



TEXAS CTE *In Action*

A College and Career Planning Guide

DISCOVER YOUR Talents

**YOUR GUIDE to CAREERS
in SCIENCE, TECHNOLOGY,
ENGINEERING, AND
MATHEMATICS**

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



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.

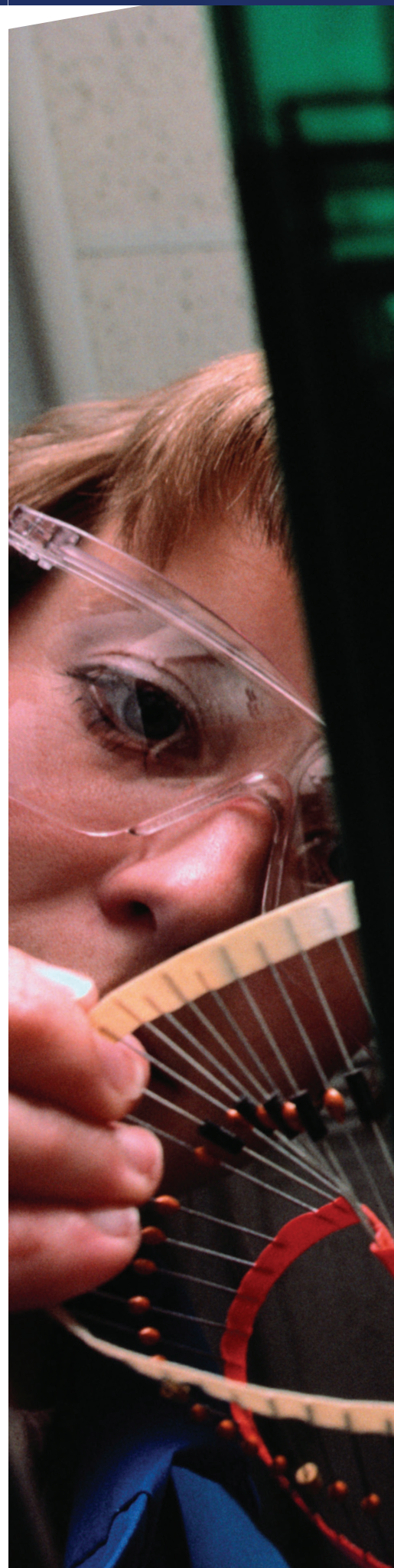
**YOU’VE HEARD
THAT ‘INFORMATION
IS POWER.’ WELL,
THIS GUIDE IS
POWER. IT PUTS YOU
IN CHARGE OF YOUR
FUTURE.**

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.



New Worlds

NEW DISCOVERIES ARE MADE EVERY DAY. Scientists, technologists, engineers, and mathematicians are pushing the boundaries of human knowledge by seeking to better understand and improve the world around us. They spend their time exploring everything from vast galaxies of stars to the tiniest subatomic particles. They invent the technologies that make our lives easier and more rewarding and develop solutions to problems that threaten our future. Thanks to the men and women on the cutting edge, we know more than ever before. If you are curious about the universe, dream of exploring new worlds of knowledge, or want to solve the planet's problems, then Science, Technology, Engineering, & Mathematics could be the right career cluster for you.

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 occupations.

- 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, a senior human resources generalist with IKON Office Solutions 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 issue of This magazine 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 Science,



Technology, Engineering, and Mathematics.

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).

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

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. 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.texasworkforce.com.



THE GRADUATE ENGINEERING
PROGRAMS AT THE UNIVERSITY OF TEXAS AT AUSTIN
AND TEXAS A&M UNIVERSITY-COLLEGE STATION
RANKED IN THE TOP 15 OF THE U.S. NEWS & WORLD
REPORT 2015 LIST OF TOP ENGINEERING SCHOOLS.

FIND OUT WHAT IT TAKES TO BECOME A
NASA TECHNICIAN, ENGINEER, SCIENTIST, OR
ASTRONAUT AT NASA'S EDUCATION PROGRAM

WEBSITE:

**[HTTP://WWW.NASA.GOV/OFFICES/EDUCATION/
ABOUT/INDEX.HTML](http://www.nasa.gov/offices/education/about/index.html)**

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 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, is your plan for preparing for the career of your choice.

First, you should choose a career cluster and an endorsement, not a particular occupational goal. In the eighth grade you might choose Science, Technology, Engineering, and Mathematics leading to a STEM Endorsement and then later become interested in a narrower field such as science or engineering.

The program of study you choose—your plan—does not stop with graduation from high school. You could then pursue a two-year degree as an engineering technician or a four-year degree in engineering.

You should set up a High School Personal Graduation 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, an undergraduate student in architecture enrolled at the University of Texas at Arlington, found his career calling at Dallas's Skyline Career Development Center, a high school with career programs in a number of different fields.

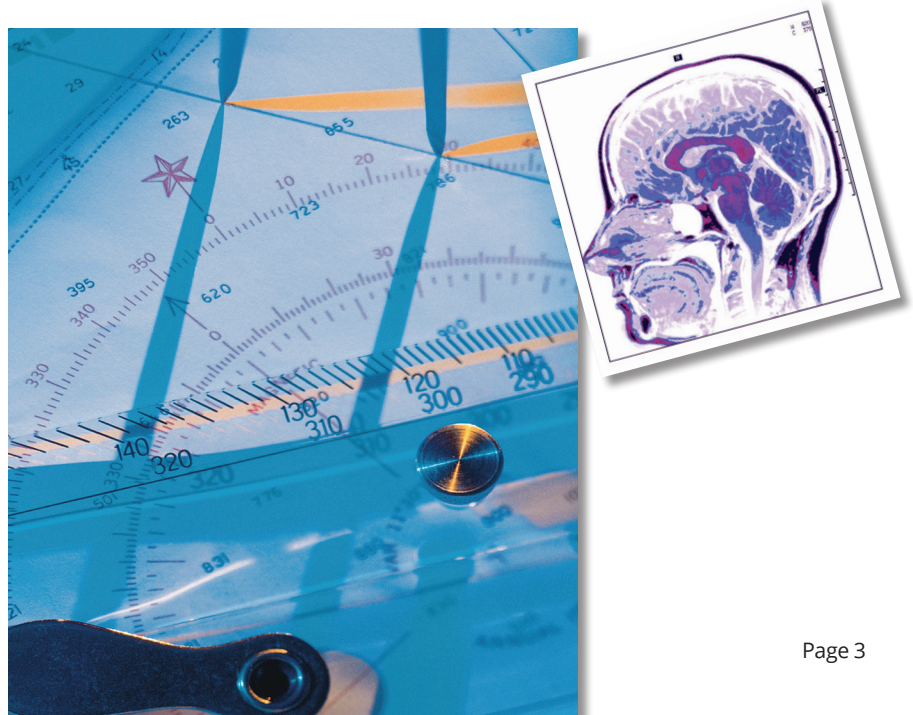
"Skyline is one of the few schools in the country that offer programs in architecture," Odamah says. "In some careers, Skyline students could even get professional certifications or licenses right in high school. It was a great place because you could find out whether you really wanted to enter a career."

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."

Science, Technology, Engineering, & Mathematics CTSOs

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

- SkillsUSA
www.skillsusatx.org
- Texas Technology Student 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 Science, Technology, Engineering, and Mathematics cluster, for example, includes chemists and civil engineers. Texas has adopted 16 Career Clusters (see back cover), the same ones designated and developed by the U.S. Department of Education.

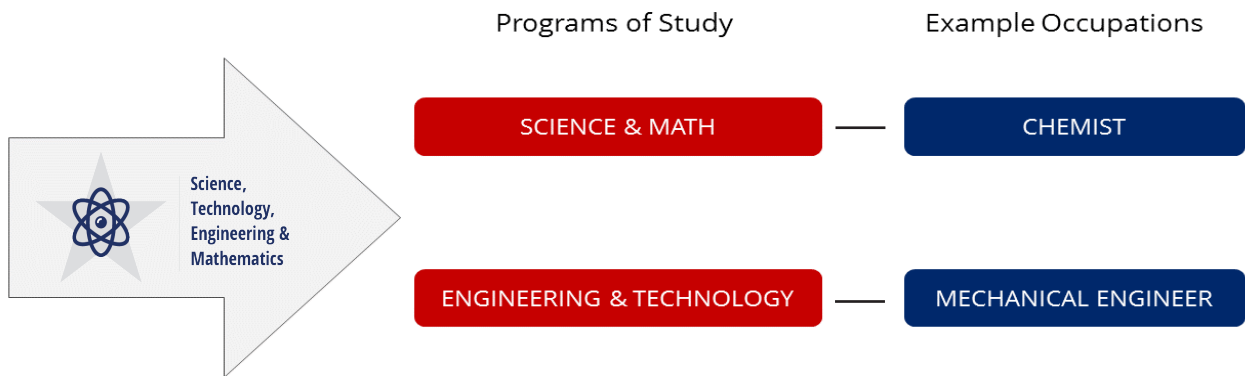
As the graphic below shows, within each cluster are programs of study, which are more specific groupings of similar occupations. Think of a program of study as being like a college major. In Science, Technology, Engineering, and Mathematics, you might choose to focus on Engineering and Technology in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

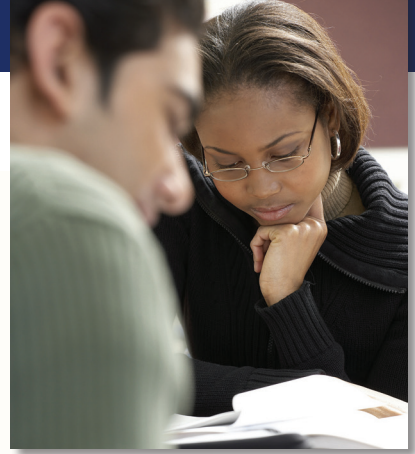
Related Occupations

Each career pathway in a particular cluster includes a range of related occupations; mechanical engineer is an example of an occupation that falls within Engineering and Technology. 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.

LIST basic information such as your name and school.

PICK a program of study within the cluster. There are two programs within the Science, Technology, Engineering, and Mathematics 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.

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 STEM (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.

High School Personal Graduation Plan

Name: Taylor Jones, West High School
 Endorsement: Science, Technology, Engineering, & Mathematics
 Cluster: Science, Technology, Engineering & Mathematics
 Program of Study: Engineering and Technology
 Career Goal: Mechanical Engineer
 Postsecondary Goal: Bachelor's Degree in Mechanical Engineering

Foundation High School Program Requirements (22 Credits)	STEM Endorsement Requirements (26 Credits)
English Language Arts (4 Credits) <ul style="list-style-type: none"> English I English II English III Advanced English Course Mathematics (3 Credits) <ul style="list-style-type: none"> Algebra I Geometry Advanced Mathematics Course Science (3 Credits) <ul style="list-style-type: none"> Biology IPC or Advanced Science Course Advanced Science Course Social Studies (3 Credits) <ul style="list-style-type: none"> 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)	Algebra II Science (1 Additional Credit) Career Related Electives (2 Additional Credits)
EXAMPLE CAREER RELATED ELECTIVES	
Concepts of Engineering & Technology Engineering Design & Presentation Principles of Technology Advanced Engineering Design & Presentation Engineering Mathematics Engineering Design & Problem Solving Practicum in Science Technology, Engineering & Mathematics	
DISTINGUISHED LEVEL OF ACHIEVEMENT	
4 Credits in Mathematics (Must complete Algebra II) 4 Credits in Science Requirements for at least the STEM Endorsement Remaining requirements	
PERFORMANCE ACKNOWLEDGEMENT	
Outstanding performance <ul style="list-style-type: none"> 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: Technology Student Association
 Extracurricular Experiences: Destination ImagiNation, FIRST High School Robotics Competition, International Bridge Building Contest, Junior Engineering Technical Society, National Engineering Design Competition, National Engineers Week
 Career Learning Experiences: Career Preparation—Paid and Unpaid, Internship, Job Shadowing
 Service Learning Experiences: Community Service Volunteer

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.

SCIENTISTS and engineers imagine the future and turn it into reality.



Build a Better World

Most people don't think of those working in Science, Technology, Engineering, & Mathematics careers as adventurers and explorers, but they're wrong. In their heads, these high-tech workers are boldly going where no one has gone before. From the iPod in your pocket to the personal computers in the school library, the things they discover and invent transform the way we live, work, and play.

"Engineers and technologists are those prepared to imagine, design, and build a better world," says John Hansen, Ph.D, director of the Ingenuity Center at the University of Texas at Tyler. The Ingenuity Center is dedicated to promoting the training of tomorrow's scientific adventurers in middle and high schools.

Hansen says this field is full of exciting—sometimes earthshaking—careers.

"The Science, Technology, Engineering, & Mathematics cluster offers a wide range of important career choices," he says. "In fact, the world's future will be propelled by ideas that will be developed by many of the men and women in these fields."

particularly bright for engineers who design our roads, rail systems, and bridges—the infrastructure we need to move people and goods.

"As the world's population continues to grow, the demand for infrastructure can only increase," he says, "and the need for more infrastructure will certainly mean a need for more and more engineers."

Focus on the Future

"People who succeed in this cluster generally have a strong attention to detail," says Hansen. "After all, get one letter wrong in chemistry and instead of aluminum—Al—you could end up with arsenic—As. That could be a pretty,

THE TEXAS MATH WEBSITE, [HTTP://WWW.WTAMU.EDU/ACADEMIC/ANNS/MPs/MATH/MATHLAB/](http://www.wtamu.edu/academic/anns/mps/math/mathlab/), OFFERS STUDENTS FREE, ONLINE MATH INSTRUCTION AND HELP.

Texas Is Terrific

Texas is a terrific place to be if you're interested in a career in science and technology. According to the Texas Healthcare and Bioscience Institute, the state boasts the third-largest number of scientists and engineers in the United States.

There's plenty of room for talented new minds, too. Texas had more than 675,166 jobs in the professional, scientific, and technical services fields in 2014, and the Texas Workforce Commission expects jobs in the sector to leap by 31 percent by 2022, well above the growth rate for all jobs in the state.

Jonathan Startin, manager of the Trans-Texas Corridor construction project for Halcrow, Inc., says the future is

10 Fast-Growing Careers

Occupation	% Growth 2012-2022	Annual Openings (2012-2022)
Petroleum Engineer	45%	1365
Information Security Analyst	45%	405
Operations Research Analyst	37%	330
Statistician	37%	55
Biomedical Engineer	36%	75
Actuaries	35%	55
Mathematician	33%	5
Computer Systems Analyst	32%	2,085
Civil Engineer	31%	1,285
Computer Support Specialist	27%	2,165

This is a projection of 10 fast-growing careers in Science, Technology, Engineering, & Mathematics in Texas from the year 2012-2022 and the number of annual openings created 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 5 new jobs for mathematicians created in Texas during the decade that the data covers. Sources: Occupational Outlook Quarterly, Spring 2014; Texas Workforce Commission.

10 Top-Paying Careers

Occupation	Average Wage	Entry-Level Wage	Experienced Wage
Architectural and Engineering Manager	\$77.09	\$46.03	\$92.61
Petroleum Engineer	\$76.61	\$42.63	\$93.59
Geoscientist	\$72.87	\$34.60	\$92.00
Computer and Information Systems Manager	\$64.97	\$41.66	\$76.62
Chemical Engineer	\$61.27	\$34.55	\$74.62
Natural Sciences Manager	\$60.46	\$36.68	\$72.34
Physicist	\$57.65	\$23.89	\$74.53
Actuary	\$55.16	\$32.00	\$66.73
Computer and Information Research Scientist	\$51.89	\$30.74	\$62.46
Nuclear Engineer	\$50.86	\$32.70	\$59.94

This is a chart of hourly wages for 10 of the top-paying careers in the Science, Technology, Engineering, & Mathematics 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.

serious mistake.”

“The ability to focus is absolutely crucial,” agrees Jeff Moehlenbruck, a director of research and development for Austin-based Zimmer Orthobiologics, a worldwide leader in development of hip replacements. “With so much information coming from so many sources,” he adds, “it’s really critical that you be a hard worker and stay on top of the information.”

It’s Never Too Late

To succeed in this cluster, you have to have a talent for math and science, but Hansen says some students, particularly women and minorities, tend to give up on science careers too early. “Many of these students,” he says, “who would be excellent scientists or engineers, preselect themselves out of these futures because they haven’t done well in precollege science and math classes.” So if you haven’t excelled in math and science so far, don’t assume you

can never be successful.

“Although diversity doesn’t guarantee invention and innovation, the more diverse our Science, Technology, Engineering, & Mathematics workforce is, the more diverse our ‘idea pool’ becomes,” Hansen says. “I’d encourage everyone to explore how to excel in math and science. It’s never too late to choose your own road to success.”

Communication and Creativity

Because teamwork is critical in technical fields, communication skills can be as important as math and science. “I always look for good team players,” says Startin. “Roads are not built quickly or by one person working alone.”

“Learning how to read, write, and speak English well is essential,” says Moehlenbruck. Creativity, too, is a plus. To make a difference in science and technology, you have to be able to create or design new and different approaches to problems.

Michael Dell, chairman of Dell Inc., based in Round Rock, became a billionaire by understanding the big picture and tackling challenges creatively. “It’s through curiosity and looking at opportunities in new ways that we’ve always mapped our path at Dell,” he has said in media interviews. “There’s always an opportunity to make a difference.”

“I look for creativity when I’m hiring,” says Startin. “A good scientist, mathematician, or engineer is always looking for a better solution to, well, everything.”



QUIZ

Is Science, Technology, Engineering, & Mathematics the right cluster for you? Take this quiz to find out. Answer “yes” or “no” to the following questions.

1.

Do you like to tinker with cars or small appliances?

2.

Are you interested in insects, snakes, frogs, or other animals?

3.

Do you like team sports?

4.

Do you like working with computers?

5.

Do you like visiting museums?

6.

Do you get good grades in math?

7.

Do you read scientific or technical magazines?

8.

Do you enjoy working on crossword puzzles?

9.

Are you good at building things from scratch?

10.

Does it bother you when people aren’t accurate and precise?

If you answered “yes” to five or more of the above questions, Science, Technology, Engineering, & Mathematics 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

MATH AND SCIENCE SKILLS

Multinational engineering firm Halcrow, Inc., is involved in building the Trans-Texas Corridor, a road and rail system that will span Texas from Mexico to Oklahoma. Jonathan Startin, the Halcrow senior consultant in charge of the project in Texas, says the project requires special skills. "First," he says, "we're looking for people who are good in math and physics."

ENGLISH SKILLS

Although science and math are important, it's just as crucial to be good in English, says Jeff Moehlenbruck, a director of research and development for Zimmer Orthobiologics, a worldwide leader in the development of hip replacements. "Verbal skills make a huge difference," he says. "It's important to be able to read, write, and speak English effectively. If you're the only one who understands your ideas, they won't go anywhere."

TEAMWORK SKILLS

"When I participate in hiring scientists, I look for teamwork ability and organizational skills," says Margo Marmelstein, oil and gas market manager for Thermo Fisher Scientific, one of the world's leading makers of analytical instrumentation. "I want to know that they will work well within their team, as well as across functions. I want to know that they can lead a project."

CREATIVE PROBLEM SOLVING

"When I'm hiring, I always look for creativity and a knack for problem solving," says Moehlenbruck. "I also look for diligence and decisiveness. In the current marketplace, we are thrown so much information and so many tasks that it's critical to be a hard worker and to be able to quickly ferret out the kernels of important information and act on them."

"I like to hire people who have creativity," says Startin. "People who ask good questions before focusing on a final solution."



The Need to Explore

THE KEY TO SUCCESS in Science, Technology, Engineering, & Mathematics is insatiable curiosity.

When he was a kid, Joseph Nors tore apart his big brother's model blimp to figure out how the electronics worked.

"I was always tearing apart toys," says Nors, now an electronics technician at the Federal Bureau of Investigation office in San Antonio. "As I got older, it was more expensive things, like old cell phones."

It's that kind of curiosity, a constant urge to get at the "why" and "how" of things, that makes for success on the job in Science, Technology, Engineering, & Mathematics.

Detective Work

"I use math all the time to answer questions like, 'Why am I seeing what I'm seeing in this satellite image?'" says Curt Reutner, an air pollution meteorologist with the Texas Commission on Environmental Quality.

"Sometimes when an unexpected pollutant shows up and we have no clue where it comes from," says Reutner, "it takes time and a lot of detective-like activity to figure it out."

The most exciting part of his job, Reutner says, is when

the detective work pays off. "You have that 'eureka' moment. You've figured out what's happening and why it's happening—the light bulb goes on."

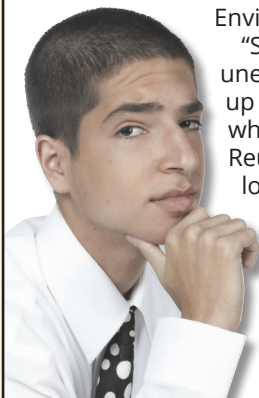
Nors says, however, it can take a while before you reach that moment, and that requires patience. "You can't get discouraged easily," he says.

Imagination Needed

To be a successful scientific detective, you need the ability to look at things in totally new ways, says Fort Worth chemist Michael J. Brubaker, who works in research and development at the pharmaceutical company Alcon Laboratories.

Brubaker, who directs research and development (R&D) activities for one of Alcon's eye-care product units, enjoys pursuing answers to challenging problems. "You have the freedom to use your mind to discover and create new ideas and new products," he says.

All that creativity has to begin with the ability to analyze and judge information, Brubaker adds. "The important thing in a science career is the ability to make sense out of the data and, based on what it gives you, decide 'What's next?'"



Continuous Learning

Because new discoveries are always being made in science and technology, analyzing data and new developments is something you have to do continuously.

"There are always inventions and creations that will change our jobs. We have to keep up with what is new out there," says Lisa Mahlmann, a senior manager of utilities and subsystems at Lockheed Martin Aeronautics Company in Fort Worth, responsible for design of the mechanical systems on military aircraft built by the company.

Most people in the field stay on top of the changes by reading scientific journals and attending professional conferences at which researchers and academic scientists present the latest findings, Brubaker explains.

Working with Others

Researchers not only come together to share the latest developments at meetings, but also team up on the job to generate the developments in the first place.

"Many people have an image of a scientist as a guy with a beard, lab coat, and Einstein-like hair working in a dark lab all alone," says Sharlini Sankaran, a biomedical engineer and the manager of education programs at Sigma Xi, a scientific research society. "In reality, scientists rarely work alone."

That makes communication skills critically important, Reutner says. "You could be the most brilliant person in the world, but if you can't write about your work or present it, nobody's going to get the message."

The Rewards

If you get your start in science and technology tinkering with gadgets to see how they work, as Nors did, then it's no surprise that the same sense of play and wonder can carry over to your adult work.

"I love to go to work," says Nors. "I refer to the electronics devices I work with as toys. It's just like being a little kid; we get to play with toys all day long."

Mahlmann says she gets "goose bumps" when she hears an airplane she helped design take off. "The sound of the whole system working together is really fantastic."

Reutner says when his work on pollution control plays out on a big scale, everybody benefits. "Many people say, 'Think globally and act locally,'" he says. "I'm living it. I'm actually making a difference in the world."

5 Cool Careers

CHECK OUT THESE EXCITING CAREERS IN SCIENCE, TECHNOLOGY, ENGINEERING, & MATHEMATICS.



1.

OCEANOGRAPHER

Understanding the world's oceans is a big—and important—job. Oceans drive the earth's weather, generate more than 70 percent of the oxygen we breathe, absorb carbon dioxide, and replenish our freshwater supply. Oceanographers team with other scientists to understand and protect this valuable resource. As an oceanographer, you might work on anything from pursuing ways to safely harvest food from the oceans to studying the effect of sonar on ocean life. Oceanographers are definitely riding the wave of our future.

2.

TV METEOROLOGIST

On TV, meteorology combines the glitz of show business with the fun of science. Behind the scenes, meteorologists get to analyze and interpret weather data to create their predictions. Then they use computer graphics programs to build the dynamic maps that we see on TV. With weather patterns shifting and changing every second, this can be a fast-paced, exciting—even glamorous—career choice.

3.

BIOTECHNOLOGIST

Biotechnology harnesses living cells and organisms to create useful products and answers to problems that previously had no solution. This approach has been around since people started using yeast to make bread rise. But today, biotechnologists are engineering living cells to create new strains of drought-resistant plants, to create drugs to treat previously incurable diseases, and to make plastic or fuel from corn instead of petroleum. You could be a part of this exciting new research.

4.

VIDEO GAME DESIGNER

Computer games are becoming more and more lifelike every day. How? Through the hard-earned sweat of game designers. Game designers combine skills in computer animation and interactive design with a deep passion for games to create simulations that are almost as good as—and sometimes better than—reality. Perseverance is key. Game designers spend months, even years, making their visions reality. These days, there's a whole lot of science behind the fun.

5.

NANOTECHNOLOGIST

In a world that has long thought that bigger is better, nanotechnologists work to make things smaller. It was once a writer's fantasy that a human could swallow a pill and have his or her insides photographed. Now, it's reality. Nanotechnologists work to get things down to the size of a molecule. Researchers in Michigan have even designed smart "nanobombs" meant to target diseased cells and kill or deliver drugs to them. For patients who could be helped by the therapy, smaller is better.

25

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Science, Technology, Engineering

Listed below are 25 careers you might consider in the Science, Technology, Engineering, & Mathematics cluster. Below are 25 careers you might consider in the Science, Technology, Engineering, & Mathematics cluster of occupations available to you at different education levels. Turn to the “Online Info” on the inside cover for more information on the cluster’s talents and ambitions. Here’s an explanation of the kind of information 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
19-1042	Medical Scientist, except Epidemiologist	17.0%	225	\$67,554	Doctoral degree
19-1022	Microbiologist	15.0%	30	\$53,797	Doctoral degree
19-1021	Biochemist and Biophysicist	21.0%	20	\$70,308	Doctoral degree
19-2012	Physicist	24.0%	70	\$119,995	Doctoral degree
19-2041	Environmental Scientist and Specialist, including Health	24.0%	315	\$75,445	Master's degree
19-2043	Hydrologist	17.0%	15	\$75,685	Master's degree
19-3092	Geographer	46%	5	\$62,091	Master's degree
19-3091	Anthropologist and Archeologist	21.0%	15	\$59,966	Master's degree
11-9121	Natural Sciences Manager	18.0%	65	\$125,747	Bachelor's plus experience
11-9041	Architectural and Engineering Manager	24.0%	750	\$160,339	Bachelor's plus experience
19-2031	Chemist	18.0%	200	\$66,401	Bachelor's degree
19-2021	Atmospheric and Space Scientist	22.0%	35	\$66,085	Bachelor's degree
17-2051	Civil Engineer	31.0%	1,285	\$98,563	Bachelor's degree
17-2171	Petroleum Engineer	45.0%	1,365	\$159,339	Bachelor's degree
17-2011	Aerospace Engineer	14.0%	290	\$105,761	Bachelor's degree
17-2031	Biomedical Engineer	36.0%	75	\$103,903	Bachelor's degree
17-2021	Agricultural Engineer	14.0%	0	\$81,929	Bachelor's degree
17-1021	Cartographer and Photogrammetrist	37.0%	45	\$50,115	Bachelor's degree
17-2111	Health and Safety Engineer, except Mining Safety Engineer	21.0%	100	\$96,283	Bachelor's degree
19-4021	Biological Technician	18.0%	190	\$41,054	Associate's degree
19-4092	Forensic Science Technician	17.0%	55	\$46,827	Associate's degree
19-4091	Environmental Science and Protection Technician	24.0%	185	\$44,941	Associate's degree

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.

g, & Mathematics



atics cluster. These are not all the career options in the cluster—they are just a sampling showing the variety back cover to research all career options in the cluster of your choice and decide on the ones that best fit your

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 microbiologist, for example, and you'll see that virtually everyone in the field has a college degree or better. 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 32 percent of the people working as chemical technicians have a high school diploma, while 39 percent have some college, and 29 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

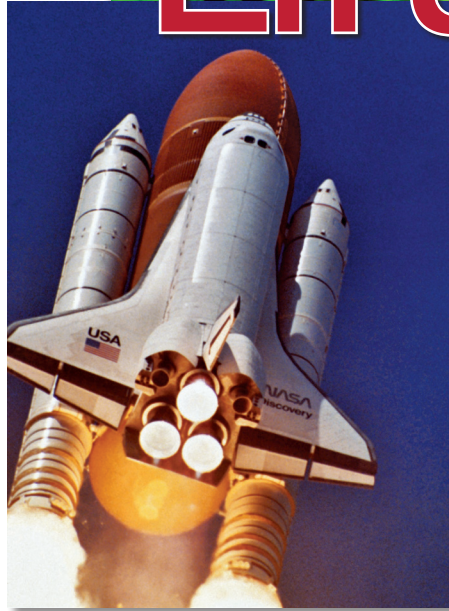
JOB DESCRIPTION: These are brief descriptions of each career from O*NET Online (online.onetcenter.org).

Education Levels	Job Description
	Conduct research dealing with the understanding of human diseases and the improvement of human health. Engage in clinical investigation or other research, production, technical writing, or related activities.
	Investigate the growth, structure, development, and other characteristics of microscopic organisms, such as bacteria, algae, or fungi. Category includes medical microbiologists who study the relationship between organisms and disease or the effects of antibiotics on microorganisms.
	Study the chemical composition and physical principles of living cells and organisms, their electrical and mechanical energy, and related phenomena. May conduct research to advance understanding of the complex chemical combinations and reactions involved in metabolism, reproduction, growth, and heredity.
	Conduct research into the phases of physical phenomena, develop theories and laws on the basis of observation and experiments, and devise methods to apply laws and theories to industry and other fields.
	Conduct research or perform investigation for the purpose of identifying, abating, or eliminating sources of pollutants or hazards that affect either the environment or the health of the population. Utilizing knowledge of various scientific disciplines, may collect, synthesize, study, report, and take action based on data derived from measurements or observations of air, food, soil, water, and other sources.
	Research the distribution, circulation, and physical properties of underground and surface water; study the form and intensity of precipitation, its rate of infiltration into the soil, movement through the earth, and its return to the ocean and atmosphere.
	Study nature, and use of areas of earth's surface, relating and interpreting interactions of physical and cultural phenomena. Conduct research on physical aspects of a region, including land forms, climates, soils, plants, and animals; conduct research on the spatial implications of human activities within a given area, including social characteristics, economic activities, and political organization; and research interdependence between regions at scales ranging from local to global.
	Study the origin, development, and behavior of humans. May study the way of life, language, or physical characteristics of existing people in various parts of the world. May engage in systematic recovery and examination of material evidence, such as tools or pottery remaining from past human cultures, in order to determine the history of earlier civilizations.
	Plan, direct, or coordinate activities in such fields as life sciences, physical sciences, mathematics, statistics, and research and development in these fields.
	Plan, direct, or coordinate activities in such fields as architecture and engineering or research and development in these fields.
	Conduct qualitative and quantitative chemical analyses or chemical experiments in laboratories for quality or process control or to develop new products or knowledge.
	Investigate atmospheric phenomena and interpret meteorological data gathered by surface and air stations, satellites, and radar to prepare reports and forecasts for public and other uses.
	Perform engineering duties in planning, designing, and overseeing construction and maintenance of building structures and facilities, such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, power plants, water and sewage systems, and waste disposal units. Includes architectural, structural, traffic, ocean, and geotechnical engineers.
	Devise methods to improve oil well production and determine the need for modified tool designs. Oversee drilling and offer advice to achieve economical and satisfactory progress.
	Perform a variety of engineering work in designing, constructing, and testing aircraft, missiles, and spacecraft. May conduct basic and applied research to evaluate adaptability of materials and equipment to aircraft design and manufacture.
	Apply knowledge of engineering, biology, and biomechanical principles to the design, development, and evaluation of biological and health systems and products, such as artificial organs, prostheses, instrumentation, medical information systems, and health management and care delivery systems.
	Apply knowledge of engineering technology and biological science to agricultural problems concerned with power and machinery, electrification, structures, soil and water conservation, and processing of agricultural products.
	Collect, analyze, and interpret geographic information provided by geodetic surveys, aerial photographs, and satellite data. Research, study, and prepare maps and other spatial data in digital or graphic form for legal, social, political, educational, and design purposes. May work with geographic information systems (GIS).
	Promote worksite or product safety by applying knowledge of industrial processes, mechanics, chemistry, psychology, and industrial health and safety laws.
	Assist biological and medical scientists in laboratories. Set up, operate, and maintain laboratory instruments and equipment, monitor experiments, make observations, and calculate and record results. May analyze organic substances, such as blood, food, and drugs.
	Collect, identify, classify, and analyze physical evidence related to criminal investigations. Perform tests on weapons or substances, such as fiber, hair, and tissue, to determine significance to investigation. May testify as expert witness in court. May serve as specialists in area of expertise, such as ballistics, fingerprinting, handwriting, or biochemistry.
	Perform laboratory and field tests to monitor the environment and investigate sources of pollution, including those that affect health. Under direction of an environmental scientist or specialist, may collect samples of gases, soil, water, and other materials for testing and take corrective actions as assigned.

High School

Liftoff

DESIGN your high school courses to get your Science, Technology, Engineering, & Mathematics career off the ground.



PROGRAM PROFILES

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

SCIENCE AND MATH

Those who choose careers in this field plan, manage, and provide research and professional services. Their goal is to improve our understanding of the natural world.

ENGINEERING AND TECHNOLOGY

Careers in this field involve problem solving in design and development of products and systems. Individuals pursuing these careers evaluate problems to develop and test solutions and provide advice and consultation.

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

Benjamin Salinas loved math from an early age. "In seventh grade I took Algebra and, at that time, a lot of my friends were very much into math," he recalls. "To this day, I still like math a great deal."

Then came an experience that changed his direction in life. During his freshman year at the Science Academy of South Texas (SciTech), a magnet school in Mercedes, Salinas took Introduction to Engineering Design, the first class in a series of courses designed by Project Lead The Way (see "Spotlight" on next page).

"My dad studied engineering at college," Salinas says, "but I had no idea what an engineer did. It was in that class that I first said, 'Oh, okay, this is what engineering is all about.'"

Salinas discovered he loved engineering, completed the Project Lead The Way program at SciTech, and is now studying at the Franklin W. Olin College of Engineering in Needham, Massachusetts.

"Looking back," he says, "I think it was vitally important that I got engineering experience at SciTech before I went to college. In fact, I'm certain I wouldn't be where I am today if I hadn't gone there."

Keys to Success

Right now in Texas, students just like Salinas are focusing their high school studies on Science, Technology, Engineering, & Mathematics. Preparation for a career in the cluster should start with rigorous academic courses.

Math and science are the most important classes for this cluster. Students in Science, Technology, Engineering & Mathematics programs of study should take four years of advanced math and four years of advanced science.

In math, the recommended courses are Algebra I and II and Geometry, as well as Calculus or Statistics, depending on which career program of study you choose to pursue. In science, the recommended courses are Biology, Chemistry, and Physics. For the advanced science, a number of options are available, including Earth and Space Science, Environmental Systems, and Engineering.

Career Electives

In addition to academic studies, it is recommended that you take Career and Technical Education (CTE) electives. These classes give you specialized knowledge and hands-on experience in your chosen program of study.

Students in the Science, Technology, Engineering, & Mathematics cluster



THE
INTEGRATED CIRCUIT
 COMPUTER CHIP WAS
 INVENTED IN JULY 1958 IN
 DALLAS.

follow one of two programs of study: Science and Math or Engineering and Technology (see “Program Profiles,” page 12). A lot of the same courses can be taken for either program, including Technology Systems, Electricity, Technical Writing, and Electronics.

Electives specific to the Science and Math program of study include Aquatic Science, Scientific Research and Design, and Meteorology. Electives specific to Engineering and Technology include Construction Systems, Manufacturing Systems, and Architecture Construction.

Certified Skills

What if you love technology, but don’t have the funds or desire to go to a four-year college? There are plenty of careers in the cluster that require less than a bachelor’s degree, particularly technician positions. Some jobs require a two-year associate’s degree in engineering, engineering technology, or computer science.

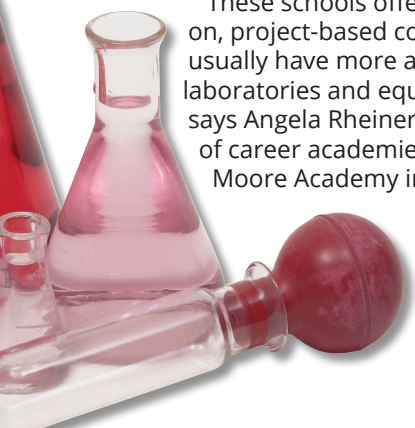
Other careers require only a certification you can earn during or after high school. Chris Newton, a junior at the Academy of Irving in Irving, says career and technical education (CTE) courses are preparing him to get his certification as a Cisco Network Associate Technician.

“These classes have helped me figure out what I want to do. Actually getting a job has become a reality,” says Newton. Once certified, he will be eligible for jobs paying \$18 an hour.

Special Academies

Some school districts take education in Science, Technology, Engineering, & Mathematics a step further (see “High-Tech High” at right). They establish separate high schools or academies within high schools that focus entirely on STEM careers.

These schools offer hands-on, project-based courses and usually have more advanced laboratories and equipment, says Angela Rheiner, director of career academies for A. J. Moore Academy in Waco.



Some require students to complete an internship or a senior project.

One of the academies at A. J. Moore is the Academy of Emerging Technologies. There, students in the environmental sciences program work with the U.S. Army Corps of Engineers to create a wetland to clean up a lake that is a main source of water for the community.

A Head Start on College

If you’re planning on going to college in this cluster, it’s a good idea to take Advanced Placement (AP) courses in math and science, says Cheryl Yowell, career and technical education

coordinator at McKinney Independent School District in McKinney. Courses in subjects such as Biology, Chemistry, Physics, Computer Science, and Statistics prepare you for tests which, if you do well, earn you college credit while you’re still in high school.

“Taking rigorous math and science AP courses put me at a level where I could compete in college with students who attended prestigious private schools or math and science academies,” says David Leal, an applications engineer with Freescale Semiconductor in Austin. Leal graduated from Rice University with a degree in electrical engineering.

SPOTLIGHT

HIGH-TECH HIGH

Project Lead The Way at the Science Academy of South Texas

The Science Academy of South Texas (SciTech) in Mercedes is ranked as one of “America’s Best High Schools” by Newsweek magazine. It focuses on Science, Technology, Engineering, & Mathematics and offers students a head start on college.

SciTech features the national Project Lead The Way curriculum—a series of courses that prepares students for rigorous college engineering programs and gives them practical experience working on real-world projects.

Mark Schroll, a SciTech technology teacher, says the curriculum is unique—students graduate with a minimum of five pre-engineering courses and twice the math and science courses required by the State.

“Though SciTech is a public magnet high school, we have no entrance requirements for the students,” Schroll said. “We get interested students from all walks of life and all skill levels. We draw students from many different school districts that stretch from one end of the Rio Grande Valley to the other.”

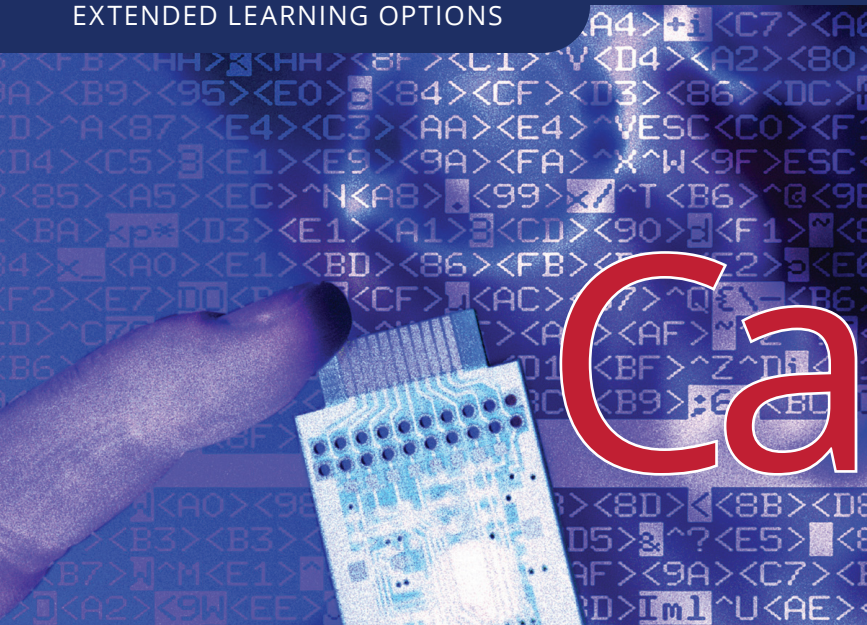
“The idea is to introduce engineering to high school students from an early age,” said Ben Salinas, a SciTech alumnus. “That

way they’ll get excited about engineering and they’ll be more likely to study it in college.”

SciTech’s engineering, math, and science classes are an effective college initiation. “I was very well prepared even though I came from an economically disadvantaged area,” says Salinas, who goes to the Franklin W. Olin College of Engineering in Needham, Massachusetts, “and I attend a top-ranked, very selective engineering school.”

When students come to SciTech they expect it to be challenging. “They may not always like that part when they are knee-deep in their work, but they see the payoff at the end,” Schroll says. “They watch as upperclassmen receive scholarships and go on to world-class colleges.”





Experiment with Careers

TRY OUT your career options with out-of-class learning experiences.

While still a student at James Bowie High School in Austin, Will Ward gained more than passing knowledge of the best depth at which to place sonars—underwater devices that use sound to track submarines and other objects—to protect U.S. naval bases. He was not working as a spy for a foreign country. In fact, he was part of the High School Apprenticeship Program at the University of Texas at Austin.

The program allows students to work at UT's Applied Research Laboratories on U.S. Department of Defense projects under the guidance of professional lab researchers.

As part of his experience, Ward explains, "I helped write the computer code that would determine the right depth at which to place sonar."

Hands-On Learning

The experience taught Ward not only about national defense, but also about the value of hands-on learning. "I learned that there is only so much you can do with pen and paper," he says. "Sometimes you just have to build it and see what works best."

There are several similar ways—including job shadowing, internships, apprenticeships, part-time jobs, and competitions—to gain real-world experience in Science, Technology, Engineering, & Mathematics outside the classroom, says Michael Rodriguez,

assistant director of the Upper Rio Grande Texas Tech Prep Youth Consortium, which coordinates career and tech-prep education in West Texas. "Some information can only be gained through real-life experience," he says.

Job Shadowing

One of the best ways to check out a career before making too much of a commitment to it, Rodriguez says, is spending a day following someone who works in a profession in which you are interested. When you job shadow, chances are just as good that you'll discover a career you don't like as that you'll find something you love.

"There are jobs that look glamorous," says Rodriguez. "One example is forensic science because of the way it's portrayed on television. But on TV, you don't see the long hours and the dirt and the grime. We've had students dead set on that career. Then we send them on job shadows. They walk out saying, 'I hated it. I don't want anything to do with forensics.'"

Interning

In an internship, a student gets a more in-depth look at a particular career by working for an employer in that field, sometimes for pay.

Sharla Crawford, a senior at Conroe High School in Conroe, liked environmental engineering when she job shadowed in the ninth grade. When she interned with an environmental engineer for an entire summer, though, she changed her mind.

"I really got to see what environmental engineering is about," she says. "There's a lot of paperwork and you deal with

the government a whole lot. I was like, 'Okay, this is not for me.'"

Another summer internship helped her find aerospace and mechanical engineering. It was with NASA's High School Aerospace Scholars Program at the Johnson Space Center in Houston. She worked with an aerospace engineer at the Neutral Buoyancy Lab. The world's largest indoor pool is used to simulate

THE UT MARINE SCIENCE INSTITUTE, ON THE GULF OF MEXICO IN PORT ARANSAS, BEGAN CONDUCTING RESEARCH IN 1946 AND IS THE OLDEST MARINE LAB IN TEXAS.

the weightless conditions of space. "It was an amazing experience," Crawford says.

Crawford adds that her internships helped her get into college. "I got a reply in three days from the college I wanted to attend," she says. "Then, in just a matter of days, they offered me a scholarship for \$5,000 a year for four years."

Competitions

Science and engineering competitions are another great way to gain real-life experience, especially in teamwork and leadership skills, says Debbie Jasek, who works with colleges on K-12 outreach as an associate research specialist for the state government's Texas Transportation Institute. Such competitions are usually held for teams. "In the real world, engineers and scientists don't work in isolation," she says. "They almost always





EACH FEBRUARY DURING **ENGINEERS WEEK**, TEXAS ENGINEERS WORK WITH MORE THAN 25,000 K-12 STUDENTS THROUGH SCHOOL VISITS, SCIENCE NIGHTS AND FAIRS, WORKSHOPS, AND OTHER ACTIVITIES.

work as part of a team.”

The Technology Student Association highlights competitions at its state and national meetings that include engineering design, radio-controlled transportation, and animatronics. SkillsUSA, a national organization that promotes leadership and career skills in all occupations, features electronics applications, mechatronics, and technical math among its competition categories.

Science Olympiad (<http://outreach.science.tamu.edu/scienceolympiad>).

php) is one of the largest competitions in Texas. It involves a variety of individual and team events that follow the formats of board games, TV shows, and athletic contests.

Another program is Destination ImagiNation (www.texasdi.org), in which students work as a team to apply creativity, critical thinking, and their own individual talents to solve a given challenge.

Finally, the First Robotics Competition (www.usfirst.org) challenges teams of students and their mentors to build a robot to solve a common problem and then enter it into a series of competitions with other teams’ robots.

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!’”

SPOTLIGHT

ENGINEERING EXCELLENCE Students Compete to Create BEST Robots

BEST (Boosting Engineering, Science, and Technology) Robotics is a nonprofit, volunteer-based organization whose mission is to inspire students to pursue high-tech careers by participating in sports-like robotics competitions.

“Some students cringe when you talk to them about a career in engineering,” says Ted Mahler, cofounder of BEST Robotics and engineer with Texas Instruments in Dallas. “In this program, professionals show them that engineering is a step-by-step process that they can master. Students in our program walk away with real engineering experience by solving a complex problem with limited resources and a firm deadline.”

BEST competitions are divided geographically into “hubs” consisting of at least eight schools each. There is no fee for schools to participate. Hubs are assisted in attracting sponsors, and industry professionals and teachers act as mentors for the students.

The BEST competition kicks off in September. Teams are provided with identical kits of equipment and presented with the rules, theme, and playing field, all of which vary each year.

Game Day occurs six weeks after kickoff and includes two parallel competitions. The



first, called the Robotics Game, allows teams to compete in a series of three-minute matches. The second, the BEST Award competition, takes into account each team’s notebook, oral presentation display, and spirit and sportsmanship. The award is presented to the team that best exemplifies the concept of boosting engineering, science, and technology. There are 15 Texas regional BEST competitors held at various postsecondary institutions across the state. The Texas BEST Championship is held at the University of Texas at Dallas.

“It’s no accident that our regional competitions take place on college campuses,” says Mahler. “We want to familiarize students with the college atmosphere and reinforce that, yes, they can go to college and succeed.”

For more information on BEST Robotics visit www.bestinc.org.



I think knowledge is a reward in itself," says Arland Alberts, an instructional laboratory supervisor in the department of biology at the University of North Texas.

That said, Alberts believes that more education after high school is also important for very practical reasons: it is the main road to success in careers in Science, Technology, Engineering, & Mathematics.

"When you pursue science," she says, "you definitely want to go all the way to a master's or a doctoral degree. This

CONTINUING YOUR EDUCATION after high school is vital for success in Science, Technology, Engineering, & Mathematics.

will ensure a better understanding of both scientific theory and field experience and how they rely on one another."

Scientific Studies

If you choose the four-year college route, be prepared to study harder and longer than in high school, says Benjamin Salinas, who attended the Science Academy of South Texas in Mercedes (see page 13) and is now an engineering student at Franklin W. Olin College of Engineering in Needham, Massachusetts.

"In terms of the technical skills I learned in high school compared to the skills I'm learning now, the classes I'm taking now are much more in depth," Salinas says. "We do more working on projects as teams in college than in

high school, partly because that's the environment Olin has created."

Salinas adds that the college workload is greater than in most high schools. "Some of my college friends say, 'I didn't do any work my senior year of high school.'" At Olin, Salinas says, "that would get you in trouble fast."

Once you leave high school, there are plenty of opportunities for first-rate four-year college instruction in Texas. Rice University, the University of Texas in Austin, and Texas A&M at College Station, for example, have been ranked among the top 100 universities in the world. Rice placed 33rd among colleges in America in the latest listing by U.S. News & World Report. The magazine puts UT Austin's graduate program in engineering among the top 20



YOUNG TEXAS-BASED CHEMICAL RESEARCHERS ARE ELIGIBLE TO WIN THE WELCH FOUNDATION'S \$100,000 HACKERMAN AWARD.

THE NUMBER ONE ENGINEERING GRADUATE SCHOOL FOR HISPANICS IN 2012 AND 2013 WAS THE UNIVERSITY OF TEXAS AT EL PASO (UTEP).^{*} UTEP'S COLLEGE OF ENGINEERING RANKS AS ONE OF THE TOP FIVE SCHOOLS AWARDING BACHELOR'S DEGREES TO HISPANICS. ^{*}SOURCE: HISPANIC BUSINESS MAGAZINE

nationwide and its graduate program in earth sciences in the top 10.

Community Colleges

If you've gone through high school without making a big academic splash, however, don't write off careers in math and science automatically. There are occupations in the field—such as lab support or manufacturing process technicians—that require applicable work experience, a one-year certificate, or a two-year associate's degree from a community college.

Some Texas community colleges and technical schools award associate's degrees in cutting-edge technologies and applications, such as computer-aided drafting and

computer network engineering. Texas State Technical College (TSTC) at Harlingen, for example, offers an associate of applied science degree in mechatronics technology, which deals with the integration of mechanics and electronics in product and manufacturing system design.

One-year certificates in advanced technologies are also available at the four campuses of the Texas State Technical College. At TSTC in Waco, for example, students in digital media design earn the virtual reality advanced technical certificate by mastering the state-of-the-art Vicon 82 Optical Motion Capture system. The equipment replicates the motion of the human body for medical research, engineering, and special effects in movies and video games.

Two-year colleges are also great places to qualify for studies toward a bachelor's degree in science or technology at a four-year college. Credits earned in community college usually transfer to four-year schools, and are often less expensive to obtain.

Military Training

Another alternative for education in many areas of Science, Technology, Engineering, & Mathematics is today's high-tech military. Many employers value the kind of hands-on work experience gained during military service and servicepeople value the boost it can give their careers.

Dan Garza, for example, now a project manager with Hewlett Packard in Houston, credits his army training with giving him his career start in technology and communications.

"I was into radios in high school," he says.

"When I entered the army after high school, I was told, 'We have several different radio schools you can go to,' so I studied radio technology in the service. When I came back, I went into electronics technology, working for the telephone company, then for Chevron Oil, but always in technology and communications."

Whatever route students take to their career goals after high school, Garza is a firm believer in the value of training in science and technology.

"Technology would be one of the primary fields that I would really try to push," he says, "and I don't just mean computers. I mean technology in general, because there are so many different fields in technology. It can be technology in medicine, technology in business, in the aerospace industry, in communications."

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.



ACCEPTED!

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.

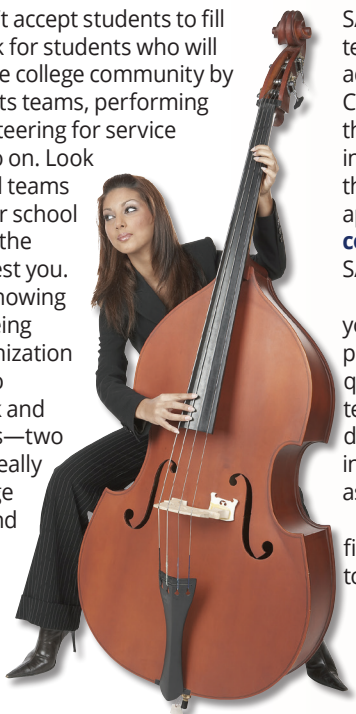
1. Make School Your Job

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.

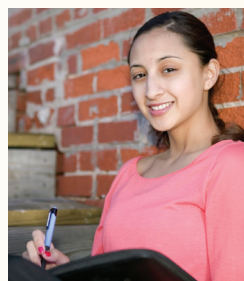
Start your first year and build a career portfolio (see page 15). It's also smart to create a computer file called "college resume" and add to it each time you participate in a service project, win an award, get a new job, and so on. Use technology to create a resume format or ask your parents or guidance 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.



Inside

College Admissions

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.

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.



Financial Aid

BASICS



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.

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.

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.

O*NET (Occupational Information Network) online.onetcenter.org

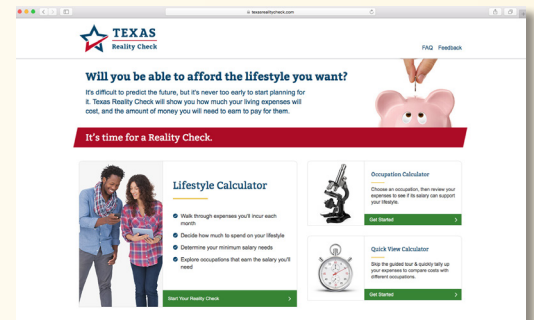
Also available in schools and libraries, O*NET provides full information on occupations, including compensation, employment prospects, and skill matching for students. Information on compensation is available on a state-by-state basis.

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 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.