TEXAS CTE In Action

A College and Career Planning Guide



MAKE IT IN LIFE

YOUR GUIDE to CAREERS in MANUFACTURING

- Showcasing 25 Careers
- High School Personal Graduation Plans
- Inside College Admissions

TEXAS CTE
Your journey starts here.

Dear Texas Student,

You are probably tired of people asking, "What do you want to be when you grow up?" Some students know exactly what they want to do, but most haven't got a clue. The idea of choosing a career is intimidating, and it feels like it's far in the future. There's little time in the commotion of classes, activities, sports, work, and fun to think about what career you want to pursue after graduation from high school or college.

It pays, though, to take the time to think about your future career. The truth is that you'll save a lot of time and money if you have a direction in life, as opposed to just finishing high school and worrying about it later. It's really a matter of dollars and sense. If you choose a career direction now, you can select classes and activities that will make you highly marketable—and highly paid—when you look for work. And it only makes sense to have an idea of what you want to do rather than just wandering aimlessly through school.

Nobody wants that. Not your parents. Not your teachers. Not your friends. They want you to be somebody. They want you to use your talents, follow your interests, and pursue your ambitions to become great at what you love to do in life. That's what you should want, too.

So the time is right to take charge of your life and think about the future. You need a plan of action for how to get from where you are today to where you want to be in a few years: starting out on a personally and professionally rewarding career.

YOU'VE HEARD THAT 'INFORMATION IS POWER.' WELL, THIS MAGAZINE IS POWER. IT PUTS YOU IN CHARGE OF YOUR FUTURE.

That's what Texas CTE is all about. The guide you are holding is one of 16 guides to different career clusters. It is designed to help you make smarter decisions about your education and career options.

You've heard the phrase, "Information is power." Well, this guide is power. It puts you squarely in charge of your future, from creating High School Personal Graduation Plans (see page 5) to choosing college or some other form of education or training after high school. Work with your parents, teachers, and counselors to make decisions, but remind everyone that it is your future at stake and that you are taking charge of it.

Get information. Get a plan. Get a clue about your career direction. It's alright if that direction changes; choosing a direction now is better than having no direction at all. Just promise yourself that you'll make smart choices about where to focus your time, energy, and passion.

We're proud that you are taking steps to plan your career direction, and we pledge that your school, teachers, and counselors will do all they can to help you make wise choices on your plans for success. We wish you the best of luck on your journey.



Gear Up

MANUFACTURING IS MAKING THINGS. Raw materials become products such as cars, computer chips, cell phones, contact lenses, cosmetics, couches, clothes, candy, and more. Employees who create those products range from production-line workers in factories assembling parts to executives in skyscrapers overseeing global operations. Repetitive tasks that typically occur in manufacturing are being performed by robots and the automation process, which requires highly trained employees that can adapt to a variety of situations. Manufacturing today needs people who can understand highly technical information and make complex decisions. Workers are responsible for creative problem solving that ensures companies meet the highest quality standards. If you like building things, can follow detailed instructions, or are good at organizing people and processes, then manufacturing could be the right career cluster for you.

TEXAS

IS THE TOP U.S. STATE FOR MANUFACTURING EXPORTS AND VALUE OF SHIPMENTS

HOT Career Areas

Texas has launched a strategic plan that targets state efforts on six industry clusters that economists say will be the engines of economic growth in Texas. As you plan your future, think about a career in one of these new and emerging sectors.

- Advanced Technologies & Manufacturing
  - Molecular technologist
  - Sensor/robotics engineer
- Aerospace & Defense
  - Aerospace engineer
  - Unmanned autonomous vehicle engineer
- Biotechnology & Life Sciences
  - Bioinformatics specialist
  - Biocontainment technician
- Information & Computer Technology
  - System integrator
  - Computer game developer
- Petroleum Refining & Chemical Products
  - Petrochemical engineer
  - Refinery process design engineer
- Energy
  - Wind/solar energy engineer
  - Geophysical (oil and gas) prospector



Plan for Success

THE FIRST STEP toward success is making smart decisions about your education and career options.

When I was in high school," says Sheryl Kovach, Human Resources Director of Environmental Services at Phillips Services Corporation in Houston, "the only job that I even knew about was receptionist work. I didn't aspire to be a manager or entrepreneur because I really didn't know about those disciplines. I was just looking forward to graduating. That was it. I really didn't know what it was I wanted to do."

Sound familiar? You, too, may not have a clue about what to do with your life.

Don't worry, though. Help is right here in your hands. This is your guide to education and career choices that can shape your future. It's one of 16 career cluster guides published by Texas CTE (**www.txcte.org**). This edition is all about manufacturing.

Let's start with some basic steps you should take to get organized, plan for the future, and start on the road to success.

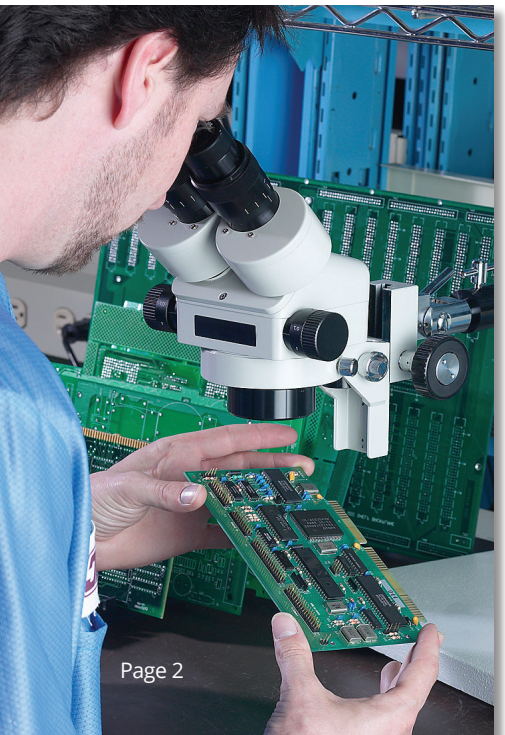
Assess Your Talents and Abilities

First, you need to figure out some things about yourself. This step can be as simple as writing down a list of your interests (like video games or rock climbing), your hopes and dreams (like helping others), your talents (like writing or math ability), and your weaknesses (if you're squeamish at the sight of blood, for example, you might not want to be a doctor).

Follow up on this informal exercise by taking some formal assessments to determine your interests and abilities. Common assessments include Texas Genuine (**www.texasgenuine.org**) and CareerTech (**www.careertech.org**).

This guide will provide you with the tools to begin your career exploration before you enter the ninth grade. It's never really "too early" to think about your career goals.

Ask your principal or counselor about the career assessments available at your school.



THE MANUFACTURING INDUSTRY EMPLOYS OVER
874,450 TEXANS
WITH AN AVERAGE ANNUAL WAGE OF $71,500.

TEXAS CTE

EVERY DOLLAR

IN MANUFACTURED GOODS GENERATES AN ADDITIONAL $1.43 IN ECONOMIC ACTIVITY FOR TEXAS—MORE THAN ANY OTHER SECTOR.

Research Your Career Options

Once you've learned about yourself, learn more about your career options. There are thousands of occupations out there of which you may never have heard, including some that do not exist because the technologies have not yet been developed. Fortunately, there are plenty of resources (see inside back cover) for you, and they are as close as the nearest computer.

One of the most helpful is the Texas Career Check from the Texas Workforce Commission. It is a vast database of information about hundreds of professions. You can find Texas Career Check at **www.texascareercheck.com**. Another good place to start is O*NET (**www.onetcenter.org**).

Gather information about what you can earn in the careers in which you are interested. Find out whether the careers you are considering have a promising future—are they adding or losing jobs? Check out the education you'll need to enter those careers.

The chart on pages 10–11 presents data on 25 possible professions. Remember, though, that these are just a sampling of careers available in the cluster. Go to Texas Career Check, O*NET, or another resource to investigate other careers.

Create Your High School Personal Graduation Plan

Once you have a better idea of your interests and abilities, you are ready to plan for high school and beyond. The High School Personal Graduation Plan, also known as a 4-year plan, is your plan for preparing for the career of your choice.

First, you should choose a career cluster, not a particular occupational goal. In the eight grade you might choose Manufacturing and then later become interested in a narrower field such as electrical engineering or avionics.

The program of study does not stop with graduation from high school, you could then pursue a two-year degree a mechanical engineer or a chemist.

You should set up a 4-year plan that takes you through career preparation after high school, revising your blueprint as needed as you go along. If your career plans include college study, ask your counselor about tests required for admission to college, such as the PSAT, SAT, or ACT.

Seek Out Special Programs

Many Texas schools offer innovative programs to prepare students for specific career areas. These include career and technical education (CTE) programs, academies, and magnet schools. Once you've decided on a career direction, ask your counselor about special programs in your area that may provide related experiences in your chosen career.

Samuel Odamah enrolled in the architecture program at the University of Texas at Arlington, having found his career calling at Dallas's Skyline Career Development Center, a high school with career programs in a number of different fields.

"Skyline is one of the few schools in the country that offer programs in architecture," Odamah says. "In some careers, Skyline students could even get professional certifications or licenses right in high school. It was a great place because you could find out whether you really wanted to enter a career."

Odamah says that the career cluster system at Skyline taught him the value of planning for his career and his life. "We learned about planning ahead," he says. "Those who plan things ahead of time don't have to catch up. It's just a matter of what a person wants out of life. Planning gives you a better platform for success."



Manufacturing CTSOs

One of the best ways to acquire experience in your chosen career is by joining a career and technical student organization (CTSO). In manufacturing, the most helpful CTSOs are:

- Business Professionals of America (BPA) **www.texasbpa.com**
- Future Business Leaders of America (FBLA) **www.fblatx.org**
- SkillsUSA **www.skillsusatx.org/**
- Texas Technology Students Association (TSA) **www.texastsa.org**



WHAT ARE Career Clusters & Programs of Study?

In Texas, High School Personal Graduation Plans will guide students' high school and college experiences (see next page). As part of this process, students focus their studies within a chosen career cluster and program of study that lead to an endorsement.

A career cluster is a group of occupations and broad industries that share certain features. The Manufacturing cluster, for example, includes production manager and industrial technician. Texas has adopted 16 Career Clusters (see back cover), the same ones designated and developed by the U.S. Department of Education.

As the graphic below shows, within each cluster are programs of study, which are more specific groupings of similar occupations. Think of a program of study as being like a college major. In Manufacturing you might choose to focus on health safety and environmental assurance in high school and college.

Related Occupations

Each career pathway in a particular cluster includes a range of related occupations; safety coordinator is an example of an occupation that falls within health safety and environmental assurance.

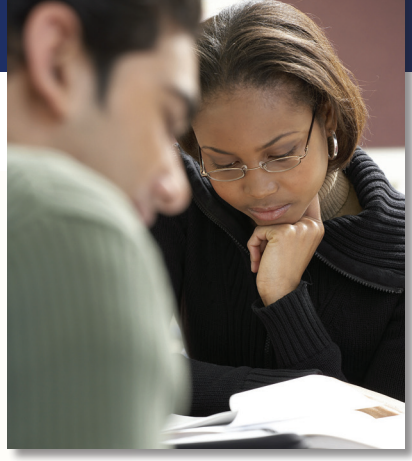
Choosing a career cluster and career pathway will help you acquire the knowledge and skills you'll need to enter your chosen career. It will allow you to follow a seamless course of study from high school into college or other postsecondary education or training. The electives you choose can complement your core academic classes to prepare you for the challenges of the real world of work.

Review Your High School Personal Graduation Plan Each Year

Don't get locked into a cluster and program of study you don't like. You should reexamine your 4-year plan at least once a year and change programs or clusters if your interests have changed. Choosing a cluster and program of study, even if it changes later, means that you'll have a direction in life. The idea is to be aware of what's going on in your life and take control of your future. When you know where your education is going and why, your classes will become more meaningful. You'll make contact with students, teachers, and employers who share your interest in a particular career area. You'll have experiences that are fun and exciting. You'll be on your way to success in school, in a career, and in life.



WHAT IS A High School Personal Graduation Plan?



It's a smart idea to create a High School Personal Graduation Plan, or 4-year plan, to guide your studies through high school and into college or other postsecondary education or training. Your 4-year plan represents your chance to take control of your education and career choices. Working with your parents/guardians and guidance counselor, you can pick the cluster on which you want to focus your studies as well as your career and postsecondary education goals. Don't worry. You aren't locked into your choices. You should revisit your 4-year plan at least once a year to update it. You can change clusters, programs of study, and career and postsecondary goals as your interests and ambitions change. Having a plan—even if it changes—is smarter than having no idea of what you want to do and why you are attending school. Here's how to fill out your 4-year plan.

CHOOSE a career cluster on which to focus your high school and college or postsecondary studies. The idea is to offer you a seamless route to follow from high school, through college or other postsecondary education, and into a career. Not all Texas schools offer all clusters, so ask your guidance counselor which clusters are available at your school.

PLAN for what you want to do after high school. Your goal may be to attend a four-year university or two-year college, join the military, or enter an apprenticeship program. Your postsecondary goal should influence the classes you take in high school; for example, you will need certain course credits to qualify for admission to a college.

SKETCH out your schedule of classes for your high school years. You will spend time completing requirement for the Foundation High School Program including electives to earn your endorsement in Business & Industry (26 credits). Planning your 4-year plan will help you get the education and experience you need to start your postsecondary and career goals.

PICK extended learning activities that complement your classes (see page 14). Work on community service projects. Plan for paid and unpaid career learning experiences, such as job shadowing and internships. All these extracurricular activities can give you experience that will help you get into college or land a job.

LIST basic information such as your name and school.

PICK a program of study within the cluster. There are six programs within the Manufacturing cluster (see page 12).

CHOOSE one or more occupations for which you would like to prepare. Use resources such as Texas Career Check (**www.texascareercheck.com**) to research your options.

High School Personal Graduation Plan

Name: Taylor Jones, West High School
Endorsement: Business and Industry
Cluster: Manufacturing
Program of Study: Maintenance, Installation, and Repair
Career Goal: Industrial Technician
Postsecondary Goal: Drafting Certificate, Bachelor's Degree in Design Technology

Foundation High School Program Requirements (22 Credits)	Business and Industry Endorsement Requirements (26 Credits)
English Language Arts (4 Credits) • English I • English II • English III • Advanced English Course Mathematics (3 Credits) • Algebra I • Geometry • Adcanced Mathematics Course Science (3 Credits) • Biology • IPC or Advanced Science Course • Advanced Science Course Social Studies (3 Credits) • U.S. History • U.S. Government (one-half credit) • Economics (one-half credit) • World Geography or World History Physical Education (1 Credit) Languages Other Than English (2 Credits in same language) Fine Arts (1 Credit) Career Related Electives (5 Credits) Proficiency in Speech (Determined locally)	Math (1 Additional Credit) Science (1 Additional Credit) Career Related Electives (2 Additional Credits) **EXAMPLE CAREER RELATED ELECTIVES** Principles of Manufacturing Concepts of Engineering & Technology Manufacturing Engineering Electronics Construction Technology Advanced Electronics Robotics & Automation Advanced Construction Technology Scientific Research and Design Practicum in Manufacturing **DISTINGUISHED LEVEL OF ACHIEVEMENT** 4 Credits in Mathematics (Must complete Algebra II) 4 Credits in Science Requirements for at least the Business and Industry Endorsement Remaining requirements **PERFORMANCE ACKNOWLEDGEMENT** Outstanding performance • in a dual credit course • in bilingualism and biliteracy • on an AP test or IB exam • on the PSAT, the ACT-Plan, the SAT, or the ACT Earning a nationally or internationally recognized business or industry certification

Curricular Experiences: SkillsUSA, Technology Student Association
Extracurricular Experience: Science Olympiad
Career Learning Experiences: Apprenticeships, Career Preparation—Paid and Unpaid, Internships, Job Shadowing
Service Learning Experiences: Boy Scouts of America, Community Service Volunteer, Habitat for Humanity

A CAREER PORTFOLIO (see page 15) is a good way to organize information about your educational experiences, record results of career interest and abilities assessments, and hold examples of your best work. Include a 4-year plan in your portfolio.



From Plan To Product



In MANUFACTURING careers, you must pay attention to both the big picture and the smallest details.

Manufacturing means creating a finished product from raw materials. It turns ideas into reality. Careers in manufacturing require the ability to picture in your mind what has to happen, and the practical skills to get projects completed as efficiently and effectively as possible.

"Manufacturing is a field for people who can bridge the abstract with physical reality", says Michael Odell, Executive Director of the Ingenuity Center at the University of Texas at Tyler. "The ability to problem-solve and visualize an end product and the smaller steps necessary to achieve the creation of that product is very important."

TEXAS
RANKS FIRST
AS AN EXPORTER OF MANUFACTURED PRODUCTS AND SECOND IN FACTORY PRODUCTION.

10 Fast-Growing Careers

Occupation	Growth Rate (2012-2022)	Avg. Annual Openings (2012-2022)
Computer Numerically Controlled Machine Tool Programmers, Metal/Plastic	55%	165
Welding, Soldering, & Brazing Machine Setters, Operators & Tenders	43%	260
Industrial Machinery Mechanics	41%	2,145
Medical Equipment Repairers	40%	205
Computer-Controlled Machine Tool Operators, Metal/Plastic	38%	660
Machinists	31%	1,785
General & Operations Managers	22%	7,065
Inspectors, Testers, Sorters, Samplers & Weighers	22%	1,915
Industrial Engineers	22%	765
Sales Representatives, Wholesale/ Manufacturing	20%	4,860

This is a projection of 10 fast-growing careers in manufacturing in Texas from the year 2012 and 2022 and the number of average annual openings in each occupation. Note that while the percentage of growth in jobs may be high, the actual number of jobs created may be low. For example, there will be only 200 new jobs for manufactured building installer created in Texas during the decade that the data covers. Source: Texas Workforce Commission.

The Importance of Technology

UT Tyler's Ingenuity Center is dedicated to promoting the technological education of Texas's middle and high school students. The center's interest in the manufacturing cluster reflects the increasing importance of technology in the manufacturing process.

Advances in robotics and computerization are boosting productivity and changing what workers in manufacturing careers do and how they prepare for their jobs. "Manufacturing is essential for a healthy economy. It is not simply a matter of production; manufacturing is about jobs that require innovation and higher levels of education. Innovation is key to being competitive in a global economy."

Creative Skills

Michael Bryant, a professor of mechanical engineering at the University of Texas at Austin, says, "There's a lot of creativity in this field, because you're literally creating the things that are going to be used all over the world. Your technical skills are like a bag of tools that you have."

Within that general profile, manufacturing offers many different opportunities for different employees. A single product, for example, has designers, engineers, factory workers, safety technicians, salespeople, public relations experts, and managers associated with it in one way or another.

10 Top-Paying Careers

Occupation	Average Wage	Entry-Level Wage	Experienced Wage
General & Operations Managers	$56.85	$25.34	$72.60
Industrial Production Managers	$51.96	$27.84	$64.02
Industrial Engineers	$47.94	$30.46	$56.69
Mechanical Engineers	$46.95	$29.04	$55.90
Materials Engineers	$40.31	$22.45	$49.24
Sales Representatives, Wholesale & Manufacturing, Technical & Scientific Products	$31.90	$14.49	$40.60
Industrial Engineering Technicians	$30.61	$21.25	$35.29
First-Line Supervisors of Production & Operating Workers	$29.92	$16.60	$36.58
Electrical & Electronics Engineering Technicians	$29.34	$18.74	$34.63
Mechanical Engineering Technicians	$30.61	$21.25	$35.29

This is a chart of hourly wages for 10 of the top-paying careers in the manufacturing cluster in Texas. Note how entry-level wages are often much lower than pay for the average worker and experienced workers in each profession. Source: Texas Workforce Commission.

Job Prospects

Being successful in today's job market requires the ability to innovate and stay current with ever changing market conditions. Knowing the needs of companies and having the right expertise is essential. Companies must comply with government regulations. As a result, industrial safety is a high demand field. Other high demand fields include advanced manufacturing, engineering technicians, and machine operators. Salaries range from $30,000-$40,000 for entry level positions. Salaries are even higher in management positions for these areas and can range from $50,000-$60,000. Salaries will increase as workers become more experienced. (For more specific information on manufacturing jobs, prospects, and pay, see "25 Career Choices" on page 10.)

Define Who You Are

Because manufacturing encompasses so much, from the world's largest pharmaceutical and energy companies right down to the local print shop or specialty metalworking shop, workers can dramatically affect the course of their careers and working conditions by picking one industry rather than another.

"It's a profession," Bryant notes, "not just a job. With a profession, the kind of work you do defines who you are."

For example, Bryant says, the pace of work in manufacturing depends on which industry you enter. "At Apple, they have developed the iPhone, which has changed the entire phone industry, so engineers at other phone companies are scrambling to keep up with a changing market," he says. "But say you're working for a company that makes oil drilling equipment. The pace isn't such that you have to get this product out in two weeks, but you've still got to produce."

Exciting Employment

Manufacturing is as important to the nation's future as it could be to yours if you pick the cluster. Although the number of manufacturing jobs in Texas is growing, nationally, manufacturing represents a declining share of the gross domestic product. The National Association of Manufacturers (NAM), however, reports that every dollar of manufactured goods produced generates $1.43 of additional economic activity. Even more important, says NAM, manufacturers are responsible for more than 70 percent of all business research and development, which ultimately benefits the entire economy.

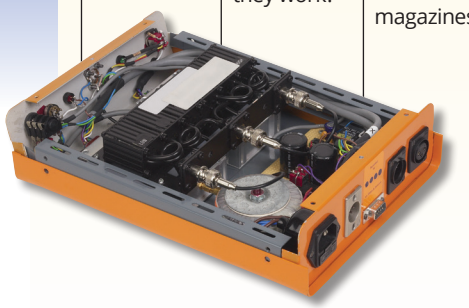
New product research is where the future of the economy lies, and NAM argues that it also makes for exciting employment if you choose a career in manufacturing. "There's a sense that you're making something for America," says Kat Snodgrass, NAM's associate director of media relations. "It's hands-on, cutting-edge, and rewarding."



QUIZ

Is Manufacturing the right cluster for you? Take this quiz to find out. Answer "yes" or "no" to the following questions.

1. Do you like working with your hands?
2. Do you like to take things apart and see how they work?
3. Do you like reading computer and technical magazines?
4. Do you get good grades in English, math, and science?
5. Are you good at putting things together by following instructions?
6. Do you like courses in school that involve hands-on projects?
7. Have you held leadership positions in sports, school, or service organizations?
8. Do you like group projects and working with others to reach a common goal?
9. Are you interested in using scientific principles to solve problems?
10. Do you know how to use tools?



If you answered "yes" to five or more of the above questions, Manufacturing may be the right cluster for you. To get a more specific and scientific measurement of your attitudes and abilities, ask your guidance counselor or teacher about taking a career assessment test or interest inventory.

What Employers Want

HANDS-ON EXPERIENCE

In manufacturing and other technical fields, hand-on experience is essential. Employers value experience gained through internships and apprenticeships. Michael Odell, Executive Director of the Ingenuity Center at the University of Texas at Tyler in the College of Engineering and Computer Science points out that "internships are equally valuable for students to explore a career and determine if a career in manufacturing is a good fit with employment and personal goals."

COMPUTER LITERACY

"The most important thing we're looking for is experience," agrees Robert Ashcroft, a manager at North Texas Plastics in Sanger. "But computer literacy is the other top priority. You need to have a familiarity, preferably with whatever software is associated with the job you are seeking."

MULTITASKING

Manufacturing companies such as North Texas Plastics hire employees for a range of positions, such as machine operators, quality assurance personnel, warehouse and inventory controllers, and machine maintenance technicians.

"We look for someone who looks neat and well-groomed, and who shows up on time," Ashcroft says. "We're want somebody who can wear a lot of different hats, who's able to multi task and do several things at one time. Also, we need somebody who's able to communicate with people well."

Many manufacturing careers begin with apprenticeships, so employers seek young people who are trainable and eager to learn. "We want somebody who's smart enough to learn," says Kirk Darroch, vice president of the North Texas Woodworker's Association.

CREATIVITY

In manufacturing careers, innovation is a constant, so anything you can do to enhance your problem solving skills is to your benefit.

Darroch gives the example of custom work, such as cabinetry or metalwork, in which clients contract on a job-by-job basis. "That takes more creativity," says Darroch. "The client comes to you and says, 'This is what I envision,' and then you produce it."



NOT Your Grandfather's Factory

Manufacturing JOBS TODAY are as likely to use computers as working on an assembly line.

Pat Dennis, an electrical engineer who wanted to become his own boss, opened Red River Trophy and Engraving in Denison in 2000. While you might think small-scale manufacturing services like engraving would primarily involve hands-on detail work, Dennis himself says he was surprised at the degree to which his success depended on the use of computers.

In fact, he says computer knowledge is the No. 1 skill you need to enter the field. "Being comfortable with a computer is essential," he says. "There are dozens of different types of software, so if you're afraid to use a computer, this is not a field for you."

High-Tech Jobs

Kat Snodgrass, associate director of media relations with the National Association of Manufacturers, says the trends Dennis sees in his business affect working conditions in manufacturing across the board.

"Currently manufacturing jobs are extremely technical, extremely skilled production jobs," says Snodgrass. "It's not your grandfather's factory these days. We use robots and high-tech computers. For the most part, you can no longer get a job in manufacturing right out of high school."

Analytical and Logical

"People in manufacturing typically fit a certain high-tech profile", says Michael Bryant, a professor of mechanical engineering at the University of Texas at Austin. "The person tends to be analytical, logical, careful, and neat," he says.

To be sure, an interest in math and science will help you in any manufacturing career, but Snodgrass stresses that the reality of the cluster is that it's not just production jobs.

"It encompasses anything that is man-made," she says. "So that's anything from pharmaceuticals to computer

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MANUFACTURING JOBS INCREASED 30.5% IN 2014.

chips to billboards to plastic products. Some aren't cool and sexy, but they are products that we use every day."

A Variety of Opportunities

The careers that are essential for making such products include engineering and design positions, production-line jobs, research positions, and jobs operating industrial robots, machines, and computers.

There are also careers you might not think of, such as those held by safety experts who inspect factories. Factory employees may specialize in fabric and apparel, metals, wood, electromechanical production, engraving, and even food production.

Risk and Change

Some entrepreneurs, like Dennis, start their own businesses. "Learning how to operate a business and work for yourself is the best thing about engraving," he says. "Most engraving companies are small. We do about $150,000 a year in sales."

Dennis points out that while such small enterprises offer a lot of freedom, they come with some risks. "It's kind of like the retail industry in which you have peak seasons," he says. "Our peak seasons revolve around the school year, and the other times you're lucky if you can pay the electric bills. There are some engraving stores that actually close in the summer."

Whether you are interested in a manufacturing career at a small company or a large corporation to be competive in today's job market it is important to embrace life-long learning. In today's fast-paced global economy the one thing you can count on is change. Being willing to constantly learn and adapting to changes are key to success in the 21st Century global economy.

There will be advances in science that will lead to new technologies. The speed at which these advances take place are accelerating at a faster and faster pace. New technologies are being introduced into manufacturing. The successful professional in this environment is someone who is interested and willing to constantly learn new skills.

Innovation is the key to success. Manufacturing provides a unique outlet for certain kinds of students to demonstrate their creativity and innovative ideas. Designing and creating innovative products is both art and science. Scaling up and manufacturing on large scales requires higher level thinking skills, especially problem solving.



5 Cool Careers

CHECK OUT THESE EXCITING CAREERS IN MANUFACTURING.

1.

ROBOTICS DESIGNER

Robotics are increasingly being used in manufacturing to make production run more efficiently. And, though in some ways robots take the place of human hands, manufacturing companies still need experts to design robots and ensure that they run properly. New trends in robotics include voice interactive robots and robotic efficiency to save energy (robots can work faster and with less waste of materials than traditional machinery with human operators).

2.

COMPUTER PROGRAMMER

In manufacturing today, many industries that once depended on factory-line workers to cut and assemble parts now rely on computer-aided manufacturing, or CAM. CAM plays a growing role in the manufacture of cars, textiles, plastics, metals, and other goods. In these industries, custom programs are designed by computer experts with the ability to understand the requirements of the manufacturing process and streamline it through automation.

3.

PRECISION MACHINIST

Manufacturing means creating whole products from sets of parts. Precision machinists are responsible for creating the parts that make up the whole. To do their job, machinists must work from extremely specific blueprints drawn up using CAD (computer-aided design) or CAM (computer-assisted manufacturing) programs. Often they must program computer numerically controlled (CNC) devices to actually machine the parts from steel, bronze, graphite, plastic, or other materials. As manufacturing enters the 21st century, skilled precision machinists are in high demand.

4.

AUTOMATION TECHNICIAN

Someone has to build, install, and maintain the increasing numbers of computerized systems used in modern manufacturing. Students who love computers and are good at analyzing and solving problems are finding rewarding careers as automation technicians. Communication skills are also important; these technicians work with engineers, designers, and business clients to set up and maintain systems that will perform as expected around the clock. Automation technicians must be able follow engineering specifications to the letter and react quickly to problems as they arise.

5.

BIOTECHNOLOGY ENGINEER

Engineers in biotechnology work with companies in the field to design a variety of cutting-edge manufacturing processes. Biotechnology uses living cells to create useful products, including new drugs, new drought-resistant strains of crops, or ethanol for fuel. Biotechnology engineers need a thorough grounding in biology and chemistry to manufacture these innovative products.

25 CAREER CHOICES

Manufacturing

Listed below are 25 careers you might consider in the manufacturing cluster. These are not all the career op levels. Turn to the "Online Info" on the inside back cover to research all career options in the cluster of your presented in each column.

- SOC: Stands for Standard Occupational Code, which organizations like the U.S. Department of Labor use to categorize career information. Sometimes you can find data on a career faster by searching for its SOC.
- GROWTH: This is the projected annual growth in Texas for the career between 2012 and 2022. Fast-growing occupations may offer greater career opportunities for young adults.
- OPENINGS: This is the projected number of job openings for the career in Texas each year. Even though a career may be fast growing, there may not be a lot of positions available. Careers with more openings will give an entry-level worker a better chance of getting a job and greater job security.
- WAGES: This is the amount the average person in the career earns in Texas per year. Naturally, entry-level wages are lower than the average, and those for workers with years of experience are generally higher.

SOC	Occupation	Growth	Openings	Wages	Education
17-2081	Environmental Engineer	24%	140	$98,348	Bachelor's plus experience
27-1021	Commercial and Industrial Designer	20%	95	$59,363	Bachelor's plus experience
11-1021	General and Operations Manager	22%	7,065	$118,246	Bachelor's plus experience
49-9062	Medical Equipment Repairer	40%	205	$42,956	Associate's degree
17-3024	Electromechanical Technician	25%	70	$53,040	Associate's degree
17-3023	Electrical and Electronic Engineering Technician	18%	555	$61,021	Associate's degree
17-3027	Mechanical Engineering Technician	21%	185	$57,572	Associate's degree
17-3026	Industrial Engineering Technician	14%	150	$63,674	Associate's degree
49-2091	Avionics Technician	15%	55	$46,826	Postsecondary award
49-2097	Electronic Home Entertainment Equipment Installer	0%	80	$31,304	Postsecondary award
49-2092	Electric Motor, Power Tool, and Related Repairer	12%	100	$37,597	Postsecondary award
49-2096	Electronic Equipment Installer & Repairer, Motor Vehicle	5%	20	$32,726	Postsecondary award
13-1023	Purchasing Agent, except Wholesale, Retail, and Farm Product	18%	870	$62,306	Work experience in a related occupation
51-1011	First-Line Supervisor of Production and Operating Workers	15%	1,380	$62,238	Work experience in a related occupation
51-7011	Cabinetmaker and Bench Carpenter	17%	190	$26,268	Long-term on-the-job training
51-7021	Furniture Finisher	17%	25	$25,965	Long-term on-the-job training
51-4012	Computer Numerically Controlled Machine Tool Programmer, Metal/Plastic	55%	165	$48,575	Long-term on-the-job training
51-4121	Welder, Cutter, Solderer, and Brazer	20%	2,155	$39,593	Long-term on-the-job training
49-9042	Maintenance and Repair Worker, General	20%	4,290	$33,527	Moderate-term on-the-job training
47-2041	Carpet Installer	15%	45	$29,067	Moderate-term on-the-job training
51-9021	Crushing, Grinding, and Polishing Machine Tender	11%	90	$27,720	Moderate-term on-the-job training
51-9122	Painter, Transportation Equipment	18%	170	$43,991	Moderate-term on-the-job training
51-9196	Paper Goods Machine Tender	5%	65	$27,389	Moderate-term on-the-job training
51-9111	Packaging and Filling Machine Operator and Tender	13%	750	$25,516	Short-term on-the-job training
51-9123	Painting, Coating, and Decorating Worker	18%	50	$30,716	Short-term on-the-job training

Source: Texas Workforce Commission (TWC)

Note: This chart is a sampling of careers in the cluster, not recommendations from TWC or any other agency or organization. Always do thorough research and consult with your parents/guardians before making a career choice.

TEXAS CTE

ptions in the cluster—they are just a sampling showing the variety of occupations available to you at different education r choice and decide on the ones that best fit your talents and ambitions. Here's an explanation of the kind of information

EDUCATION: This is the minimum preferred level of educational attainment for people working in the career in the United States. This can range from short-term on-the-job training to a doctoral degree taking several years of college.

EDUCATION LEVELS: The color bars show the mix of education levels attained by people actually working in the profession in Texas (see bars at right). If a bar features mostly one color, that means that level of education is likely the one you'll need to reach to work in the profession. Look at environmental engineer, for example, and you'll see that a large majority in the field have at least a four-year college degree. If the three colors in the bar are roughly equal in size, that means that there are opportunities in the profession for people of all education levels. For example, about 29 percent of the people working as purchasing agents have a high school diploma, while 34 percent have some college, and 37 percent have four-year degrees or better.

High School	Some College	College or Better
Percentage of people in the occupation who have at most high school diplomas	Percentage of people in the occupation who have some college	Percentage of people in the profession who have a four-year college degree or better

JOB DESCRIPTION: These are brief descriptions of each career from O*NET Online (**www.onetcenter.org**).

Education Levels	Job Description
	Design, plan, or perform engineering duties in the prevention, control, and remediation of environmental health hazards at industrial sites utilizing various engineering disciplines. Work may include waste treatment, site remediation, or pollution control technology.
	Develop and design manufactured products, such as cars, home appliances, and children's toys. Combine artistic talent with research on product use, marketing, and materials to create the most functional and appealing product design.
	Plan, direct, or coordinate the operations of industrial companies or public and private service organizations. Duties and responsibilities include formulating policies, managing daily operations, and planning the use of materials and human resources.
	Test, adjust, or repair biomedical or electromedical equipment.
	Operate, test, and maintain unmanned, automated, servo-mechanical, or electromechanical equipment. May operate unmanned submarines, aircraft, or other equipment at worksites such as oil rigs. May work in deep ocean exploration, or hazardous waste removal. May assist engineers in testing and designing robotics equipment.
	Apply electrical and electronic theory and related knowledge, usually under the direction of engineering staff, to design, build, repair, calibrate, and modify electrical components, circuitry, controls, and machinery for subsequent evaluation and use by engineering staff in making engineering design decisions.
	Apply theory and principles of mechanical engineering to modify, develop, and test machinery and equipment under direction of engineering staff or physical scientists.
	Apply engineering theory and principles to problems of industrial layout or manufacturing production, usually under the direction of engineering staff.
	Install, inspect, test, adjust, or repair avionics equipment, such as radar, radio, navigation, and missile control systems in aircraft or space vehicles.
	Repair, adjust, or install audio or television receivers, stereo systems, camcorders, video systems, or other electronic home entertainment equipment.
	Repair, maintain, or install electric motors, wiring, or switches.
	Install, diagnose, or repair communications, sound, security, or navigation equipment in motor vehicles.
	Purchase machinery, equipment, tools, parts, supplies, or services necessary for the operation of an establishment. Purchase raw or semifinished materials for manufacturing.
	Supervise and coordinate the activities of production and operating workers, such as inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators.
	Cut, shape, and assemble wooden articles or set up and operate a variety of woodworking machines, such as power saws, jointers, and mortisers, to surface, cut, orshape lumber or to fabricate parts for wood products.
	Shape, finish, and refinish damaged, worn, or used furniture or new high-grade furniture to specified color or finish.
	Develop programs to control machining or processing of parts by automatic machine tools, equipment, or systems.
	Use hand-welding, flame-cutting, hand-soldering, or brazing equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products.
	Perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of an establishment in repair. Duties may involve pipe fitting; boiler making; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.
	Lay and install carpet from rolls or blocks on floors. Install padding and trim flooring materials.
	Set up, operate, or tend machines to crush, grind, or polish materials, such as coal, glass, grain, stone, food, or rubber.
	Operate or tend painting machines to paint surfaces of transportation equipment, such as automobiles, buses, trucks, trains, boats, and airplanes.
	Set up, operate, or tend paper goods machines that perform a variety of functions, such as converting, sawing, corrugating, wrapping, boxing, stitching, or sealing paper or paperboard sheets into products.
	Operate or tend machines to prepare industrial or consumer products for storage or shipment. Includes cannery workers who pack food products.
	Paint, coat, or decorate articles, such as furniture, glass, plateware, pottery, jewelry, cakes, toys, books, or leather.

PROGRAM PROFILES

HERE ARE the programs of study available within the manufacturing cluster in Texas high schools.* The State has created programs of study for each of these areas. These documents detail high school classes you might take, extended learning opportunities, and postsecondary programs.

HEALTH, SAFETY, AND ENVIRONMENTAL ASSURANCE

Employees in this field create safe working environments. They monitor and maintain safety and health procedures. They also ensure that factories comply with government regulations.

LOGISTICS AND INVENTORY CONTROLLER

In this field, workers get materials to production workers. They order the items and check them into the company warehouse when delivered. In addition, they pack and ship the finished products.

MANUFACTURING PRODUCTION PROCESS ENTRY

Employees in this field design and plan how new products are going to be manufactured.

MAINTENANCE, INSTALLATION & REPAIR

Workers in this field install, maintain, and repair the manufacturing equipment as needed.

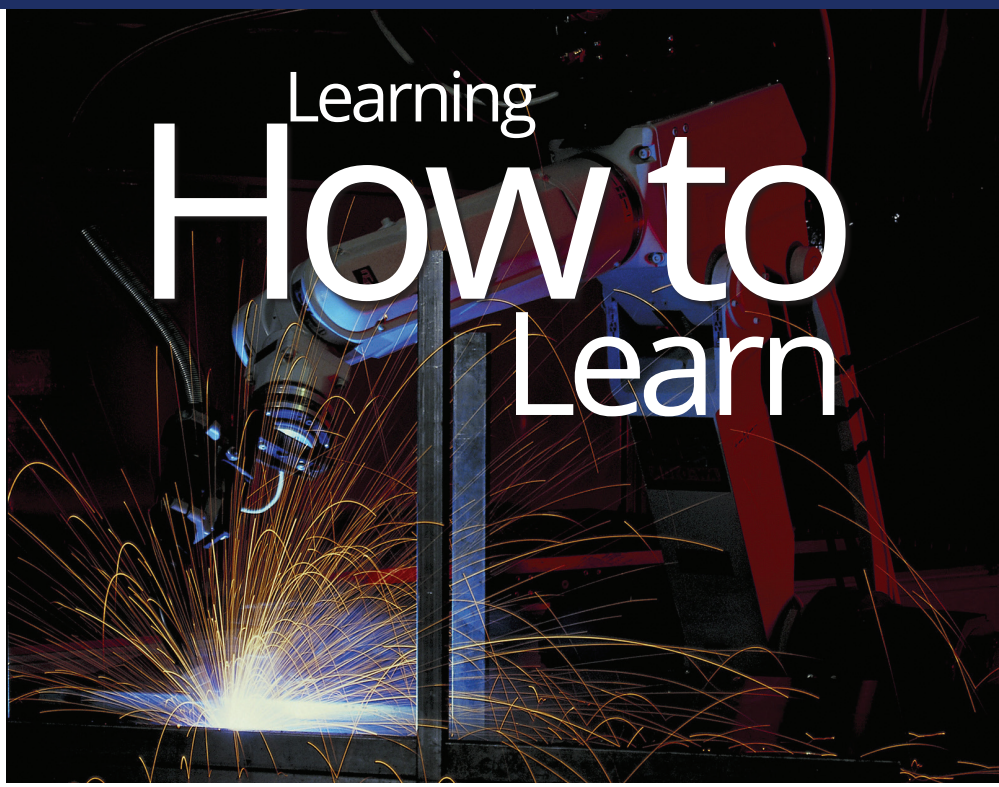
PRODUCTION

Employees in this field transform raw materials into finished products. They create the parts needed to make products or assemble the parts into products.

QUALITY ASSURANCE

In this field, workers make sure manufactured goods meet design standards and specifications. If there are problems in production, they might be asked to find the cause and propose a solution.

*Not all schools offer all programs of study or clusters. Ask your counselor about which programs are available at your school.



Learning How to Learn

High school COURSES HELP STUDENTS master the basics of lifelong learning in manufacturing careers.

The nature of manufacturing has changed, and that has changed the way people prepare for manufacturing careers. If you like working with your hands, these careers may still be perfect for you. In manufacturing, students must master not just the how-tos of manufacturing, but the whys as well.

"Nowadays, it's not the old 'sweatshop' work," says Mike Harris, president of the San Antonio Manufacturers Association. "It involves a lot of computer and technical equipment. Students need to understand how technology works, and learn those things while they're still in high school. It's key to their advancement later on."

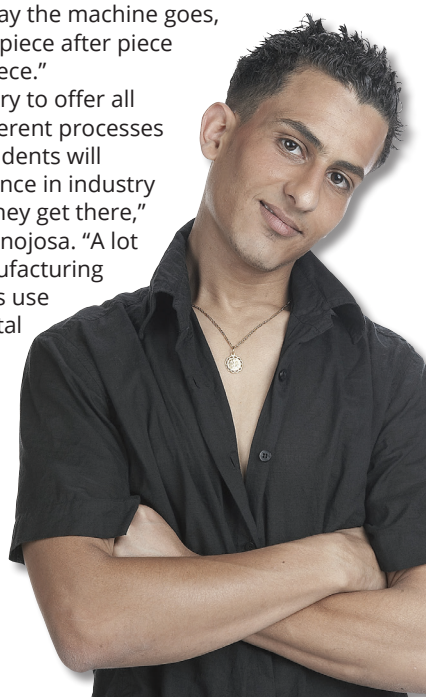
TEXAS MANUFACTURING WORKERS TAKE HOME **PAYCHECKS** THAT ARE 22 PERCENT HIGHER THAN THE NATIONAL AVERAGE.

Master the Three Rs

Learning the whys means mastering the basics—reading, writing, and arithmetic—that underlie the complexities of modern technology in production facilities.

Even welding has been transformed by the high-tech revolution. "Computer-controlled plasma torches are used to cut multiple pieces of materials," says Edward Hinojosa, a welding instructor at Edinburg North High School in Edinburg. "You enter or input the parameters into a computer and away the machine goes, cutting piece after piece after piece."

"We try to offer all the different processes that students will experience in industry when they get there," adds Hinojosa. "A lot of manufacturing facilities use gas metal arc



FOR EVERY 1 MANUFACTURING JOB

CREATED IN TEXAS, 2.5 SERVICE-SECTOR SUPPORT JOBS ARE CREATED. FOR EACH PETROCHEMICAL MANUFACTURING JOB, EIGHT SERVICE JOBS ARE CREATED.

welding, and some of it is robotic. Our students learn the basic principles of how the processes work."

Math and Computer Skills

To master modern technology, students have to have a strong background in math and computer skills. "Manufacturers are indicating that some of our high school students do not have the basic qualifications, particularly in math, that it takes to operate some of the machinery," Harris says.

"We're having a hard time finding people who can work the equipment that is now used in manufacturing. You've got to have entry-level folks coming on board who will be able to absorb the training that's required for these processes and then develop the higher skill levels."

How-to Learning

You can start work on these how-to skills, along with your academic skills, while you are still in high school. At many Texas high schools, students can earn professional skill certifications that can help them find immediate employment upon graduation.

The most common high school programs in manufacturing are machining and welding, but other certifications include driller trainer, erosion control technician, fiber optics technician, and refrigeration technician. Many school districts also have agreements with local community colleges that let students earn college credit for technical courses while still in high school.

At Klein Forest High School in Houston, machining students learn both manual and computer-controlled processes, including computer numerical control (CNC) machining. "We spend nine weeks learning manual machining and nine weeks learning CNC," says Gary Burgess, a machining teacher at Klein Forest. "I teach a class called Introduction to Technical and Numerical Control, which is an intro to CNC, and another called CNC Programming. The students learn a complete manufacturing process."

Applying the Basics

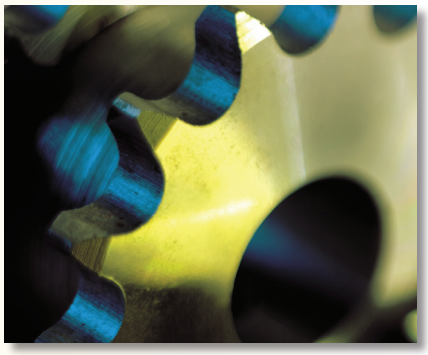
Perhaps the most important thing you can learn in high school is how to apply foundation skills. "How do you sand something to get a good finish? How do you make something dimensionally correct? How do you use tools safely, and take care of them?" says Anne Bernhardt, who teaches a plastics manufacturing class at Dallas's Skyline High School.

Her students learn to use computer graphics applications, computer-aided design, and laser engraving, but "you can't program a robot to do what you don't know how to do," Bernhardt says. "So you have to start with, how do you do these things manually? You've got to learn to be safe around machinery, you've got to have an understanding of what the processes are, how they work, and the variables involved. Someone who's just entering numbers into a computer doesn't have the judgment to say, 'You know what? This doesn't make sense.'

"I think that students today don't get a chance to do very much critical thinking," Bernhardt adds. "So career and technical education courses are very important for students to get a well-rounded education. The people to hire are the ones who can think on their feet and have a good understanding of what they're doing."

SPOTLIGHT

A NEW START
Building Solid Futures in Manufacturing



Daniel Leyva, a full-time machine tool operator at Chromalloy Component Services in San Antonio, followed a difficult road to career success. Living on his own since the age of 17, he has had to deal with homelessness and health issues.

With perseverance and the help of San Antonio's Manufacturing Technology Academy (MTA), however, Leyva got the training he needed to build a solid future. He spent his junior and senior high school years earning dual high school and college credit at MTA and St. Philip's College Southwest Campus in San Antonio.

MTA is a partnership among the area's high schools, community colleges, and businesses. They realized that San Antonio needed a lot more skilled high-tech workers than it was producing, so they created the academy to help students master the techniques and machinery used in modern manufacturing.

Leyva not only earned 30 credits and a college certificate of completion at MTA, he worked for eight weeks as an intern at Chromalloy. He excelled at his work, took a part-time position upon completing his internship, and was hired full-time in 2006.

MTA is open to high school juniors and seniors throughout Bexar County. Students spend half of their day at their home school and half at MTA, taking classwork and instruction in skills such as welding, machining, and computer integrated manufacturing. "I had great teachers who assigned lab projects that allowed me to be more creative and get more hands-on experience," Leyva says.

Seniors spend a summer working, as Leyva did, as paid interns for local manufacturers. Many MTA students continue their education while earning a living. "The academy is providing a pipeline for interested students to meet industry's demands," says Gene Bowman, MTA's program director. "The opportunities for jobs with tech companies, with good benefits, are very good in our region."

On the Job Out of the Classroom

TRY OUT your career options with extended learning experiences.



Students who live near McAllen, Texas, can study precision manufacturing techniques in high school. But they're not just sitting in a classroom. They can leave school during the day to learn practical skills in a shop at a local college campus. And in the summer, they can earn credit by working at a real job—and earn real dollars for doing it.

These are the kind of opportunities that open up to you in extended learning programs. "Extended learning" is a term covering a variety of educational experiences that take place outside the traditional classroom.



Real-World Experience

It could mean job shadowing, for instance, in which you follow and observe a worker in a field in which you're interested. You might shadow a welder on the shop floor, seeing exactly why the specific skills and knowledge you're gaining are important, and how you'll use them.

You might find yourself leaving school for half days to take classes and do lab work at a local community college, and earn college credit while doing it. Or you could find an internship or an apprenticeship, and work for a company while earning your diploma. Or it might be a combination of these things.



Hands-On Learning

In South Texas, for instance, students from the Mission Consolidated Independent School District learn about precision manufacturing by taking coursework at South Texas College (STC). This two-year program prepares high school juniors and seniors for careers in areas such as tool and die making, industrial maintenance, plastics processing, and quality assurance.

Students in the program learn to use machining equipment, computerized mill and lathe machines, and drafting software, and take courses in machining mathematics and blueprint reading. They get practical experience both in high school courses and at STC's Technology Center, earning up to 39 hours of college credit at no cost, and receive a precision manufacturing certificate upon high school graduation.

The program was created with help from area manufacturers. "We got a lot of companies calling, saying that they needed employees for this area," says Raul Ruiz, a project training specialist at STC. "The curriculum was designed by the manufacturing companies in the community." Firms involved in the project include General Electric, Black and Decker, and Panasonic.

THE TEXAS STATE TECHNICAL COLLEGE SYSTEM OFFERS SEVERAL **TWO-YEAR PROGRAMS** THAT PREPARE STUDENTS FOR TEXAS-BASED MANUFACTURING CAREERS.

In the summer, the program really pays off for students. "We have a paid internship program for the students during the summer," Ruiz says. "We place them with a manufacturing company. They can earn as much as $1,400

TOYOTA AND GENERAL MOTORS ARE THE TWO LARGEST AUTO MANUFACTURING EMPLOYERS IN TEXAS.

for the six weeks, and some students get hired after the internship." Students who choose to continue coursework at STC after graduating from high school can continue at STC to earn an associate's degree in precision manufacturing and a bachelor's degree in applied technology or engineering.

Early Employment

Such arrangements are fairly common in manufacturing. Dallas-area Garland High School, for example, has a popular machining program that provides skilled employees for area industries. "We work with manufacturers in the community to place students. It can be summer work or after graduation," says Phillip Gilbreath, director of career and technical education for Garland Independent School District. "In the afternoon, some students can go to work in an industry they're studying. And in the second year, in the spring semester, students can go straight to work in the machining industry."

Gary Burgess, a machining teacher at Klein Forest High School in Houston, says job prospects are also bright in his area. "There are lots of opportunities for students when they graduate. They can have a job by the spring semester of their senior year," he says.

SPOTLIGHT

MANUFACTURING MASTERY

SkillsUSA and TSA Competitors Strut Their Stuff



Imagine walking into a competition in an exhibition hall packed with students and spectators. You're going to be given a drawing and some materials. You'll have to write a computer program, set up a machine, and manufacture a shiny metal part. You're not just competing for a trophy, either; your performance might lead to a scholarship or a full-time job.

That's what it's like at the SkillsUSA and Technology Student Association (TSA) regional, state, and national competitions held every year.

About 16,000 Texas students belong to SkillsUSA and 9,000 belong to Texas Technology Students Association, learning the leadership, employability, and workplace skills it takes to succeed.

SkillsUSA members compete in more than 75 different events in a wide variety of skills, but students interested in manufacturing have an invaluable opportunity to develop the technical skills they need to reach their career goals. Competitions include events in computer numerical control (CNC), welding, milling, and turning.

"For welding, they might give students a blueprint and they would have to weld various types of joints," says Victor Ramirez, an El Paso high school teacher and a board member of SkillsUSA Texas.

TSA competitions focus on technical events such as computer-aided design (CAD), and electronic research and experimentation. In the manufacturing prototype event, students design and manufacture a product prototype and describe how the product would be mass produced in a state-of-the-art American plant.

Competitions in CAD are among the most popular, says TSA State Coordinator Curtis Green. "Students are given an engineering or architectural problem and asked to solve it by the end of the time period."

Competitors at the SkillsUSA national finals play for big stakes, says Ramirez. "Some of the bigger technical schools in the country give out a lot of scholarships," he says. "One of my students came in third place, and a company offered him a job as an apprentice immediately, and to put him through school for free."



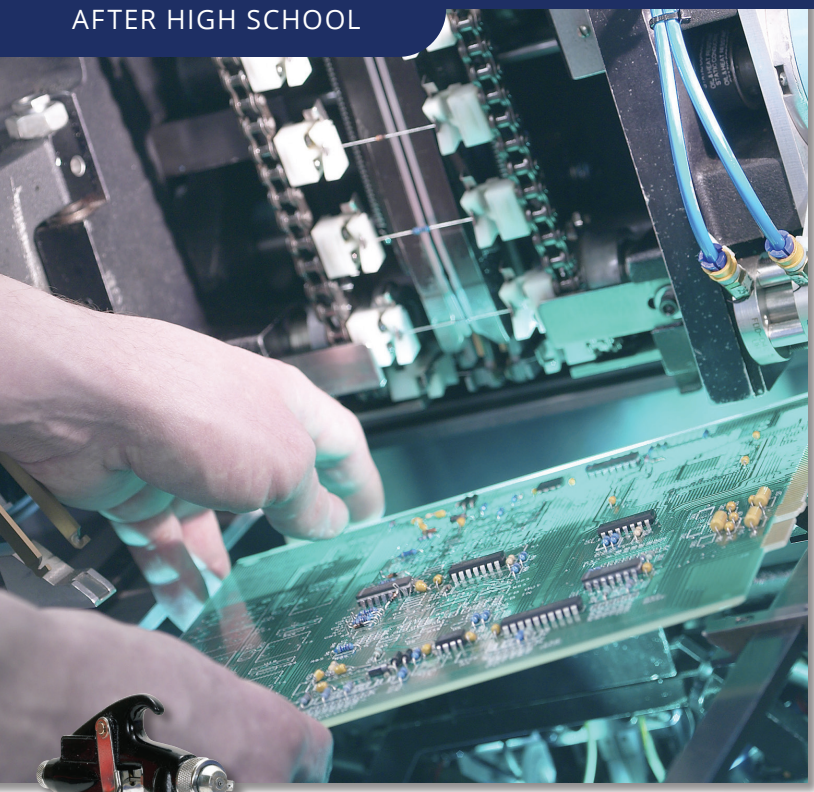
CREATE a Career PORTFOLIO

One valuable tool that can help you get ready for college and beyond is a career portfolio—a collection of items that document your achievements both in and out of school, assembled in one convenient package.

A career portfolio is not simply a resume, although it can certainly include one. So what should go in a career portfolio? A variety of things, depending on your own personal experiences. It could include transcripts and grades; writing samples; letters of recommendation from teachers, mentors, or employers; awards you've received; and items that document other activities, such as internships and job shadowing experiences.

"You need to be specific—dates, how many years, any awards, what they meant, and who you received them from," says Grace Brauchle, who helps students put their portfolios together as the career center coordinator for Lehman High School in Kyle.

Brauchle says portfolios come in handy when students apply for jobs or admission to college. "First impressions are a very big thing," she says, "and you want to be the one whose papers get passed around the office. You want to be the one where the admissions counselors say, 'Wow, look at this one!'"





Opportunities Abound

HIGH DEMAND for skilled workers in manufacturing increases the payoff for advanced education after high school.

After Rick Gutierrez graduated from high school in Comanche, he wasn't sure what he wanted to do. For a while he worked on a farm, repairing equipment and doing other chores.

"My dad kept pushing me to do something else," says Gutierrez, and when the farm laid him off, he decided to go back to school. "About five years later my dad said, 'The farm didn't really lay you off, I told them to fire you, so you'd be forced to go do something else.' He actually had me fired!"

It was a drastic move, but it paid off for Gutierrez. He enrolled in courses at the Texas State Technical College (TSTC) campus in Brownwood. He started working toward a degree in industrial maintenance, but became interested in the machining courses he was taking. "I ended up loving it, making something out of nothing," Gutierrez says.

Gutierrez switched to computer numerical control (CNC) machining work at TSTC, earning an associate's degree in two years, and quickly learned that it's a high-demand field.

One company in the area that is constantly on the lookout for skilled machinists is Round Rock's Centex Machining, a high-tech operation that manufactures parts and devices for orthopedic surgery, including full hip- and knee-joint replacements.

"There are very, very few skilled machinists in this part of the world," says Centex President Rich Phillips. "Because we do medical devices, they have to be made perfect. For medical implants, 'close enough' isn't close enough."

Amazing Work

"We decided a number of years ago that we got the best results by 'growing' our own employees," says Phillips. "So we teamed up with the TSTC campuses in Waco and Brownwood, which both offer two-year programs in manufacturing technology. We found that, if we hire their students, we can put them with one of our more experienced employees and bring them along quickly. We're so anxious to get the students that normally we offer them full-time employment and full benefits."

That's how it went for Gutierrez. "My teacher referred me to Centex, and they hired me over the phone. I went to have a look, and I said, 'Yeah, I'm in.' It's amazing work they do here."

Directions to Success

There are any number of different routes after high school to employment in manufacturing, ranging from employment right out of high school to advanced studies at a university.

For instance, says Rufus Lamere, chair of TSTC Waco's mechanical engineering technology department, "We have a one-year machining certificate program that is strictly to get people trained so they can get out in the shop and start working right away. We also have a two-year associate's degree that requires about 18 hours of academic courses."

At Tyler's Ingenuity Center, two-year programs are oriented to careers as a technician, machinist, and tool-and-die manufacturer, and there are quite a few of those.

"Our students can choose all different types of careers," Lamere says. "We have people who go to work, for example, at Bell Helicopter doing CNC gear grinding, which is a very specialized field. We had one student who's now making musical instruments!"

SOUTH TEXAS COLLEGE IN MCALLEN ESTABLISHED ITS FIRST BACHELOR'S DEGREE PROGRAM IN 2005: THE BACHELOR OF APPLIED TECHNOLOGY IN TECHNOLOGY MANAGEMENT.

TEXAS PRODUCES NEARLY 10 PERCENT OF
THE NATION'S COMPUTER
AND ELECTRONICS PRODUCTS AND NONMETALLIC MINERAL PRODUCTS, SUCH AS BRICK, GLASS, AND CEMENT.

Apprenticeships

In many cases, students can benefit from the high demand for skilled workers. Businesses and industries are often willing to help with apprenticeships and internships. "Students can enroll in community college and join a union apprenticeship program," says Bill Smith, with the Dallas Independent School District.

"They'll go to class one or two nights a week, for three or four years, and when finished, they come out with journeyman licenses that are recognized by unions nationwide."

Internships

Many colleges partner with area businesses. UT-Tyler has a relationship with Trane, a major manufacturer of air conditioners and heating equipment. "Trane has internships to which we can send students, offering summer or part-time employment," Hansen says.

Manufacturers are always looking for promising employee candidates. A number of aerospace manufacturers offer apprenticeships in the Dallas/Fort Worth area, for instance, as do petroleum companies around Houston.

Companies try out an employee before they make their investment in hiring them. It can cost between $7,000 and $15,000 to recruit, hire, and train a new employee. Internships are wonderful opportunities for companies to identify people that they'd like to hire. It minimizes their risk.

Advanced Degrees

If you choose to pursue education beyond a two-year degree, your job opportunities—and the potential rewards—will only increase. When you are interested in a four-year degree, you could go into industrial technology or industrial safety, and we have a master's degree in industrial management, which is about being responsible for planning and controlling the operation of a production plant. Industrial managers assist manufacturing engineers in making sure the production facility works appropriately, that the line is operating efficiently.

Texas A&M at Kingsville also offers a master's degree in industrial management through its college of engineering. At Southern Methodist University in Dallas, graduate students can earn doctorates in engineering plus industrial management. The program focuses on the application of engineering principles to planning and operational management of industrial production.

Continuing Education

Education doesn't end once you've earned a degree, either. Many people find that after a few years in the industry, they learn about careers they hadn't even thought of.

There aren't many students who say, 'I want to become a safety specialist' right out of high school. What happens is, they get into a manufacturing career and then develop a further interest in safety and become a supervisor in safety or safety training development. Many employees return to school to qualify themselves for career advancement.

"There are a lot of opportunities for advancement," says Gutierrez, "and moving up to engineering is great. If you're good at what you do and you're passionate about your work, you're always going to have great jobs and job offers."



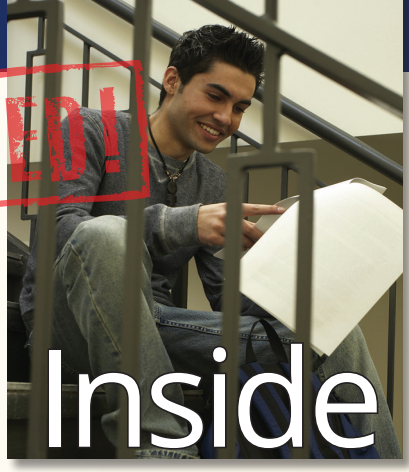


Get the CREDIT You Deserve

Dual credit in Texas is a great way to earn college credits toward a postsecondary degree while you're still in high school. Dual credit programs center on "articulation agreements," contracts between the student, his or her high school, and postsecondary institutions the student would like to attend. While most students take basic core courses such as English, history, math, science, and social science, coursework may include areas in Career and Technical Education.

Dual credit courses cover the same material as the equivalent college course, allowing the student to receive credit toward the college degree. It's like a bank account. The credit is banked for you at the college, and you withdraw it when you enroll.

Ask your counselor about advanced placement, dual credit, or articulated courses and other opportunities to earn college credit.



Inside College Admissions

SIX THINGS Texas students should know about getting into college

Applying to college is a lot like looking for a job or trying out for a team. You choose something that interests you, and then try your best to convince whoever is in charge that you have what it takes to be part of their organization. But whereas there might be only a few spots open on your high school's varsity football squad, there are thousands of places available in hundreds of colleges each year. Whether you are the first in your family to apply to college or both of your parents have advanced degrees, going through the admissions process can be stressful. Fortunately, there are plenty of free resources available for Texas college-bound students. The best is College for All Texans (**www.collegeforalltexans.com**), which features a list of all the state's colleges and universities, a checklist for selecting a school, and a link to the online Texas Common Application. To help you get started on your own college search process, here are six steps you should take.

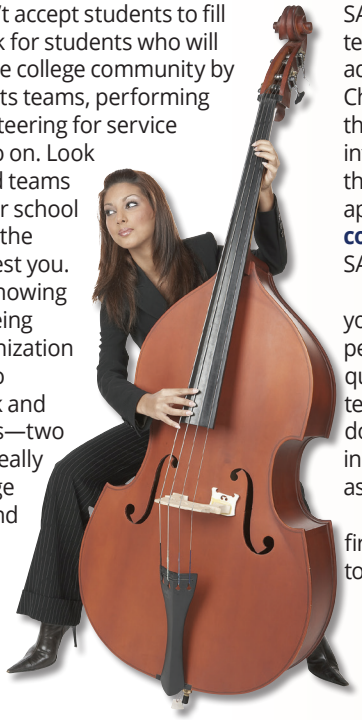
1. Make School Your Job

The first thing college admissions officers look for on your application is your grade point average. It's simple—you have to make the grades in high school to earn your spot in a college. The easiest way to do that is to think of school as your job, starting in your first year. If you show up late for work, slack off, and talk back to the manager, you'll get fired faster than you can say, "Do you want fries with that?" But if you always arrive on time, work really hard, and try to learn from management, then pretty soon you'll probably get a raise or a promotion.

What works on the job works in the classroom, too. Take challenging courses. Turn in all your work on time. Pay attention in class. Contribute to discussions. Ask for help when you don't understand something. By treating school as a career, you'll have a better shot at earning the grades and teacher recommendations that you need to move to the next level.

2. Get Involved in Activities

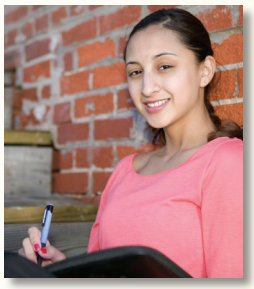
Colleges don't accept students to fill seats. They look for students who will add to the entire college community by playing on sports teams, performing on stage, volunteering for service projects, and so on. Look at the clubs and teams available at your school and sign up for the ones that interest you. In addition to showing school spirit, being part of an organization is a great way to build teamwork and leadership skills—two traits that can really help your college application stand out from the pack.



3. Build a Resume Portfolio

What if you had to take a final exam on the last three years of a subject and didn't have any notes to study? Well, that's exactly what it's like trying to complete a college application if you haven't kept an ongoing file of all your activities, honors, and employment.

Start your first year and build a career portfolio (see page 15). It's also smart to create a computer file called "college resume" and add to it each time you participate in a service project, win an award, get a new job, and so on. Use technology to create a resume format or ask your parents or guidance counselor for help. When you sit down to complete your college applications, review your career portfolio and call up the resume—all the information you need will be right at your fingertips.



4. Prep for Tests

Most colleges use scores from the SAT, SAT II, or ACT tests in making their admissions decisions. Check which tests the schools you're interested in require and sign up to take them in time to include the scores in your application. College for All Texans (**www.collegeforalltexans.com**) also has a free ACT, SAT, and GRE prep course.

Spend time preparing for the tests before you walk into the room with your No. 2 pencils and calculator. Go through sample SAT questions at **www.collegeboard.org** or ACT tests at **www.actstudent.org**. There are also dozens of test-prep books you can buy, some including software that tracks your progress as you go through sample exams.

Remember: If you don't do well on a test the first time, you usually can take it again and try to improve your score.

5. Make a List of Colleges

Do you want to stay in Texas for college or see another part of the country? Would you be more comfortable at a big university or a small college?

Think about what you would like to study and what matters most to you (like location, size, or religious affiliation), and then start developing a list of colleges that fit your criteria.

Use online tools like **www.collegeforalltexans.com** or **www.collegeboard.org** to learn more about each school and take online campus tours. Buy or borrow from the library some of the many college guides available. If possible, schedule visits to the schools you are interested in, or, through the school's admissions office, arrange an interview with a recent grad who lives in your area so you can ask questions about courses, faculty, or anything else.

By the fall of your senior year, narrow the list down to the top five or six choices. While some online applications are free, it can cost up to $70 per school to apply, so be realistic about how much you can spend on applications.

6. Submit Polished Applications

Once you send in an application to a college there's no taking it back, so make sure you get it right the first time. Double-check your spelling. If you use the same essay for multiple schools, remember to change the name of the school to fit each application. Make sure you have any required standardized test results (ACT, SAT, SAT II) sent to each school.

Be neat and complete, and meet every deadline. Make copies of each application before you hit the send button or pop it in the mail. If you don't receive an email or postcard confirming that your application was received, contact the college to make sure it arrived. Items can get lost or misdirected, especially when thousands of students are sending in applications at the same time. By having copies, you can easily submit again.

EVEN IF you get accepted to college, you'll never be able to pay the bill, right? Wrong! There's financial aid available if you know where to look.





Financial Aid BASICS

College isn't cheap. With tuition and room and board at private schools often topping $40,000, and even in-state, public schools costing several thousand dollars a year, you may wonder why you should even apply.

Well, don't worry. Every Texas student can afford to go to college.

"Access and affordability of higher education can be intimidating to students and parents; however, there are numerous resources available to walk you through the process and into an exciting future," says Heather V. Crowson, vice president for enrollment management at Sam Houston State University.

The secret to getting the aid you need to go to school is in filling out the necessary forms, getting good grades, and applying to schools that offer generous financial aid packages. (A financial aid package consists of need- or merit-based scholarships and grants plus work-study jobs and low-interest student loans.)

Here's a quick overview of steps you can take to get the financial aid you need to continue your studies after high school. For more information about the aid available at a specific college or university, go to the school's website and click on the "Admissions and Financial Aid" link. Many schools provide an online form you and your parents can fill out that will give you the estimated financial aid package you might receive if accepted to that school.

Apply: You definitely won't get any financial aid if you don't apply. To figure out how much grant money (which you don't pay back) and loans (which you do pay back) you'll need to afford school, colleges use a formula that factors in your parents' income and investments, your income, the number of kids in the family who will be in college at the same time, and other financial information. Families of all income levels may receive aid, so fill out the forms.



All schools require the Free Application for Federal Student Aid (FAFSA), which determines eligibility for federal aid, such as work-study, Pell grants, and the Stafford loan program; and for college grants and, sometimes, merit scholarships. Complete the application as soon as possible at the beginning of October your junior year. FAFSA forms and instruction booklets are available in your guidance counselor's office, or you can complete the form online at **www.fafsa.ed.gov.**

Most private schools also require applicants to complete a school financial aid application and, in some cases, the CSS/Financial Aid Profile form (**https://student.collegeboard.org/css-financial-aid-profile**) which is used to award nonfederal student aid funds. Carefully read each college's application to determine financial aid deadlines and what forms you will need to submit.

Study In-state: Whether you choose a public or a private school, staying in-state for college will cut your costs considerably. Plus, since Texas covers 267,339 square miles, you can "go away" to college without ever leaving the state.

To help ensure that qualified Texas high school graduates with financial need can go to college, the State Legislature established the TEXAS (Towards Excellence, Access, and Success) Grant Program. Grants can be used to study at any public college or university in the state and are equal to the student's tuition and required fees. In 2012-2013, approximately 33,100 students received TEXAS Grants. To apply, fill out the FAFSA.

Another way to score some serious state aid is to get good grades in high school. Texas students who are in the top 10 percent of their graduating class are eligible for automatic admission to any public university in the state. With that automatic admission comes the opportunity to apply for merit scholarships and special programs available at each school.

Take Two at a Community College: The first two years of many college programs are filled with core courses that could easily be taken at a local community college for a lot less money. If you fill out all the forms, do the math, and still can't afford a four-year school, enroll in a community college for the first two years, then transfer to a four-year school.

By living at home, working part-time, and getting required courses out of the way, you could save tens of thousands of dollars in tuition and room and board, and be able to afford to attend the college of your choice for junior and senior years. For a complete list of the state's community colleges, go to the Texas Association of Community Colleges website at **www.tacc.org**.

Target Your Search: Applying to a couple of colleges where your grades and talents put you near the top of the typical talent pool makes it more likely you'll qualify for merit aid and other special school scholarships and grants. Do a little research on college websites to find schools where your standardized test scores and grade point average rank you in the top 25 percent or so of the most recently accepted first-year class. Colleges want to attract the best and brightest students available, and often will offer attractive scholarship/grant/loan packages to convince those students to come to their school.

There are also more than 1 million local, national, and college-specific scholarships available each year. The trick is to find and apply for scholarships that best fit your strengths and talents. FastWeb (**www.fastweb.com**) is a free college scholarship search source. Register online and you will start receiving email notices about scholarships, internships, and other opportunities that fit the profile information you submit.

LOOK IT UP! Here are key words and phrases used in this guide that you may not already know.



What does that mean?

Articulation agreements: formal agreements between or among educational organizations (high schools, community colleges, and universities) that align courses and majors in a way that allows students to transition from one institution to another without loss of course credit or time.

Associate's degree: a two-year degree awarded by a community or technical college.

Bachelor's degree: a four-year degree awarded by a university.

Career and technical student organizations (CTSOs): curricular organizations for students that offer activities and competitions related to particular careers.

Career cluster: a way of organizing curricula, instruction, and assessment around specific occupational groups (for example, Information Technology or Health Science) that offers students core academics, coursework related to specific occupations, and extended learning experiences.

Master's degree: a degree awarded by universities for study beyond a bachelor's degree.

Career guidance: structured developmental experiences presented systematically from kindergarten through 12th grade that help students analyze and evaluate abilities, skills, and interests.

Career portfolio: a collection of student work indicating progress made in subjects, activities, or programs. In career cluster systems, portfolios are often used to assess student performance in extended learning experiences.

Doctoral degree: a degree awarded by universities for study beyond a master's degree. Also referred to as a Ph.D. or professional degree.

Dual credit: credit given in both high school and college for college-level courses taken while in high school.

Extended learning experiences: participation in career and technical student organizations, extracurricular activities, job shadowing, internships, or service learning.

Financial aid: scholarships, grants, loans, and work-study funds awarded to students to pay for college expenses.

Internship: an extended learning experience in which students work temporarily at entry-level jobs in careers that interest them.

Job shadowing: an extended learning experience in which students observe professionals in particular careers as they go through a day on the job.

Postsecondary education: education beyond high school. Middle school and high school are referred to as secondary education, so postsecondary means after high school.

Program of study: a way of organizing the curricula and educational activities within a career cluster related to a student's specific academic and career goal.

Service learning: an extended learning experience in which students do volunteer work related to their career goals.

Targeted industry clusters: six industry clusters that have been identified by Texas as high-demand, high-growth sectors paying high wages. As they are developed by the State, these may be hot areas in which to build a rewarding career.

Program of Study: an education plan suggesting the high school courses a student should take to prepare successfully for graduation and transition into postsecondary education. The vision for Texas CTE is that eighth graders, in consultation with their parents/guardians, counselors, and teachers, will select a program of study and create a plan. Plans are to be reviewed and revised at least once each school year.





Online Info

Explore these Internet resources for more about your education and career options.

TEXAS CAREER CHECK

The State of Texas has created a special website for students and others researching careers. It's called Texas Career Check. Texas Career Check lets you explore higher education options by looking at detailed information by school and program of study, AND you can explore careers, occupational information, and postsecondary education options. You'll find a wealth of information about hundreds of career choices. To explore Texas Career Check, go to **www.texascareercheck.com**.

America's Career InfoNet
www.acinet.org/acinet
This is the place to search for occupational information, industry information, and state-specific labor market information.

College for All Texans
www.collegeforalltexans.com
Here is everything a Texan needs to know about preparing for, applying for, and paying for college or technical school. And it's all in one up-to-date, easy-to-navigate mega-site almost as big as the state itself. Remember: $4 billion is available every year to help Texans attend college.

Employability Skills Framework
http://cte.ed.gov/employabilityskills/
Employability skills are general skills that are necessary for success in the labor market at all employment levels in all sectors. The Employability Skills Framework is a one-stop resource for information and tools to inform the instruction and assessment of employability skills.

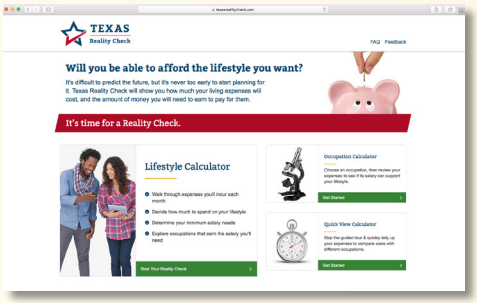
My Next Move
www.mynextmove.org/
This is a career planning resource for students, parents, career changers, and career advisors.

O*NET (Occupational Information Network)
online.onetcenter.org
Also available in schools and libraries, O*NET provides full information on occupations, including compensation, employment prospects, and skill matching for students. Information on compensation is available on a state-by-state basis.

U.S. Department of Labor Occupational Outlook Handbook
www.bls.gov/home.htm
This nationally recognized resource offers information on job responsibilities, earnings, working conditions, and job prospects for the future.

Take a Reality Check

The Texas Workforce Commission has created an online resource called Reality Check to help you understand how much money you'll need to live on your own after high school or college and how you can earn it. There are three ways to explore careers, expenses, and earnings. For the first option, which is called "Get a Reality Check," you choose an area you'd like to live in, such as Austin. You then go through a series of screens with real-world costs for items such as housing, clothing, transportation, health care, and personal expenses. The site automatically adds up your estimated monthly expenses, then uses salary information for Texas to show you careers that will make you that much money. The second option, called "Future Salary," starts with the wages you expect to earn, what education you plan to pursue, and the career cluster that interests you. Then it generates a list of careers in which you can make that amount of money. The third option, "Occupation Direct," begins with your occupational choice and the area where you want to live, then shows how your estimated expenses subtract from the salary for your chosen job. The site, which is at **www.careerwise.mnscu.edu/careers/realitycheck.html**, is a great way to play "what if" when it comes to mixing your job, earnings, and expense options.



The results of Reality Check show you how expenses add up quickly when you are living on your own.

TEXAS CTE

Texas CTE Career Clusters



Agriculture, Food & Natural Resources

Processing, production, distribution, and development of agricultural commodities and natural resources



Architecture & Construction

Designing, managing, building, and maintaining the built environment



Arts, A/V Technology & Communications

Creating, exhibiting, performing, and publishing multimedia content



Business Management & Administration

Organizing, directing, and evaluating functions essential to productive business operations



Education & Training

Providing education and training services, and related learning support services



Finance

Financial and investment planning, banking, insurance, and business financial management



Government & Public Administration

Executing governmental functions at the local, state, and federal levels



Health Science

Providing diagnostic and therapeutic services, health informatics, support services, and biotechnology research



Hospitality & Tourism

Managing restaurants and other food services, lodging, attractions, recreation events, and travel-related services



Human Services

Providing for families and serving human needs



Information Technology

Designing, supporting, and managing hardware, software, multimedia, and systems integration



Law, Public Safety, Corrections & Security

Providing legal, public safety, protective, and homeland security services



Manufacturing

Processing materials into intermediate or final products



Marketing

Performing marketing activities to reach organizational objectives



Science, Technology, Engineering & Mathematics

Performing scientific research and professional and technical services



Transportation, Distribution & Logistics

Managing movement of people, materials, and goods by road, pipeline, air, rail, and water

About Texas CTE

You may have seen the name Texas CTE on the cover of this magazine. What exactly is that?

Texas CTE is the name of Texas' college and career education initiative. The idea behind it is simple: Planning for the future so that students achieve lifelong success. As Texas CTE grows, you'll see how subjects such as English, math, science, and social studies are relevant to your personal goals and ambitions. You'll get the chance to begin a plan that gets you where you want to go in life. You'll have the opportunity to take courses and engage in extended learning experiences that give you marketable skills. Best of all, you'll be in control of your future. Read all 16 editions of Texas CTE in Action (available through your counselor) to explore Texas' career clusters and start on the road to success.