CITY AND COUNTY OF SAN FRANCISCO
BOARD OF SUPERVISORS

OFFICE OF THE LEGISLATIVE ANALYST

LEGISLATIVE ANALYST REPORT

To: Chair Dufty, City and School District Select Committee
From: Andrew Murray, Office of the Legislative Analyst
Date: September 11, 2007
Re: **Best Practices in High School Vocational Education Programs**
(OLA No. 020-07)

SUMMARY OF REQUESTED ACTION

Summarize recent developments, innovations, and best practices in vocational education and school-to-career programs. Identify the impact of vocational education programs on workforce readiness and other issues, including school attendance and graduation. Briefly describe the current status of vocational education in the San Francisco Unified School District, including offerings, enrollment, funding, and partnerships with other organizations.

EXECUTIVE SUMMARY

A number of best practices have emerged as vocational education (now often referred to as career technical education (CTE)) has changed to respond to calls for high school reform and evolving workforce needs. Best practices include:

- Career academies and programs of study;
- Increased academic rigor in vocational courses;
- Career guidance;
- Partnerships with postsecondary institutions;
- Certification, partnerships with industry, and focusing on growth industries;
- Work-based learning;
- School-based enterprises and student organizations;
- Programs for historically disadvantaged or underserved populations;
- Improved facilities and equipment; and
- Improved teacher training.

CTE can play a role in workforce readiness. However, some studies have identified traditional academic preparation and soft skills among those most needed for workforce readiness. As such, technical education's specific role in providing students with workforce readiness given limited instruction time is unclear. Also, although CTE can be structured to incorporate many educational approaches that experts believe reduce dropping out (individualized graduation plans, greater range of options and alignment of courses with student goals, etc.), the research regarding CTE's specific impact on dropping out appears to be inconclusive. An overarching question that continues to be debated is

whether CTE can be an effective tool in helping students attain comprehensive academic preparation, or whether CTE is in some sense an alternative to comprehensive academic preparation.

San Francisco Unified School District (SFUSD) is following many CTE best practices. SFUSD's most substantial CTE offering, the career academies/pathways, has enrollment of approximately 850 students, out of a total high school enrollment of approximately 19,000. To be effective at stemming dropouts, SFUSD programs likely need to reach students earlier. SFUSD and other districts are in a challenging position of determining how to allocate limited CTE resources. On one hand, districts would like to offer sophisticated, cutting-edge CTE programs to their best students, to help ensure that they continue to enroll in the district. At the same time, districts must consider what CTE resources to allocate for the lowest achieving students, as perhaps the only effective intervention to make them employable immediately after high school (whether they graduate or not).

INTRODUCTION

Vocational education generally refers to training, often a course of secondary and/or postsecondary study, related to a specific industry or trade, which provides students with skills appropriate for entry-level jobs in occupations requiring less than a baccalaureate degree. Vocational education also commonly includes elements such as internships or industry-recognized credentials. Historically, secondary (high school) education has been organized on tracks, including vocational education, academic education (covering traditionally academic subjects such as language, mathematics, science, etc.), and a general track. Terminology has changed over time. The primary federal program funding vocational education has recently adopted a new term, "career technical education" (CTE, also referred to as career and technical education, earlier referred to as vocational and technical education,[1] or simply vocational education).

A fair amount of disagreement exists regarding CTE's mission and purpose, as well as future direction, which has been a nearly constant theme since its inception in the early 1900s. Disagreement exists about whether it is a secondary or postsecondary activity, focuses broadly enough on non-work vocations (family, community, etc.), and whether it is a method of teaching or content. Importantly, disagreement exists regarding whether vocational education should focus on providing a pathway to immediate employment for students with limited academic achievement or on providing all students with technical skills that expand occupational options.

CTE is attempting to re-invent itself to respond to changing workforce needs. As a growing share of jobs in knowledge-based economies, such as California's, will require a college graduate employee, educators are re-evaluating CTE's historic focus on entry-level jobs requiring less than a baccalaureate. Whereas in a manufacturing economy, high school graduates were able support themselves and their families with relatively high-wage blue-collar jobs, it is more difficult for the same population to succeed today.

[1] Perkins IV replaced the terminology Vocational and Technical Education with Career and Technical Education.

In addition, CTE is attempting to re-invent itself to respond to broader demands for high school reform. A number of school reform reports focus on the achievement gap between students in the United States and those in other countries and the achievement gap between well-prepared and other students. In 1990, the federal government mandated that vocational education integrate more rigorous academic content. In the new era of focus on standards, achievement, and the need for technical fluency, vocational education is challenged to make two potentially conflicting improvements simultaneously: improve all students' knowledge of basic academic subjects and improve all students' practical abilities.

Many supporters of CTE and high school reform are advocating that high school have a single goal of preparing all students for college with broad and deep preparation in academic and practical skills. However, another faction notes that some students do not have the inclination or academic achievement for college. For such students, they advocate a focused course of vocational study, perhaps as alternative to the "graduation" track, that will provide practical skills for immediate employment. The "college for all" movement appears to run the risk of leaving students not bound for college behind.

A number of common practices have emerged in CTE. These include block scheduling, career majors and academies, articulation agreements with postsecondary institutions, and work-based learning. In 2004, 21.5% of public high schools (29% of urban high schools) offered career academies, defined as a multi-year program in which the curriculum integrates academic and career/technical education courses, organized around one or more broad career themes.[2] 75% of urban public high schools offered work-based learning credit, and 60% offered job shadowing.[3]

CTE is not limited to high school. In the U.S., thousands of comprehensive high schools, vocational and technical high schools, area vocational centers, and community colleges offer CTE programs. According to the Association for Career and Technical Education (ACTE), virtually every high school student takes at least one CTE course, and one in four students takes three or more courses in a single program area.

VOCATIONAL EDUCATION

Background

The federal Smith-Hughes Act of 1917 created the first CTE programs, driven by the growing need to prepare young people for jobs created as a result of the industrial revolution. As originally envisioned, vocational education was a sequence of courses and experiences in agriculture, home economics, and trade and industrial education designed to prepare individuals for entry-level employment requiring less than a baccalaureate degree. Vocational education emphasized job-specific skills, focused on meeting the needs of industry, largely to the exclusion of the traditional academic curriculum. The Smith-Hughes Act established vocational education as a separate system of education that included separate state boards of vocational education, funding, methods of study, and teacher preparation programs and

[2] National Center for Education Statistics
[3] National Center for Education Statistics

certification. As a result, vocational education has historically been somewhat isolated from traditional academic education.

Recently, vocational education's focus on entry-level work and family preparation has changed due to the influence of successive waves of educational reform in the 1980s and 1990s and federal legislation. As a result, the division between academic and vocational education (operated as dual educational tracks for college-prep and work-bound youth) has diminished. Recent federal legislation, described below, has dramatically shifted federal vocational education policy, directing efforts towards the broader goal of improving student achievement and performance and integrating academic content into vocational education.

Changes in CTE focus have reflected differing philosophies of what CTE should be, including:

> Education through Work: Where CTE is the instructional modality (context) for teaching traditional academic and practical content.
> Education about Work: Education about the social and practical aspects of work life, including career ladders and workplace safety, for example.
> Education for Work: The practical and technical skills required for different occupations.
> Employment Bound: Focus on providing academic and technical skills to the 33% of high school graduates who are employment-bound or the 8–12% most educationally disadvantaged students who need extensive job training to enter the labor market upon high school graduation.
> Practical Skills for All: Organize career and technical programs in coordination with postsecondary institutions to provide technical education to all students, including those pursuing degrees, certificates, and immediate career placement.

Perkins Act of 2006

The Carl D. Perkins Career and Technical Education Improvement Act of 2006 (Perkins IV) re-authorized earlier Perkins legislation of 1984, 1990, and 1998. Perkins sets federal policy on vocational education and is the only significant source of federal funding for CTE. CTE is now defined by Perkins as providing a "technical skill proficiency, an industry-recognized credential, a certificate, or an associates degree." One distinction between the focus of Perkins IV relative to earlier versions is that the law now allows program funding to be expended on preparation for careers requiring a baccalaureate, master's or doctoral degree.[4] The Act provides an increased focus on the academic achievement of CTE students, changes state and local accountability, and strengthens the connections between secondary and postsecondary education. Note that the focus on achievement and accountability are related to the similar push created through No Child Left Behind legislation.

[4] The 1998 Perkins law said that vocational education offered students the knowledge and skills needed to prepare for further education and careers "(other than careers requiring a baccalaureate, master's or doctoral degree)." This parenthetical clause has been eliminated, so CTE programs under the new law can prepare students for careers that will eventually require a bachelor's or advanced degree (such as teaching). However, an additional clause was added that will require Perkins funding to be targeted to secondary and sub-baccalaureate postsecondary programs. For example, you can now offer a elementary teacher preparation academy at the high school level, even though that career generally requires a bachelor's degree, but you could not fund a bachelor's degree program in elementary education out of Perkins funds.

Perkins funding is allocated to states through formula grants. States in turn fund a variety of educational and job training programs, based at educational institutions. Funding is allocated to programs based primarily on the number of school-aged children (ages 5-17[5]) in the community, as well as an assessment of a community's financial health, determined in part by the tax base.

Federal Funding for CTE

President Bush's budget request for FY 2007-08, as released in February 2007, included a 50% decrease in funding for Perkins. It would also eliminate Tech Prep (described below) funding within Perkins. The Bush administration sought 25% decreases in Perkins funding in FY 2003-04 and FY 2004-05, and proposed to entirely eliminate the program in FY 2005-06 and FY 2006-07.

California's Perkins Approach

California expends its Perkins funding through public secondary education institutions and its community college system.[6] California's Perkins activities focus on educating students in 58 career pathways organized around 15 industry sectors (Appendix A), involving grades 7 - 12. Sectors include: Agriculture & Natural Resources; Arts, Media, & Entertainment; Building & Environmental Design; Business & Finance; Education & Child Development; Energy & Utilities; Engineering; Fashion Design, Mfg., & Production; Health Sciences & Medical Technology; Hospitality & Tourism; Information Technology; Manufacturing; Public Services; and Transportation. Note that these are similar to the sectors adopted by other states and those promoted by the U.S. Department of Education Office of Vocational and Adult Education. The State also recently (January 2007) adopted a framework for implementing the standards at the local level.

Each sector includes foundation standards and career pathway standards. Foundation standards are fundamental skills and knowledge necessary in preparing all students for college, careers, and citizenship.[7] Each foundation standard has four to six subcomponents that are similar across all sectors, but also have characteristics that are unique to the specific industry sector.[8]

California Funding for CTE

California's Governor is proposing to reverse years of declining funding for CTE by budgeting $52M in his FY 2007-08 budget, an 18% increase over the previous year. In addition, Proposition 1D of November 2006 (Kindergarten-University Public Education Facilities Bond Act of 2006) authorized placement of a $10.4B general obligation bond to fund K-12 and Higher Education. The bond will

[5] Based on the National Center for Education Statistics' Common Core of Data, updated from a standard of 15-19 year olds used in previous Perkins laws, information that was not easily available.
[6] California's 2000 - 2004 Perkins plan: http://www.cde.ca.gov/ci/ct/pk/documents/stateplan.pdf
[7] California Career Technical Education Model Curriculum Standards, Grades Seven Through Twelve (May 2005) foundation standards: Academics; Communications; Career Planning and Management; Technology; Problem Solving and Critical Thinking; Health and Safety; Responsibility and Flexibility; Ethics and Legal Responsibilities; Leadership and Teamwork; Technical Knowledge and Skills; and Demonstration and Application.
[8] http://www.cde.ca.gov/be/pn/im/documents/infocibspaldfeb05item02.doc

provide $500M for a Career Technical Facilities Program for new or modernized facilities and equipment. School districts, county offices of education, and direct-funded charter schools are eligible. A 50% match is required, and can be paid over time. According to the California Legislative Analyst's Office, approximately 500 school districts (out of about 1,000) would be eligible for new construction and modernization grants.

Governor's Career Technical Education Summit

On March 13, 2007, the California Governor hosted the Governor's Career Technical Education Summit. It was an effort to engage business, labor and education leaders to map the future course of CTE. It was accompanied by news that the Governor intends to boost the state's funding of CTE in the coming fiscal year. In addition, it was an opportunity to discuss implementation of Proposition 1D. In the Governor's speech at the event, he noted that his proposed new funding will build stronger partnerships between businesses and schools, expand student internships, and create career-themed high schools, among other things.

RELATED VOCATIONAL PROGRAMS

In addition to standalone, elective vocational education courses offered in high school, vocational training is offered through a number of other avenues. These include courses of study spanning secondary and post-secondary education, school-to-work programs, and vocational training open to non-students.

Tech Prep

A direct result of the renewed emphasis on academics, Tech Prep is a part of Perkins (created as part of Perkins II (1990)) that supports structured articulation efforts between secondary and postsecondary institutions. Also referred to as "2+2", Tech Prep funding is intended to support programs that provide vocational students with a 2-year high school technical program that is academically challenging, followed by a nonduplicative and sequenced 2-year postsecondary occupational education or an apprenticeship program. Technical fields can include engineering technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health, or business. Programs can begin as early as the 9th grade, and must culminate in an associate's degree or certificate.

Federal dollars allocated under Tech Prep flow to each state and in turn are awarded to individual consortia, consisting of at least one secondary school and one postsecondary institution. In order to be eligible for Tech Prep funding, a program must contain the following seven elements: articulation agreements; appropriate curriculum design; curriculum development; in-service teacher training; counselor training; equal access for special populations; and preparatory services. States are required to prioritize funding of Tech Prep programs that offer effective employment placement; transfer to 4-year baccalaureate programs; are developed in consultation with business, industry, labor unions, and institutions of higher education that award baccalaureate degrees; and address dropout prevention and re-entry and the needs of special populations.

Tech Prep has led to education reform by opening up communication lines between secondary and postsecondary institutions through the articulation process. "Middle college" programs, another interesting concept resulting from Tech Prep initiatives, are designed for underrepresented populations as a means of experiencing college while still in high school. Students are enrolled in community college classes as well as honors level high school classes providing an opportunity to earn a high school diploma and an associate's degree concurrently.

School-to-Work

The School-to-Work Opportunities Act (STWOA, 1994) was designed to address the concern that American youth were not adequately prepared to meet the demands of the technological and globally competitive work force. The Act provided funding for school-based learning, work-based learning, and connecting activities. School-based learning is characterized by classroom-based instruction including academic and business-defined occupational skill standards. Work-based learning involves career exploration, work experience, and structured training and mentoring (apprenticeship and job shadowing) at job sites. Connecting activities are mentorships, matching students with work opportunities, and other means of bridging the gap between school and work. Occupational skills were to be integrated into the curriculum of all subject areas while maintaining the same academic standards necessary to prepare students for postsecondary education. The ultimate ambition of school-to-work programs was skill certification through an industry-recognized credential. STWOA was defunded in the 1990s, although many high school vocational education programs continue to maintain some elements of the program, such as school credit for work experience.

Regional Occupation Program (ROP)

The State of California funds a separate CTE program, the Regional Occupation Program (ROP), which is not directly associated with Perkins. Created in 1967, it funds 74 regional programs/centers, which provide tuition-free CTE courses on hundreds of different topics to approximately 500,000 students and adults annually. One motivation for the formation of regional programs was to pool resources to afford the specialized equipment and instructors required of vocational education, which some high schools could not afford. School districts or county offices of education run local ROPs, and some ROP programs are tightly integrated with secondary school CTE programs, whereas others are more standalone and provide many offerings to adults that are not enrolled in secondary school. The mission of ROP is to help students gain admission into entry-level occupations. As such, the programs are often structured as individual classes, not courses of study. State law governing ROP also prioritizes high school students age 16 through 18 (mostly juniors and seniors). Many ROP courses are articulated for community college or university credit. Each local ROP program must have business leaders participate in their advisory committee, which helps ensure that course offerings are relevant to labor market demands. The State's total ROP program funding was $457,608,000 in FY 2006-07, allocated to regional programs based on average daily attendance (ADA).

Job Partnership Training Act and Workforce Investment Act

The Job Training Partnership Act (JTPA), which took effect on October 1, 1983, provided job-training services for economically disadvantaged adults and youth, dislocated workers and those facing significant employment barriers. JTPA was designed to move individuals without jobs into permanent, self-sustaining employment, and to improve participants' wages. On July 1, 2000 the Workforce Investment Act (WIA) replaced JTPA. WIA offers a comprehensive range of workforce development services through statewide and local organizations. Services include on-the-job training, job search assistance, basic education, work experience, and miscellaneous other services. The program emphasizes adult and postsecondary education.

BEST PRACTICES IN CAREER TECHNICAL EDUCATION

As noted above, changes in CTE are being driven primarily by the need to address changing workforce requirements and the broader drive to reform secondary education. Recall that CTE was first established to provide job-ready workers and a pathway to employment for students viewed as being unable to succeed in challenging academic courses or occupations. It is changing to attract students of all achievement levels and to provide a rigorous academic grounding in addition to technical material.

The best practices discussed below have been drawn from a number of sources, including the Association for Career and Technical Education, U.S. Department of Education, Office of Vocational and Adult Education, National Governor's Association, National Research Center for Career and Technical Education, and the *Journal of Career and Technical Education*, among others. All agree that CTE must address relevant issues of high school reform. Although CTE is struggling to some degree to assert its value in an era focused on achievement in academic basics, many agree that there continues to be strong value in technical education. However, not all CTE activities are equally valuable. Standalone courses particularly seem to have the least impact on a participant's career trajectory. Many players are involved in technical education, including states (education standards), districts, community colleges, universities, and employers. Identifying the appropriate role of each and coordinating impactful programs will be a key to technical education success.

Career Academies and Pathways

Addressing the education reform goals of smaller settings, contextual learning, higher expectations, career counseling/guidance, and stronger support for struggling students, career academies are perhaps the most noteworthy emerging best practice. (Note that the terminology is not consistent - the terms career academy, pathway, cluster, and program of study are often used interchangeably.) Often organized as small schools (standalone or schools within schools with no more than 500 students), career academies focus their instruction on specific career trajectories.

Most career academies are open to all students on a competitive basis. Similar to career academies, career pathways are two- or four-year sequenced courses that offer academic and technical education focused on specific career trajectories. Students in a common pathway often enroll in academic courses

as a cohort. Academic teachers often integrate career-relevant material into academic courses, referred to as an interest-based context.

Recall that the Governor noted in his speech at the recent Career Technical Education Summit that the state's expanded CTE funding would be used in part to create career-themed high schools. As discussed further below, in *Improving High School: A Strategic Approach*,[9] the California Legislative Analyst's Office noted that vocational courses at the secondary level do not provide significant wage increases unless they are sequenced tracks. Therefore, many programs are moving away from offering standalone courses. Also, rather than in-depth focus on a particular occupation, many academies, pathways, or clusters focus on breadth of preparation for many occupations in a given field.

Similar to academies and pathways, "programs of study" are multi-year series of courses beginning in 9th grade and extending through at least two years of postsecondary education that contain academic and technical components leading to industry certification, or an associate's or bachelor's degree. Programs of study often have the following components:

- Ninth and 10th grade courses focus on academic subjects in the context of careers;
- Grades eleven and twelve take core curriculum and technical electives in a chosen career field;
- Pathways exist between high school and postsecondary institutions with options for dual enrollment and credit attainment;
- Internships and work-based learning opportunities;
- College and career exploration and guidance; and
- Consistently high academic standards.

A growing number of community and technical colleges are creating high schools on their campuses that support and accelerate the transition to college through a blend of secondary and postsecondary coursework. Many of these “middle colleges” focus on helping average to low-achieving students make successful transitions to postsecondary education.

Increased Academic Content in Vocational Courses

Perkins now requires the integration of more rigorous academic content into vocational education courses. In addition, many secondary schools are employing other reforms that will enable CTE students to succeed in more rigorous courses. For example, many schools are establishing higher expectations for students. In addition, many schools are providing assistance for students transitioning from middle school to high school, particularly for students that need extra help to meet grade level proficiency in basic skills such as literacy and mathematics. New curriculum is likely to be contextually-based and grounded in the need for students to demonstrate mastery of rigorous industry standards, high academic standards, and related general education knowledge, technology, and general employment competencies. Increasingly, as a result of the "college for all" movement, high schools are ensuring that the academic content of the vocational track meets applicable college entry requirements.

[9] http://www.lao.ca.gov/2005/high_schools/improving_hs_050905.pdf

A corollary of improved academic content is the push for increased accountability. CTE programs are increasingly measuring their effectiveness using standards such as GPA, standardized test performance, diploma attainment, and postsecondary degree or credential attainment.

Career Guidance and Counseling

To better engage students and provide them with greater control over their educational and career trajectory, many educators are advocating for education plans and regular career counseling. College and career guidance and counseling programs aim to help students make more informed and better educational and career choices. Among other things, programs provide information on high school course offerings, career options, the type of academic and occupational training needed to succeed in the workplace, and postsecondary opportunities that are associated with their field of interest. Indeed, the National Governor's Association Center for Best Practices, issue brief on *Retooling Career Technical Education*[10] goes so far as to recommend that all high school students be required to declare a course of study.

Partnerships with Postsecondary Institutions

One CTE initiative that seems to have attracted substantial praise is Tech Prep, which promotes coordinated course sequences, articulation, and dual credits between high schools and postsecondary institutions, primarily community colleges. Dual credits and undertaking college level coursework while in high school are seen as means of easing the transition between high school and postsecondary education for students that might not otherwise adapt well. Recall that course sequences are viewed as being much more beneficial, and potentially much more engaging, than standalone or redundant courses. Eliminating duplicated coursework between high school and postsecondary systems was one recommendation of the National Governor's Association.

Certification, Partnerships with Industry, and Focusing on Growth Industries

Partnerships with industry can take many forms. Nearly all CTE reform recommendations include making curriculum current and targeted to industry's needs and training standards. Indeed, one requirement of ROPs is that they employ industry advisory bodies. One example of training for industry skill standards is the Ford Motor Company's Ford Academy of Manufacturing Sciences (FAMS), launched in 1990. The program includes a standard curriculum in manufacturing systems and processes, technology, science, and math that promotes teamwork and the use and application of math and science knowledge to solve workplace problems. In addition, the program includes paid internships. More than 70 high schools are now using the FAMS curriculum. An example of certification is the Cisco Career Certification in areas such as network security. Microsoft and other technology companies also have certification programs that can be taught by various educational institutions.

[10] http://www.nga.org/Files/pdf/0706TECHED.PDF

Work-Based Learning

Work-based learning, including internships, apprenticeships, mentoring, and job shadowing, has been a cornerstone of CTE. Work-based learning is the most direct orientation students can have to the work world, and can ease the transition after graduation. In addition, work-based learning provides students with real-world exposure to occupations, which can be invaluable in helping the students make career choices. According to the U.S. Department of Education, employers, employer groups, and employee associations currently sponsor apprenticeships, closely supervised on-the-job training, in more than 500 occupations, which are particularly common in construction and manufacturing occupations. Apprentices often earn wages equal to roughly half of those of a fully trained worker.

School-Based Enterprises

School-based enterprises, which are business-like operations run by students, are effective educational tools in helping to prepare students for the transition from school to work or college. For many students, they provide the first work experience. For others, they provide an opportunity to build management, supervision and leadership skills. School-based enterprises have been in existence for many decades.

Student Organizations

Student leadership organizations, such as Future Business Leaders of America, provide networking, career exploration, and leadership development opportunities. Organizations bring together students interested in specific career and technical fields, providing them with a range of individual, cooperative, and competitive activities.

Programs for Historically Disadvantaged or Underserved Populations

CTE has a history of providing targeted services to disadvantaged and underserved populations, including students with disabilities, female students in traditionally male occupations, and underserved youth. CTE programs continue to work in this vein, broadening career options.

Improved Facilities and Equipment

Many CTE programs rely on outdated classroom facilities and equipment. These neither engage students nor prepare them for the workplace. As noted above, $500M of Proposition 1D (November 2006) funding will be directed towards new or reconfigured (modernized) CTE facilities and equipment.

Improved Teacher Training

CTE teachers are less likely than are other teachers to have a bachelor's degree, and many feel they have not received sufficient training on curriculum integration. Therefore, they are not well positioned to successfully use CTE as a means of teaching core academic subjects. In addition, many are not familiar with their industry's current technology and practices. Some recommend that all teachers develop

personal professional development plans. CTE teachers might need to develop the skills required to facilitate internships and teach soft/employment skills to students.

VOCATIONAL EDUCATION IN SFUSD

The San Francisco Unified School District (SFUSD) has 19 high schools enrolling approximately 19,000 students annually in 9th - 12th grades. The district's CTE programs are coordinated by the School to Career (STC) office, so named because it originally focused exclusively on school-to-work activities when there used to be separate ROP and Perkins offices. (They have since been consolidated.) STC/ROP/Vocational Education coordinator Marigrace Cohen notes that the district networks with other CTE practitioners to identify best practices that SFUSD can implement.

Apart from general district resources, SFUSD funds its CTE programs with federal funding from the Perkins program and state funding for ROP. One particular concern of the district's is that CTE programs are not enrolling students before they drop out. Many drop out before 9th or 10th grade, whereas SFUSD CTE programs generally start in the 11th grade. (Recall that ROP funding, which provides the bulk of the district's CTE resources, is limited to age 16 and older (roughly grades 11 and 12) and Perkins funded-programs are limited to grades 9 - 12.) The district is beginning to look at opportunities to expand CTE offerings to 10th graders, then eventually 9th graders as well.

SFUSD high school curriculum is currently organized on two tracks - college preparation (meeting California State University and University of California college entry requirements) and general (referred to as "graduation," focused on meeting minimum graduation requirements). Within each of these tracks, students have the option of participating in a number of CTE activities. However, some individual high schools offer very limited CTE activities, and enrollment in many CTE programs is competitive and restricted due to limited funding.

SFUSD's CTE Funding

The district receives dedicated CTE funding through two sources, the federal Perkins program and the state ROP program. Based on the declining population of school-aged children in the city, SFUSD's Perkins allocation is diminishing over time. In FY 2001-02, the district received over $650,000. In FY 2006-07, the district received just $450,000. San Francisco receives approximately $1M per year for its ROP activities.

SFUSD's Career Academies/pathways

The district uses Perkins funding to offer four- or six-semester-long sequences of courses, referred to as "pathways" or "academies" (depending on the preference of the host high school). The three defining features of career academies/pathways are:

- Small learning community (organized as schools within schools);
- College preparatory and technical curriculum; and

- Partnerships with employers, the community, and institutions of higher education.

Seven SFUSD high schools host a total of sixteen academies/pathways, as listed in the table below. Academy subject areas are determined based on the district's assessment of local labor market needs.

Table 1. SFUSD High School Academies/Pathways

Academy/Pathway	High School
Biotech	Galileo , Lincoln
Engineering (August 2007)	Burton, Washington
Environmental Sciences	Galileo
Finance	Burton, Lincoln
Health	Wallenberg
Hospitality and Tourism	Galileo (August 2007), Washington
Information Technology	Balboa, Galileo, Lincoln
Law	Balboa, Mission
Teacher Training	Lincoln

Approximately 850 students were enrolled in academies/pathways in 2006-07, which have experienced a 15% cumulative enrollment increase over the past three years. Students enrolled in academies/pathways take English, social studies, and their career electives as a cohort in 11th and 12th grades. Academy/pathway students are also encouraged to undertake a 6-week paid internship at a local business or organization in the summer between 11th and 12th grades. Several hundred students do this each year, with support provided by the School to Career office. As well, in 12th grade academy/pathway students they must enroll in at least one relevant City College course.

San Francisco's ROP

Approximately 1,250 students (1,100 SFUSD high school and 150 adult) participate in ROP courses each year, a number that has been declining in recent years. San Francisco's ROP is administered by the Board of Education and operated by the school district. Funding can be used for professional development of teachers, materials and supplies, and teacher salaries. Funding is based on ADA in ROP courses.

The majority of ROP funding in San Francisco is expended on courses integrated into the high school curriculum at SFUSD's academies/pathways. ROP funding here is used to support courses in growth industries. SFUSD is developing ongoing training and internship placement agreements for each of their ROP sectors.

SFUSD received $75,000 from the City's Rainy Day Fund in 2005 to start an ROP construction pre-apprenticeship program. SFUSD is now partnering with City College on that program. SFUSD is also signing an agreement with construction trade unions for internships in that industry.

The district also uses ROP funding to offer a small number of stand-alone electives (including photography and computer art) within high schools. SFUSD is moving away from standalone electives and towards four- and six-semester-long sequences of courses in academies/pathways.

In addition, through ROP it offers a small number of tuition-free courses available to anyone in the community age 16 or older (enrollment priority for high school students). In spring 2007, the ROP offered five such classes: computer repair (cancelled); graphic arts/design; Microsoft Office 2000; financial services/bank teller; and Oracle Academy.

Note that San Francisco's ROP approach differs significantly from the approach taken by ROPs in some other counties. Elsewhere, some ROPs offer over 100 courses to adult learners. San Francisco's approach clearly makes the courses less accessible to youth not enrolled in school and transitional youth that have already graduated. San Francisco's approach is however consistent with a recommendation in *Improving High School: A Strategic Approach*, in which the California Legislative Analyst's Office recommended that ROC/Ps focus on high school students (rather than non-students) and course sequences (rather than stand alone courses for entry-level skills). It is also consistent with recently passed state legislation (AB 2448, effective January 1, 2007), to focus ROP resources on high school students, rather than adults not enrolled in high school. For various reasons, over time the district has discontinued some popular CTE offerings, such as the automotive repair shop at Mission High School.

Career Counseling/Exploration and Tech Prep

All approximately 3,500 high school students that graduate annually must fulfill a graduation requirement of completing a nine-week SFUSD course called College Prep/Careers, which includes career exploration. Students enrolled at the seven schools with academies/pathways take a different version of the course (including a career interest inventory) than students at other schools. All high schools also have high school counseling departments, staff of which are supposed to meet with every student at least once per year as well as distribute career counseling materials throughout the year.

SFUSD is also building Tech Prep relationships, usually structured articulation agreements and coordinated, sequenced courses between high schools and postsecondary educators, primarily community colleges, resulting in credentials. As noted, every academy/pathway student must take at least one relevant community college course. In addition, the district accepts many community college courses for high school credit. However, SFUSD and the community college district have not yet otherwise created any formal sequenced courses resulting in credentials. The district did partner with City College to offer SFUSD students a course leading to a Cisco Systems Technical Certification Credential. However, at the conclusion of the first offering it was determined that the coursework was too challenging for high school students not otherwise specifically educated in information technology.

San Francisco's School-to-Work

In the 1970s and 1980s there was federal funding for school-to-work summer jobs. At the time, SFUSD placed 1,500 - 2,000 students per summer in paid summer jobs. Federal funding for school-to-work was eliminated at end of the 1990s, and as a result SFUSD now places about 50% of its former level.

Flexibility to Create Job Training Opportunities

Note that one means of fostering greater job training through high schools is simply allowing greater flexibility for principals and teachers to create school-work partnerships, apart from the district-wide CTE efforts. One example is that recently reported in the *San Francisco Chronicle* story "A piece of the pie: From coastal farm to city cafe, Mission High students learn about baking and beyond."[11] Through this informal program arranged by an English and science teacher, one morning each month 12-15 learning disabled Mission High School students volunteer at Pie Ranch, an organic berry farm in Pescadero, CA. In addition, many of the students, as well as other Mission High School students, have regular part-time jobs at Mission Pie, the farm's retail pie outlet. The teens at the farm and shop learn vocational skills such as how to interact with customers, harvesting, planting, cooking, baking, and general work responsibilities.

Preparing Students for Postsecondary Training

SFUSD also views itself as a contributor to CTE by aiming for comprehensive academic preparation for all students, preparing them for postsecondary training. Although high school graduation alone is generally not adequate to secure a living wage job in the current economy, Ms. Cohen notes that virtually any high school graduate can enroll in some postsecondary training program. She also notes that such programs, often six- to 18-month programs of study at a community college, can result in certification providing a relatively high-paying (above $15/hour) job. These are available in occupations such as x-ray technician, physical therapy assistant, nurse's aide, and convergence technology technician (voicemail and other communications technologies). The 12- and 24-month Bridge to Biotechnology program at City College of San Francisco can result in laboratory jobs paying as much as $18 - $25/hour. Ms. Cohen states that mastery of English as not critical in many of these technical occupations, which makes them accessible to a broad cross section of high school graduates.

HIGH SCHOOL REFORM

As noted above, vocational education reform is taking place within the context of broader reforms to secondary education. A number of studies have particularly raised concerns about the quality of education in the U.S. relative to that in other countries and the U.S.'s ability to compete in the global economy. These reports drew two parallel themes. First, the education levels of our residents and how well they are prepared for today's labor market will have a direct relationship to this country's economic vitality. In addition, our current K-14 system is inadequately meeting the needs of a majority of our students.

The model of today's high schools was conceived of at the beginning of the 20th century to efficiently educate all students, providing different tracks for students based on perceptions of their academic abilities. High schools were historically organized on three tracks. The college preparatory track focused on meeting the admission requirements of college. The vocational track provided vocational education.

[11] "A piece of the pie: From coastal farm to city cafe, Mission High students learn about baking and beyond.", *San Francisco Chronicle*, May 16, 2007

The general track provided a general course of study without a vocational focus and without meeting college entry requirements. A landmark report, *The American High School Today* (1959) theorized that only 15% of high school students had the intellectual ability to take rigorous courses, and that another 10% to 20% could stretch to participate in such courses. The remaining students didn't have the ability and should simply learn general job and living skills.

In *High Schools for the New Millennium*,[12] the Bill & Melinda Gates Foundation stated that "Top performing students often get education that is neither relevant nor challenging. Average students fall through the cracks in a system that accepts mediocrity. And low performing students are often placed in watered-down courses, without individual support to develop skills such as reading, writing, and problem solving."

A wave of educational reform initiatives occurred throughout the 1980s. The National Commission on Excellence in Education, created to address the failure of U.S. students to perform well compared to students in other industrialized countries on standardized achievement tests, published *A Nation at Risk*[13] in 1983. The report called for a recommitment to academic basics, with enhanced curricula at all levels consisting of more English, mathematics, science, and technology courses. Five specific areas of reform were targeted:

- Strengthening high school graduation requirements by establishing Five New Basics: a) four years of English, b) three years of mathematics, c) three years of science, d) three years of social studies, and e) one-half year of computer science;
- Establishing minimum academic achievement standards;
- Increasing class time on academic basics;
- Improvement of teacher preparation and the education profession; and
- Accountability.

In 1991, the U.S. Department of Labor Secretary's Commission on Achieving Necessary Skills (SCANS) issued a report titled *What Work Requires of Schools: A SCANS Report for America 2000*.[14] This report examined the work skills required to enter and succeed in the workforce of the future, and focused on the role of schools in preparing adolescents for work. The report concluded that over half of all young people leave high school without the knowledge or foundation required to find and maintain a good job.

Breaking Ranks II, of the National Association of Secondary School Principals, identified seven cornerstone strategies to improve student performance:

> Core knowledge: Establish the essential material a student is required to learn in order to graduate, and adjust the curriculum and teaching strategies to realize that goal.

[12] http://www.gatesfoundation.org/nr/downloads/ed/edwhitepaper.pdf
[13] http://www.ed.gov/pubs/NatAtRisk/index.html
[14] http://wdr.doleta.gov/SCANS/whatwork/whatwork.pdf

Connections with students: Increase the quantity and improve the quality of interactions between students, teachers, and other school personnel by reducing the number of students for which any adult or group of adults is responsible.
Personalized planning: Implement a comprehensive advisory program that ensures each student has frequent and meaningful opportunities to plan and assess his or her academic and social progress with a faculty member.
Adapting to differences: Ensure teachers use a variety of instructional strategies and assessments to accommodate individual learning styles.
Flexible use of time: Implement schedules flexible enough to accommodate teaching strategies consistent with the ways students learn most effectively and that allow for effective teacher teaming and lesson planning.
Distributed leadership: Institute structural leadership changes that allow for meaningful involvement in decision making by students, teachers, family members, and the community and that support effective communication with these groups.
Continuous professional development: Align comprehensive, ongoing professional development programs and individual Personal Learning Plans of staff members with the content knowledge and instructional strategies required to prepare students for graduation.

The High Schools that Work initiative identified a number of key practices that impact student achievement. These include high expectations; programs of study (strong core and concentration); work-based learning; and career/technical studies in high demand fields with rigorous basic skills.

Individual states responded by adopting stricter high school graduation requirements, increasing teacher standards, and other efforts, including:

- Education in smaller settings (including small schools);
- Intense focus on reading, literacy, and mathematics, particularly for incoming students;
- Extra-help sessions;
- Rigor, expectations, and preparation for college;
- Career academies;
- Cohorts of students;
- Involvement of students' family;
- Active and contextual learning; and
- Support for middle to high school transition.

THE DROPOUT EPIDEMIC

Referred to in the education literature as "the silent epidemic," many school districts are experiencing high rates of dropouts. According to Ending the Silent Epidemic[15], about one third of all public high school students and one half of minority students fail to graduate with their class every year. Students in the foster care or child protective services programs or who have had contact with the juvenile justice

[15] Ending the Silent Epidemic is a partnership organization composed of Civic Enterprises, MTV, National Governors Association, TIME Magazine, Bill & Melinda Gates Foundation, The Case Foundation, and The MCJ Foundation.

system are much more likely than other students to drop out. In addition to those that drop out, a number of students attend school so irregularly or make such limited academic progress that they are unlikely to ever graduate. Indeed, in part due to the dropout epidemic, Bill Gates called the U.S.'s high school model obsolete, and has made secondary education reform one of the main initiatives of the Bill & Melinda Gates Foundation.

According to research conducted by Ending the Silent Epidemic, students drop out for the following reasons, among others:[16]

- Nearly 50% said the main reason they left school was because classes were not interesting.
- Nearly 70% said they were not motivated to work hard and two-thirds would have worked harder if more were demanded of them.
- Approximately one-third left for personal reasons (to get a job, become a parent, or care for a family member) and one-third cited "failing in school" as a major factor.
- More than 80% said their chances of staying in school would have increased if classes were more interesting and provided opportunities for real-world learning.

Importantly, 62.4% of dropouts will leave school before the 11th grade, and high school dropouts will earn an average of $1 million less during their lifetimes than college graduates.[17] Dropouts are also much more likely than high school graduates to be unemployed, in poor health, living in poverty, on public assistance, and to be single parents of children that also drop out of high school.[18]

Note that there is a large literature discussing the difficulty in measuring the dropout problem as many youth, especially in urban areas, move in and out of school; move from school to school within districts and between districts and states. As well, there are different definitions of dropout or completer based on the point at which one begins to measure the problem. Ending the Silent Epidemic has made accurate measurement one of its primary missions.

Ending the Silent Epidemic has proposed a ten-point plan to address dropouts, including:

- Establish early warning systems for struggling students;
- Provide adult advocates and student supports;
- Support parent engagement and individualized graduation plans;
- Establish a rigorous college and work preparatory curriculum for high school graduation;
- Provide supportive options for struggling students to meet rigorous expectations;
- Raise compulsory school age requirements under state laws; and
- Expand college level learning opportunities in high school.

In *Improving High School: A Strategic Approach*, the California Legislative Analyst's Office noted that 30% of the State's entering 9th grade class will drop out before completing high school. The

[16] *Ending the Silent Epidemic*
[17] *Ending the Silent Epidemic*
[18] *Ending the Silent Epidemic*

report's recommendations, similar in many respects to those of Ending the Silent Epidemic, for addressing this include the following:

- An academic push - focus on teaching and learning to increase academic skills;
- Early attention to low performance - special programs in elementary and middle school;
- More personalized schools - more supportive environment to keep students engaged;
- Greater range of options - alignment of courses with student goals; and
- Parental involvement - parents must help keep students on track.

The High Schools that Work initiative published *10 Strategies for Improving High School Graduation Rates and Student Achievement*.[19] These include:

- Getting students ready in middle school for the challenges of high school;
- Focussing on easing the 8th to 9th grade transition;
- Developing an extra-help system to provide recovery when students fail a class or grade;
- Requiring all students to complete a solid academic core, complete additional mathematics, science, and humanities courses or complete a planned sequence of courses in a career field; and
- Create partnerships with employers and community and technical colleges.

Role of CTE

As noted, CTE is reinventing itself to strengthen its rigor and address changing workforce needs. In doing so, CTE has the opportunity to address secondary school reform imperatives, such as engaging students. For instance, a number of the recommendations from Ending the Silent Epidemic can be partially addressed by CTE reform, such as individualized graduation plans and rigorous college and work preparatory curriculum. The same is true of many of the recommendations from High Schools That Work, such as a planned sequence of courses in a career field and partnerships with employers and community and technical colleges.

Although many view CTE as an effective means of engaging students and stemming dropouts, the specific linkage between CTE and dropping out has not been entirely established, in part because of selection bias.

- One significant study of such by the National Research Center for Career and Technical Education, *Dropping Out of High School and the Place of Career and Technical Education*,[20] found that of students that enter high school at normal age or younger, some CTE coursework (up to one third of all coursework) was correlated with higher rates of graduation. Beyond that point, CTE coursework was negatively correlated with graduation rates.

- Another study conducted in 1998 by the University of Michigan found that high-risk students are eight to 10 times less likely to drop out in the 11th and 12th grades if they enroll in a career

[19] http://www.sreb.org/programs/hstw/publications/2006Pubs/06V65TenStrategiesGraduationRates.asp
[20] http://www.nccte.org/publications/infosynthesis/r&dreport/DroppingOut-Plank.pdf

and technical program instead of a general program. The same study also reported that a quality CTE program can reduce a school's dropout rate by as much as 6%, and that CTE students are less likely than general-track students to fail a course or to be absent.[21]

- A study of high school students in Texas found that students engaged in Tech Prep had higher attendance rates and slightly higher graduation rates than other students.[22]

- In *Improving High School: A Strategic Approach*, the California Legislative Analyst's Office stated that little evidence exists that secondary vocational education reduces dropout rates, although noted that the research on this issue has methodological issues and is generally considered inconclusive.

ADDRESSING WORKFORCE NEEDS

Recent changes to CTE involving infusing greater academic content into vocational coursework have been driven by larger school reform efforts and the conclusion among many that the U.S.'s traditional secondary education system is ill-prepared to meet future workforce challenges driven by the loss of manufacturing jobs, outsourcing, and the information economy.

A recent report by the Public Policy Institute of California[23] noted that California's economy has long been characterized as needing a large number of college graduate workers, and has become more so over time, as the state's economy shifts towards industries that need more highly skilled workers and as skill requirements within industries increase. The most important growth industries are projected to be health and education services and professional services (including legal, engineering, and computer services, among others). Projections of educational attainment of residents and in-migration indicate that the population will not have the level of education required by the economy. Specifically, by 2025, 41% of jobs are projected to need a college graduate employee (an increase from less than 33% in 2005), whereas 33% of the state's working-age residents are projected to have a college degree. Job growth is expected to be the strongest at the high end (at least a bachelor's degree) and the weakest on the low end (high school graduates and those with some college, but no degree). The manufacturing industry is the one expected to be the most in decline. This is consistent with other research. A report by the policy think tank Hudson Institute entitled *Workforce 2000: Work and Workers for the 21 Century* (1987) projected that "education beyond high school but less than a baccalaureate degree was expected to be essential to be able to qualify for higher wage jobs."

Although jobs requiring a high school graduate will decline as a share of all jobs in California from 2005 to 2025 (from 22% to 19%), the actual number of such jobs will increase by 323,000 over the period, due to growth in the size of the total labor market. Therefore, the need for college graduates will

[21] *Kulik, James*, Curriculum Tracks and High School Vocational Studies (Ann Arbor: University of Michigan, 1998).
[22] Brown, C.H. "A Comparison of Selected Outcomes of Secondary Tech Prep Participants and Non-Participants in Texas." *Journal of Vocational Education Research* 25, no. 3 (2000): 273-295.
[23] *Can California Import Enough College Graduates to Meet Workforce Needs?*, May 2007, http://www.ppic.org/content/pubs/cacounts/CC_507HJCC.pdf

increase, as will the need for skilled workers without a 4-year degree. A recent opinion piece in the *San Francisco Chronicle*[24] makes this case, noting that many jobs with solid incomes are available to people without bachelor's degrees but with two-year degrees, certificates, or specific technical training. In *Improving High School: A Strategic Approach*, the California Legislative Analyst's Office noted that vocational courses at the secondary level do not provide significant wage increases unless they are sequenced tracks. Community college courses that result in certificates or degrees do provide long-term benefits.

A number of different researchers have identified skills that today's economy requires. This extensive list includes well-developed analytic thinking; communication; problem solving; creative thinking; conflict resolution; reliability; positive attitude; willingness to work hard; the ability to work in groups; and the ability to use a personal computer. In 1991, the U.S. Department of Labor Secretary's Commission on Achieving Necessary Skills (SCANS) report titled *What Work Requires of Schools: A SCANS Report for America 2000* recommended five competencies and three foundations. Competencies considered essential to job performance include: (a) identifying, organizing, planning, and allocating personal resources, (b) effective interpersonal relations with others, (c) acquiring and using information, (d) understanding complex system relationships, and (e) selecting, applying, and using a variety of technologies. To attain these SCANS competencies requires a foundation consisting of (a) basic skills in reading, writing, computing, listening, and speaking, (b) thinking skills used in decision-making, creative thinking, solving problems, metacognition, and reasoning, and (c) personal qualities such as individual responsibility, self-esteem, sociability, self-management, and integrity. The SCANS competencies and foundations underlie many of the recent educational achievement and accountability reforms at the federal level.

Note that changing workforce needs vary regionally. Some regions of the U.S. are not anticipating a college graduate shortfall. Recent projections from the Bureau of Labor Statistics suggest that the U.S. economy overall will only require about 13% of its workforce to possess a baccalaureate and another approximately 8% to possess more than a baccalaureate. In the most recent U.S. Census (2000), approximately 26% of adults possess such credentials.

CONCLUSION

CTE is in transition, attempting to establish its place and value amidst education reforms that focus on a return to basic academic preparation and the push for "college for all," which contrasts with a traditional tenet of CTE, the value of sub-baccalaureate preparation. CTE has partially secured a place in secondary education by promoting its contribution to technical fluency and workforce readiness and as a learning context. CTE programs are also attempting to build effectiveness and support by adopting many of the recommendations of broader secondary education reform, such as small learning environments and contextual learning.

Given ongoing education reform efforts, the changing labor market, and limited educational resources, there is considerable debate about what technical education should be offered in high schools and to

[24] "Good paying jobs without a 4-year degree", *San Francisco Chronicle*, page B-9, March 14, 2007

which students, particularly how to allocate general district resources to CTE when many districts explicitly prioritize comprehensive academic training and college preparation. These are questions that cannot be answered by best practices alone.

SFUSD is following many CTE best practices. However, a relatively small share of SFUSD students enroll in the most substantial CTE offering, the career academies/pathways. In addition, if CTE is to be effective at stemming drop outs, SFUSD programs need to reach students earlier. SFUSD and other districts are in a challenging position of determining how to allocate limited CTE resources. On one hand, districts would like to offer sophisticated, cutting-edge CTE programs to their best students, to help ensure that they continue to enroll in the district. At the same time, districts must consider whether it might be appropriate to offer CTE to the lowest achieving students, as perhaps the only effective intervention to make them employable immediately after high school (whether they graduate or not). Indeed, it might be effective to include CTE as a component of an alternative to the "graduation" track that focuses on providing basic academic and workplace skills to students that are so under-credited that they are very unlikely to graduate.

Appendix A - California's Perkins Approach - 58 Career Pathways Organized Around 15 Industry Sectors

INDUSTRY SECTOR

Agriculture and Natural Resources
- Agricultural Business
- Agricultural Mechanics
- Agriscience
- Animal Science
- Forestry and Natural Resources
- Ornamental Horticulture
- Plant and Soil Science

Arts, Media, and Entertainment
- Media and Design Arts
- Performing Arts
- Production and Managerial Arts

Building Trades and Construction
- Cabinetmaking and Wood Products
- Engineering and Heavy Construction
- Mechanical Construction
- Residential and Commercial Construction

Education, Child Development, and Family Services
- Child Development
- Consumer Services
- Education
- Family and Human Services

Energy and Utilities
- Electromechanical Installation and Maintenance
- Energy and Environmental Technology
- Public Utilities
- Residential and Commercial Energy and Utilities

Engineering and Design
- Architectural and Structural Engineering
- Computer Hardware, Electrical, and Networking Engineering
- Engineering Design
- Engineering Technology
- Environmental and Natural Science Engineering

Fashion and Interior Design
- Fashion Design, Manufacturing, and Merchandising
- Interior Design, Furnishings, and Maintenance

Health Science and Medical Technology
• Biotechnology Research and Development
• Diagnostic Services
• Health Informatics
• Support Services
• Therapeutic Services

Hospitality, Tourism, and Recreation
• Food Science, Dietetics, and Nutrition
• Food Service and Hospitality
• Hospitality, Tourism, and Recreation

Finance and Business
• Accounting Services
• Banking and Related Services
• Business Financial Management

Information Technology
• Information Support and Services
• Media Support and Services
• Network Communications
• Programming and Systems Development

Transportation
• Aviation and Aerospace Transportation Services
• Collision Repair and Refinishing
• Vehicle Maintenance, Service, and Repair

Public Services
• Human Services
• Legal and Government Services
• Protective Services

Marketing, Sales, and Service
• E-Commerce
• Entrepreneurship
• International Trade
• Professional Sales and Marketing

Manufacturing and Product Development
• Graphic Arts Technology
• Integrated Graphics Technology
• Machine and Forming Technology
• Welding Technology