently, I do not use data driven decision making strategies, however I am planning to revise my program curriculum to address this issue.

30. Do you intend to use data-driven decision making in the future?

	Administrators	Teachers
Yes	81.3%	71.8%
No	4.2%	7.7%
Not Sure	12.5%	17.9%

31. How could standardized technical assessment data reports be improved to make them more useful for decision making?
Administrators

- First we need the test to measure what we need them to measure.
- Additional breakdown by skill.
- Larger Print; Breakdown data in other forms such as pie charts, Gantt, Paretto charts
- Align cut off scores with national scores. Some NOCTI cut off scores are skewed. 2. Include business and industry in test design for relevancy. Some NOCTI emphasize a small segment of a course.
- An individual report for each student should be available to show strengths and weaknesses in the different content areas covered by the assessment.
- The loudest complaint I hear about NOCTI is that the tests questions are out of date. Teachers have no way of knowing this except what students report after testing. I don't know how to solve this issue. Having more detailed test blueprints might help teachers align competencies to the blueprint.
- Not sure.

- If data reports provide a clear indication of specific expected learning outcomes, how our students have performed, and suggestions for improvement, then they will be useful.
- Accessible by computer and able to pull reports on an as needed bases.
- Have more teacher and curriculum input on the assessment
- The reports themselves are OK. Providing additional training for teachers in interpretation of test scores would help.
- Standardized technical assessment data needs to generate reports on an individual basis, to a program basis, to a school wide basis, to a state wide basis and finally on a national basis and possibly an international basis depending on the career area. We need to be able to see how each and every student that completes a program compares to every other individual in their cohort class.
- Results should be tied to specific skill sets/standards.
- It would increase the credibility of the tech areas as the other traditional ed areas already use data (e.g. English, Math,etc)
- If data reports provide a clear indication of specific expected learning outcomes, how our students have performed, and suggestions for improvement, then they will be useful.
- make available online
- At the program level, it would help to match the assessment with the curriculum.
- Our current assessments do not give adequate information that can be analyzed
- Correlate the data to effective practices that impact student success.
- not sure
- Not sure, We are looking in the possibility of using WorkKeys assessment to help with standardization of results.
- Comparison with state and national scores
- the more detailed the better
- My question is do the National Normed assessments really match what our DOE says is the competencies to be teaching.

Teachers

- I think they are only one element that should be used to measure a student's success. We tend to focus "too much" time on standardized tests of any format.
- I think they should be used as a guide to decision making, not a must. There is too much emphasis placed on a standardized score. It should only be used a guide. Schools should be given training on how best to incorporate the interpretation of the scores into their teaching objectives.
- This could be an entire training.
- Some technical assessment data is relevant. However, many times tests and test scores are not really good indicators of student learning. NOCTI has a performance component to the assessment which is more valid than just taking a multiple choice test.
- They were hard to understand...
- I am happy with what I have.
- Access to the actual test questions or samples, results by question or standard, and an easier way to compile results.

- Valid content. Questions/answers made by persons that actually work in the trades or have a great deal of past(recent) experience in the trade for which questions are being written.
- By keeping them updated and more relevant to industry standards.
- Expand assessments beyond multiple choice questions
- The terminology could be directed in a way that is easier to understand.
- Make them program-specific.
- Our information is sufficient for decision making.
- I am unsure at this time
- I am not sure, it seem to me that students are not interested in working to get better.

Section III: Professional Development Opportunities

32. Did your teacher training or administrator college programs include coursework about assessment and/or evaluation?

	Administrators	Teachers
Yes	72.9%	69.2%
No	12.5%	10.3%
Don't Remember	14.6%	15.4%
N/A—used alternative license to enter teaching with no pre-service program	0.0%	2.6%

33. Was it required or optional?

	Administrators	Teachers
Required	64.6%	69.2%
Optional	4.2%	5.1%
Don’t remember	14.6%	5.1%

34. What topics were covered in the assessment coursework? (Check all that apply.)

	Administrators	Teachers
Don’t remember the topics.	10.4%	12.8%
Different types of assessment methods	56.3%	53.8%
How to decide what should be assessed	47.9%	38.5%
How to write assessment items	45.8%	48.7%
How to interpret assessment data	64.6%	35.9%
How to make instructional adjustments based on assessment data	41.7%	35.9%
How to engage others in data analysis and data-based decisions	18.8%	28.2%
Other	4.2%	2.6%

35. If you received professional development in the last five years, what topic(s) did it involve? (Check all that apply.)

	Administrators	Teachers
Technical training related to CTE area of expertise	45.8%	46.2%
Teaching strategies	66.7%	82.1%
Lesson plan development	27.1%	43.6%
Curriculum development and planning	64.6%	64.1%
Diversity or cultural training	43.8%	48.7%
Classroom management techniques	54.2%	56.4%
Motivating students to learn	47.9%	59.0%
Learning styles	62.5%	51.3%
Legal or ethical issues related to teaching/education	70.8%	46.2%
School or district policies and procedures	70.8%	35.9%
Working with students with special needs	60.4%	41.0%
How to write good tests	16.7%	23.1%
How to use and interpret test data	43.8%	23.1%
Aligning curriculum to national, state, or local standards	56.3%	64.1%
Other	4.2%	5.1%

36. If you have received professional development in interpretation and use of technical assessment data, which of the following best describes how suitable it was for you and your state of readiness?

	Administrators	Teachers
I did not have this training	31.3%	35.9%
The training contained the information I needed and was presented at an appropriate level.	39.8%	38.5%
The training was too complex and not well explained.	10.4%	5.1%
The training was too low level—I already knew most of what was presented.	8.3%	0.0%
The training did not contain enough information about real world applications.	8.3%	7.7%
Other	2.1%	0.0%

37. Who provided this professional development in using assessment data?

	Administrators	Teachers
A school, district, or state administrator	14.6%	15.4%
A school, district, or state data specialist	14.6%	2.6%
A knowledgeable teacher or peer (inside or outside the district)	2.1%	15.4%
A consultant	12.5%	5.1%

An instructor from a local university	14.6%	10.3%
A representative from a professional testing organization	12.5%	2.6%
Other	6.3%	7.7%
Not sure	8.3%	17.9%

38. Do you know how to obtain or access professional development in the use of assessment data for data-based decision making?

	Administrators	Teachers
Yes	58.3%	48.7%
No	12.5%	17.9%
Not sure	25.0%	20.5%
This would not be my role.	2.1%	10.3%

39. If you were to receive professional development in the use of assessment data for data-based decision making, what forms of training would you prefer? (Rank the top three forms with 1 the first priority, 2 the second priority, and 3 the third priority.)

	First	Second	Third
Conference presentation(s)	23.1%	12.8%	12.8%
Web seminars	7.7%	7.7%	7.7%
Online training modules	10.3%	10.3%	7.7%
State summer institute workshop	7.7%	5.1%	12.8%
Train-the-trainer workshop for teacher leaders	10.3%	7.7%	7.7%
College course	2.6%	5.1%	2.6%
School-level workshop	20.5%	10.3%	10.3%
Mentoring or coaching	7.7%	0.0%	2.6%
Study/support group	0.0%	17.9%	7.7%
Self-generated (e.g., books, magazine articles on topic)	7.7%	7.7%	10.3%
Other	0.0%	0.0%	0.0%

40. Have you participated in inservice workshops on the following topics in the past five years? (Check all cells that apply.)

	Administrators			Teachers		
	Yes	No, but they were available.	No, they were not available, but I wish they were.	Yes	No, but they were available.	No, they were not available, but I wish they were.
Information on how tests are developed and what makes a good vs. poor test	25.0%	25.0%	37.5%	30.8%	10.3%	46.2%
Information on appropriate and inappropriate uses of tests and test data	39.6%	12.5%	29.2%	25.6%	12.8%	46.2%
What questions test data can and cannot answer	22.9%	20.8%	33.3%	20.5%	12.8%	53.8%
	Yes	No, but they were available.	No, they were not available, but I wish they were.	Yes	No, but they were available.	No, they were not available, but I wish they were.
How to interpret student level test data (e.g., determining student strengths and weaknesses, determining student improvement over time)	45.8%	12.5%	25.0%	33.3%	10.3%	41.0%
How to interpret group-level test data (e.g., shared strengths and weaknesses within a classroom, comparing results to classroom practices)	41.7%	12.5%	27.1%	28.2%	10.3%	46.2%
How to compare classroom or individual data to school, district, state, or national averages	41.7%	12.5%	27.1%	28.2%	12.8%	43.6%
How to measure student and classroom improvement over time	41.7%	8.3%	31.3%	43.6%	5.1%	41.0%
The meaning of technical terms used on tests (e.g.,	35.4%	14.6%	29.2%	38.5%	2.6%	46.2%

norms, mean, standard deviation, percentage, percentile, cut score)						
Information on types of tests and test items available	41.7%	18.8%	22.9%	35.9%	7.7%	41.0%
How to select the most appropriate measure for the curriculum	27.1%	14.6%	35.4%	25.6%	12.8%	46.2%
Other	2.1%	4.2%	0.0%	0.0%	0.0%	12.8%

41 If you were to receive professional development in the use of assessment data for data-based decision making, who would you most like to deliver the training and why?

	Administrators	Teachers
An administrator	8.3%	2.6%
A school, district, or state data specialist	20.8%	5.1%
A knowledgeable teacher or peer	18.8%	53.8%
A consultant	16.7%	12.8%
An instructor from a local university	0.0%	2.6%
A representative from a professional testing organization	16.7%	12.8%
Other	8.3%	2.6%
Not sure	8.3%	5.1%

42. Please explain briefly why you would want that person to deliver the training.

	Administrators
An administrator	I would want a knowledgeable administrator to deliver it because that would be a peer who has the same perspective I have as a fellow administrator. I hope they would be able to put it in terms I would understand. An unfortunate part of state standardized testing is that the mathematics used for federal accountability purposes has changed more than once, and it is somewhat complex.
A school, district, or state data specialist	Knowledge of recent applications State is who we report to -- they are best suited to tell us what they want. They are most likely to stay up to date with what is out there and what we need. They would have the best overall understanding of the assessments that are used in the CareerTech System.

	Someone local or familiar with our State requirements and needs can be interpret the data as we would need it or be able to use for program improvement.
A knowledgeable teacher or peer	I would feel less intimidated about asking questions. I believe that someone with "hands-on" experience in this process would know what my concerns would be--and how to relate the training in a way that I could benefit. What someone with the practical experience Person who actually uses and interprets the data
A consultant	A consultant is usually a specialist in the area that has dealt with numerous groups addressing the same issue. The consultant is not tied to any specific interest group and is focused on information. They are usually skilled in presenting to different groups. I think a consultant would be unbiased, as opposed to a rep from a testing agency. I feel someone from outside the district can seem more credible. They would be the expert I feel someone from outside the district can seem more credible Knowledgable and unbiased
An instructor from a local university	
A representative from a professional testing organization	If we choose a nationally normed test product (commercially based test), then that company needs to provide the professional development for that product. It doesn't matter who as long as they are knowledgeable and can present the needed information. I would want an expert in the field. Someone who works with data on a regular basis.
Other:	

Teacher coaches	The staff trust them, they are teachers too.
Someone who can answer questions	Often times presenters used a canned speech and do not get to the real need of the audience
Someone who is actually using it and has considerable firsthand experience using it. I have had it with professional presenters who have little background	I am sick to death of the retired super or principal that is now the expert on everything and can present on any topic. How stupid does the audience need to be to buy this hogwash.
DESE Program Administration	He is the one I must report to and ask questions of.

	Teachers
An administrator	I am training to be an administrator and a current administrator would best know how to present the data.
A school, district, or state data specialist	I believe a state data specialist would be better because they know the assessments at the state level better. They become a great source of follow up information
A knowledgeable teacher or peer	That is a tough call, but I think an experienced teacher with solid credentials will gain the respect of the teachers. The experienced teacher is in the trenches and practicing what they are preaching....at least I hope! They would be able to relate to what we are experiencing in the classroom and tailor information for our use. A knowledgeable peer has used this data in a manner I would need to use it and would be viewing interpretation in much the same manner as I would. Teachers are the people working with the students. Too often administrators forget the daily life as a teacher and all that it entails and consultants don't have a clue sometimes. They "pretend" to be in your shoes to help with a "quick fix". Not all consultants are bad. Many do a great job. But when it comes to teachers having to implement new teaching strategies, it is much better to have it delivered by other teachers who are in the classroom doing it, rather than administrators who see it as the next "big thing" to all conform

	too to try to increase student achievement.; Familiar with peer needs They know better ways to do what I do. They have all the same challenges as I do; They have a more applied knowledge. Would have the same point of reference They know what teacher's need. They tend not to be too technical like some administrators or other experts can be. I think someone who uses the data themselves and can relate and apply this information in a practical rather than in theoretical manner More relaxed with a fellow co-worker. Training should be based on subject area. A current expert would be best because others are too far removed from training. They have a more applied knowledge. I think someone who uses the data themselves and can relate and apply this information in a practical rather than in theoretical manner.
A consultant	I would want the consultant to possibly be the instructor I had for my graduate course. .And he is also a consultant with PATTAN. Someone outside the school would provide a different prospective.
An instructor from a local university	
A representative from a professional testing organization	Seems like it makes the best sense. They should know there materials and why that is what is assessed. Want someone that deals with that subject at a professional level and knows how to convey that knowledge to others.; Want someone that deals with that subject at a professional level and knows how to convey that knowledge to others. For better understanding, I prefer the delivery of the training to be conducted by the group that developed the assessment data

	Hopefully they would have a good understanding of the subject!
Other:	
Someone who has documented success in this area. This person would be able to communicate theoretically and concretely methods that would lead to success and improvement.	We have plenty of people who tell us what can be done for a lesson or a day but none who can demonstrate to us the keys to unlocking sustained progress. This person may be impossible to find.

43. Have you assessed the professional development needs of the staff with regard to assessment and data-based decision making?

	Administrators
Yes	39.6%
No	58.3%

44. For the professional development your teachers received on any topic in the past five years, what form did that professional development take?

Teachers have not participated in professional development.	4.2%		
	1 (less effective)	2	3 (more effective)
Conference presentation(s)	10.4%	6.3%	10.4%
Web Seminars	2.1%	18.3%	2.1%
Online training modules	8.3%	0.0%	8.3%
State summer institute workshop	6.3%	6.3%	12.5%
Train-the-trainer workshop for teacher leaders	0.0%	6.3%	2.1%
College course	2.1%	4.2%	4.2%
School-level workshop	4.2%	12.5%	4.2%
Mentoring or coaching	0.0%	2.1%	12.5%
Study group/collaborative team	10.4%	4.2%	12.5%
Self-generated (e.g., books, magazine articles on topic)	12.5%	6.3%	2.1%

45. Have your teachers had any professional development in the past five years specifically on the topic of interpretation and use of assessment data?

	Administrators
No	45.8%
Yes, most or all of them	27.1%

Yes, some of them	22.9%
Yes, but has been more than 5 years ago	2.1%

46. Do you see a need for your teachers to have training (or additional training) in the use of assessment data for data-based decision making?

	Administrators
Yes	77.1%
No	4.2%
Not sure	18.8%

47. If you wanted to provide your teachers with professional development in the use of assessment data for data-based decision making, would you know where or how to obtain or access it?

	Administrators
Yes	58.3%
No	41.7%

48. If your teachers were to receive professional development in the use of assessment data for data-based decision making, what forms of training would you prefer? (Rank the top three forms with 1 the first priority, 2 the second priority, and 3 the third priority.) (Note: survey program malfunction—only 2 ratings.)

	Administrators	
	First	Second
Conference presentation(s)	10.4%	16.7%
Web seminars	4.2%	6.3%
Online training modules	4.2%	10.4%
State summer institute workshop	10.4%	8.3%
Train-the-trainer workshop for teacher leaders	10.4%	8.3%
College course	0.0%	2.1%
School-level workshop	22.9%	12.5%
Mentoring or coaching	10.4%	12.5%
Study group/collaborative team	14.6%	14.6%
Self-generated (e.g., books, magazine articles on topic)	4.2%	0.0%
Other	0.0%	0.0%

49. What topics would you like the training to contain? (Check all that apply. Also rank the top three uses with 1 the first priority, 2 the second priority, and 3 the third priority.) (Note: survey program malfunction—no prioritization provided.)

	Administrators

Information on how tests are developed and what makes a good vs. poor test	56.3%
Information on appropriate and inappropriate uses of tests and test data	60.4%
What questions test data can and cannot answer	43.8%
How to interpret student-level test data (e.g., determining student strengths and weaknesses, determining student improvement over time)	81.3%
How to interpret group-level test data (e.g., shared strengths and weaknesses within a classroom, comparing results to classroom practices)	58.3%
How to compare classroom or individual data to school, district, state, or national averages	52.1%
How to measure student and classroom improvement over time	70.8%
The meaning of technical terms used on tests (e.g., norms, mean, standard deviation, percentage, percentile, cut score)	39.6%
Information on types of tests and test items available	37.5%
How to select the most appropriate measure for the curriculum	58.3%
Other	0.0%

Section IV: General Assessment Perception

50. Overall, what is your perception of the value of technical skill assessment?

	Administrators	Teachers
Very positive	37.5%	25.6%
Somewhat positive	45.8%	46.2%
Neutral	12.5%	17.9%
Somewhat negative	4.2%	2.6%
Very negative	0.0%	2.6%

51. Has your opinion on the value of standardized technical skill assessment changed over the past five years?

	Administrators	Teachers
Yes—it has become more positive.	37.5%	25.6%
Yes--- it has become more negative.	4.2%	7.7%
No--- it is about the same.	50.0%	53.8%
Not sure	2.1%	5.1%
N/A—less than 5 years experience	6.3%	2.6%

52. If your opinion has changed, please briefly describe why.

Yes—it has become more positive.

Administrators

- In 2000, I mandated that NOCTI or a skill certification exam must be taken as an element of the Graduation Project for Seniors. Our Board of Directors supported my position that if a student did not take it they would not walk for graduation. This survey confirms my position.;
- I have become more confident in the usefulness for continuous improvement.
- 'I worked with testing data extensively in the past and see how it is extremely beneficial
- As society and job requirements change, so to does the need to rightly use assessment data
- I believe that tests have improved. If the tests are better and the data is more accurate it is worth study.
- The use of technical skill assessment seems to add accountability to career education for the teachers, student, and career center.
- Opinion has changed because of increased pressures to be more accountable.

Teachers

- I have been given a greater understanding through the trainings of the need of assessment data and its application to career and tech ed.
- Recognized trade test should be used ex AWS State boards CAN
- Identifies areas for improvement in student education; 'The implementation of state exams and requiring students to pass for graduation requires a solid teach to the test concept.
- It has become more positive now that I understand it and can use it more.
- Identifies areas for improvement in student education
- The implementation of state exams and requiring students to pass for graduation requires a solid teach to the test concept.

Yes—it has become more negative.

Administrators

- Because it is difficult to find a national recognized test that is appropriate for every career path.

Teachers

- Student learning is being compromised to meet AYP and increase student test scores on high stakes tests. Students are now required to take remedial classes who have scored "low" on state mandated tests and loose out on other classes or electives.
- Teachers are now forced to teach to the test so that the students pass it, and other "excellent" curriculum that is not tested like consumer math, art, music, entrepreneurship/business, health/phys-ed are no longer looked upon as "relevant" because they are not on the test. However, to become a successful, productive citizen, you need more that algebra and reading. Testing with both teachers and students has dramatically changed the educational system, not as a way to help students increase learning, but a means to determine what schools are doing wrong with students whose strength is not testing.

- In the future the assessment data results should used as a means of finding ways of improving student achievement.

Section V: Educational Situation and Demographics
53. (school and district/region name omitted from this summary)
54. In what state is your school?

	Administrators	Teachers
Illinois	4	0
Missouri	15	9
Oklahoma	9	11
Pennsylvania	10	17
Virginia	10	1

55. What CTE program(s) do you teach/administer? (Check one or more.)

	Administrators	Teachers
A business cluster program	0.0%	0.0%
A construction cluster program	87.5%	28.2%
A health cluster program	75.0%	30.8%
A manufacturing cluster program	70.8%	15.4%

56. Which of the following best describes your highest level of education?

	Administrators	Teachers
High school diploma	0.0%	0.0%
High school diploma plus some college courses/credits	0.0%	7.7%
High school diploma plus some specialized training (e.g., Military Occupational Specialty, apprenticeship)	2.1%	2.6%
Associate's degree	0.0%	7.7%
Bachelor's degree	0.0%	30.8%
Master's degree	60.4%	48.7%
Specialist's degree	20.8%	0.0%
Doctorate	16.7%	0.0%

57. How many years have you been in this position in your current school?

	Administrators	Teachers
Less than 1	2.1%	5.1%
1 to 5	52.1%	28.2%
6 to 10	22.9%	33.3%
11 to 15	4.2%	5.1%
16 to 20	6.3%	7.7%

More than 20	12.5%	17.9%

58. What is your gender?

	Administrators	Teachers
Female	31.3%	51.3%
Male	66.7%	46.2%

59. What is your age?

	Administrators	Teachers
Under 21	0.0%	0.0%
21 to 30	0.0%	5.1%
31 to 40	8.3%	28.2%
41 to 50	31.3%	33.3%
51 to 60	47.9%	28.2%
Over 60	10.4%	2.6%

60. How many years have you been teaching?

	Teachers
Less than 1	0.0%
1 to 2	2.6%
3 to 5	15.4%
6 to 10	33.3%
11 to 15	10.3%
16 to 20	5.1%
More than 20	30.8%

61. How did you become licensed or certified to teach in CTE?

	Teachers
Traditional college/university pre-service program	69.2%
Alternative licensure route	20.5%
Other (please describe)	7.7%

62. How many years of experience in the occupation/trade did you have before being licensed to teach the CTE program in your state?
Teacher average: 10.55. Range: 0-24 years

63. How many years of teaching experience did you have prior to becoming an administrator?

	Administrators
None	0.0%
Less than one	0.0%

1 to 5	22.9%
6 to 10	25.0%
11 to 15	27.1%
More than 15	25.0%

64. How many years have you been an administrator?

	Administrators
Less than 1	0.0%
1 to 2	12.5%
3 to 5	16.7%
6 to 10	29.2%
11 to 15	16.7%
16 to 20	10.4%
More than 20	14.6%

65. How many years of teaching experience did you have specifically in CTE prior to becoming an administrator?

	Administrators
None	29.2%
Less than one	2.1%
1 to 5	20.8%
6 to 10	16.7%
11 to 15	16.7%
More than 15	14.6%

Appendix 3B

Material Review Protocol

Professional Development for Teachers and Administrators
on the Use of Assessment Data
Year III NOCTI-NRCCTE
Review Form for Workshop Materials

We appreciate your willingness to help us refine the workshop materials, which consist of a Powerpoint presentation and a Facilitator's Guide. Note that the materials for the participants will be like the Facilitator's Guide, except that pages 5-10 will be deleted as will the blue suggested answers. Also, graphics and some informal but professional-level humor will be added later on.

Please use the following form to enter your comments, and feel free to expand the form where needed. After you are finished, please email the form to sandypritz@nocti.org. We hope to receive your input by October 26.

Section and subsection	**Fine as is**	**Not needed**	**Meaning unclear or Not phrased appropriately**	**Suggestions for change/rationale**
PowerPoint Presentation (slide # as subsection for comment)				
Facilitator Guide				
Summary of the NOCTI-NRCCTE Project				
The Workshop Presentation				
• Step 1				
• Step 2				
• Step 3				

• Step 4				
• Step 5				
Social Networking				
Worksheets/content Step1				
Worksheets/content Step 2				
Worksheets/content Step 3				
Worksheets/content Step 4				
Glossary				

Opinion and comments on the overall package:

- Suitable for a one-day workshop?
- Targeted at the right level for secondary CTE administrators and teachers?
- Appropriate tone?
- Anything else?

We are very grateful for your input!

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