FAMILY COMPANION GUIDE

Your Questions Answered

TEXAS EDUCATION AGENCY
TexasEcosySTEM

WELCOME

The STEM (Science, Technology, Engineering and Math) Family Companion Guide is for caregivers, anyone who plays a parenting role, and anyone who believes children and teens deserve the best future. This guide will help you navigate the educational decisions your child will face preparing for the future career.

This Companion Guide answers the questions caregivers often ask. This includes family research and information that teachers feel is the most important related to STEM.

We have kept answers brief and user friendly with a focus on statewide information, national statistics, and meaningful research. We provide online links for those who wish to learn more. There is a lot here, so we suggest you skip to the questions that interest you. Please use this as a resource – do not feel as though you must read it all at once.

We believe STEM can grab students' interest through hands-on activities and help them grow into problem solvers and critical thinkers. If you are a big STEM fan already, great! If not, we hope this guide sparks your interest.

You can open the world of STEM to your child in these simple steps:

1. Talk to your child about STEM;
2. Encourage your child to actively engage in STEM classes at school; and
3. Expose your child to STEM activities outside of school.

We have included the story of young STEM professional Sarah in this Companion Guide as an example of how these three actions shaped exciting, rewarding work that blends her curiosity, love of nature, need for variety and desire to travel. Without supportive parents and teachers, and exposure to STEM activities and education, she would not be living her dream. Her route was not direct, yet early STEM experiences and encouragement pushed her to succeed. We hope she inspires you.

We would like to thank the Greater Cincinnati STEM Collaborative for their original work with this guide and for allowing Texas to adapt it for our Texas EcosySTEM.

For more information, please go to https://tea.texas.gov/academics/college-career-and-military-prep/science-technology-engineering-and-mathematics-education-stem

Contact: Michelle Sedberry, STEM Coordinator
michelle.sedberry@tea.texas.gov

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HELLO

Elaine & kids

Fellow Parents,

Hi, I'm Elaine Williams, and I am the parent of two children, an eighth grader and a freshman in high school. I have worked in Education for over 15 years and have always volunteered by tutoring, making phone calls, coaching sports, fundraising, serving on committees, or finding resources and programs for other parents to assist their children in school. I know that staying involved with their children's school and becoming a true partner will enhance your child's learning process.

The STEM Family Companion Guide is one of those resources that everyone can use to assist with educating the children through your daily routine. You may realize you are already using STEM in your everyday interaction with your children. I did, and I am no rocket scientist.

I hope you enjoy this STEM companion for families. From my personal experience, I know how valuable STEM can be.

-Elaine Williams

TAMRA'S STORY

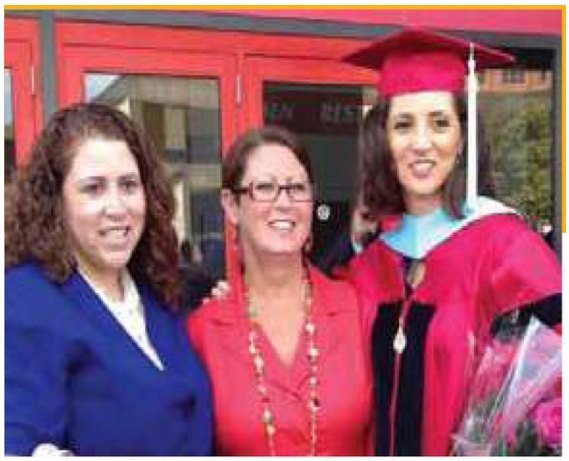
Strict standards, falling in love with math charted unusual path

Tamra's mother was vigilant about her daughter succeeding in math, grounding her if she brought home less than an 85 percent. "*My mother was serious, but also very inspiring. She believed in me and said anything worth having is worth working for. She told me I was smart, but she always focused on the work.*

Learning from the example, Tamra built grit after taking Algebra I, II and pre-calculus twice in high school. ''*A lot of people believe that if you are a math teacher or professor (as she has been) that it comes easily. For me, that is furthest from the truth. I struggled mightily.*"

In fact, Tamra failed a number of times, but always rebounded. A fresh-faced teacher caught her attention with geometry, "*where I experienced a love of learning math, even though it was a challenge.*" She was named most improved student. To follow the teacher the next year into an honors class, Tamra enrolled in a summer community-college course, but was placed in the lowest class. As a result, she insisted on transferring to public school, where, with few students and much teacher attention, she persevered, earning an A.

Again, placing in pre-calculus on a college math-entrance exam, she "*decided then and there to get an A. There was a behavior change and I didn't blame my teachers as I had. I sat in the front of the class, took notes, re-wrote those notes, used different colors, created note cards and drilled myself. I did my homework the day it was assigned so I had time to see my professor, but the biggest benefit was the small cohort I traveled in from class to class. Studying together was a great support system.*"



Tamra with her mother, Yvonne Curington, and sister, Shelly Ragland, at her 2012 Ph.D. graduation ceremony. Her early math failures taught her persistence.

For her, the choice of a Historically Black College/University was crucial to success. Tamra is bi-racial, identifying as African American. "*The math department chair, Dr. David Adams, would sit with me for 45 minutes and let me work through many questions. That was the difference between a small college versus a large university.*"

Originally enrolled in engineering, Tamra switched to math "*due to my frustration with physics and circuit theory. Math made sense because I had taken so much.*" It was then that she vowed to pursue a Ph.D.

Parenthood after graduating altered her path. "*I went home to figure it out and started subbing. In a high school one day, I was giving a test and saw how apathetic the students were: some were not even attempting the test, some fell asleep. I thought then I could be a teacher who could help.*" She completed a master's, then taught in the public schools. "*It's an interesting thing to have been a student, a teacher, then a professor preparing future teachers and also a mathematics-education researcher for in the same district.*"

Fast forward several years and Tamara selected a doctorate in education program *"with an emphasis on math teaching and*

learning because I wanted to be the math supervisor of an urban district." She completed her coursework over ten years *"researching four African-American girls taking algebra I as ninth graders, their experiences and perceptions, comparing them to my own"* for her dissertation.

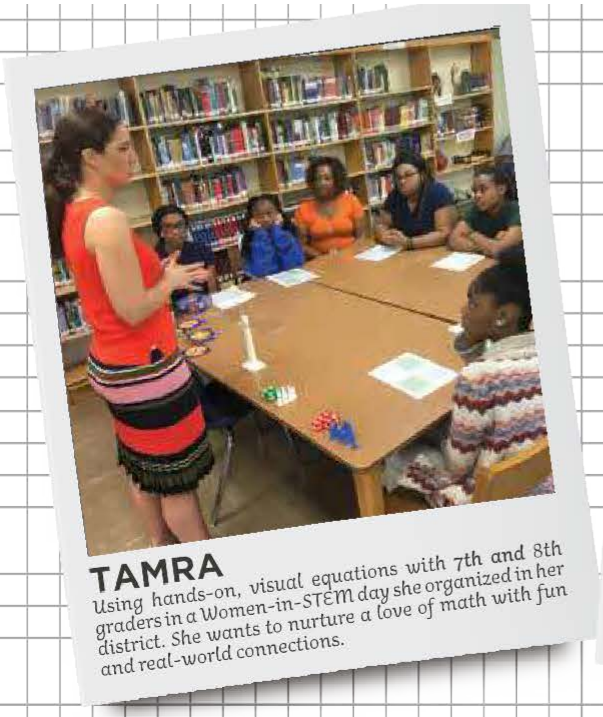
As a society, Tamra believes we discourage girls from pursuing math. *"We have these beliefs about math and engineering and the stereotype that they are for white males and Asians. Girls and minorities don't do math. Sometimes we pass along implicit biases unaware."*

She works to combat that message as well the misconception of a math gene in her duties as a supervisor of curriculum and instruction. She handles math, science, English as a second language and gifted teaching and learning for the entire district.

"A math brain does not exist," according to Tamra. *"Math requires time, experience and practice. Teaching math is like when I played high school basketball. The test is the game, homework, and class work. The practice. It's okay to make mistakes as long as we learn from them before we play the game."*

The math expert who once fumbled considers math *"the language that opens the door, answering the questions of why it is important to learn, what does it do?"* She has students gather clues from Edgar Allen Poe's creepy classic, *"The Pit and the Pendulum."* To measure how much time the victim has to escape or grabs their attention, asking them to figure how much time they really (don't) have to safely text and drive.

"Some people can live without being able to calculate the equation of an ellipse – the path of the sun. Like going to a foreign country and not being able to speak, you can live without it, but won't appreciate what's going on around you. You won't understand the beauty and mystery behind all of these things or, possibly, have as much fun."



TAMRA

Using hands-on, visual equations with 7th and 8th graders in a Women-in-STEM day she organized in her district. She wants to nurture a love of math with fun and real-world connections.

TAMRA

Collaborates with other educators in a project that combines math, physics with literature that asks students to create an evidence-based public-service announcement on texting and driving

Parent Tips:

Tamra as a baby with the mother who would inspire her to keep trying.

1. START with your child's teacher first, then your school district to uncover all the STEM enrichment opportunities that might interest your child. Use the Texas EcosysSTEM website and The Connectory to find hands-on experiences and real-world applications essential to developing your child's curiosity.

2. SUPPORT your child's natural exploration. Parents have to be willing to have a conversation. It doesn't have to be high level; ask where your child thinks the bug lives, count its legs and wings.

3. FIND a tutor if your child is struggling; don't wait.

4. ENCOURAGE your child to play an instrument. By counting whole, half, quarter, eighth and sixteenth notes, they learn fractions and how to add different denominators. Music provides several math applications.

5. FOCUS on developing a growth mind-set in your child. Let your child know that failure and mistakes are valuable parts of this process.

6. ENCOURAGE your child to believe in themselves. Depth is more important than speed. Faster in not smarter. Mathematicians often think very slowly, yet deeply.

MAPPING MATH
BEFORE HIGH SCHOOL

> Grades K-3

Developing foundations of strong number sense and algebraic reasoning

> Grades 4-6

Applying foundational mathematics and exploring mathematical and geometric relationships

> GRADES 7-8

Applying algebraic thinking, proportional reasoning, expressions, and equations

01
MASTERING STEM BASICS

Sarah at the volcano rim. Photo Courtesy of USGS-HVO

SARAH'S STORY

Perfect STEM career product of supportive parents, right placement

Twenty-four-year-old Sarah, always dreamed of working outdoors and of traveling the world, being physically active, and making a difference. She couldn't help it. Her parents loaded her in a front pack as an infant and trekked Mt. Leconte, the highest point in the Smoky Mountains. Her family visited national parks, camped, and hiked. They have ticked off an impressive list.

"I was 100 percent looking at jobs that were NOT sitting at a desk," Sarah says. *"I wanted a career that got me outside and had me constantly moving, that would take me places in the world to discover new things. That really narrowed my choice to geology, where you have to travel or you only know the local geology. You literally study the world, know the distinctive parts, how they connect, how they are different and how they work together.*

When I was 11, we went to Yellowstone National Park and I learned about super volcanoes, magma and geothermal activity." Sarah remembers. *"It was the first time I ever went to an active volcano and it was so big, mysterious and unknown. I had no idea then it would be my future."*

Sarah just graduated with a master's degree in geophysics and landed a dream job: deformation geophysicist for the US Geological Survey - Hawaiian Volcano Observatory on Hawaii's Big Island. Translation: Sarah hikes the volcano to measure its activity.

What is STEM?

STEM is short for science, technology, engineering, and math. STEM teaches science, math, and engineering as a whole, using technology to relate learning to the real world. STEM education and training increase the number of college science and technology graduates entering a growing workforce. Students succeed with in-demand STEM jobs!

STEM challenges students with projects, concrete knowledge, and experience. For example, a digital-drawing program may be included in a geometry lesson. STEM is hands-on, mind-on, and feeds natural student curiosity, when they are most ready to learn.

STEM is also known as STEAM (STEM + Arts). The arts include design, which is how STEM interacts with the world, so we often group arts as a family member. STEM appears here as the most commonly used term. STEM education is a method of hands-on teaching and learning where students learn to apply academic content by creatively solving real-world problems with innovative design-based thinking to prepare students for future career opportunities.

Why is STEM important?

STEM is everywhere, shaping our daily lives. Walk outside into nature (science), pick up your cell phone technology, drive a car designed by engineers or bake brownies using math to measure, select the correct oven temperature and timing. We are a technology-driven society and those with STEM skills better meet challenges, enjoy a higher quality of life and greater income. STEM careers are also "helping" professions that solve the problems facing our communities with rewarding work.

Promoting STEM does not necessarily mean every child will become an engineer. However, STEM is for everyone and grows children in these ways:

1. STEM prepares children for an ever-changing technological world. From the Internet to inventions we can't yet imagine, those with technology and technological skill hold an advantage.

2. STEM teaches kids how to analyze and problem-solve, developing critical thinkers. The thought patterns math and science develop also apply to the many challenges of work, career, and life.

3. STEM builds creativity. Brainstorming, designing, tinkering, collaborating, contributing & communicating opens our children's minds to more possibilities in the lab or architecture studio, 3-D printing, gaming, web-design, and industrial fields.

4. STEM education develops "21st- Century skills or employability skills" to increase emotional intelligence and build stronger relationships. STEM education uses group activities, where students learn to listen, empathize, express and promote themselves, and draw parallels between learning and the larger world.

5. STEM builds grit. STEM subjects are challenging. As children struggle, they increase their skills and learn not to give up. Intelligence is created through effort.

6. STEM creates confidence when students overcome the challenges of difficult tasks or subjects. As a result, they become lifelong learners able to tackle new demands.

7. STEM fields are growing in demand and pay higher wages. The Texas Work Force Commission projects Texas will have the second-highest percentage of the nation's future STEM job opportunities by 2026.

8. STEM inspires innovators & inventors. Entrepreneurs who create products and services that improve our lives are the single, largest source of new jobs for our economy.

9. STEM will improve our world standing. In the PISA 2018 Worldwide Ranking, the latest tests of 15-year-olds from around the world, American kids ranked #37 in math and #18 in science
- far behind many other industrialized nations.

10. STEM solves the world's problems with research that cures diseases, engineering that modernizes decaying transportation systems and technologies that produce new jobs. STEM talent will fix global problems and improve our lives.

Let's not forget that STEM is just plain fun, tapping our natural curiosity, the joy of discovery and learning about the world.

Defined by The Partnership for 21st Century Skills, these are a set of abilities that students need to develop in order to succeed in the information age and include:

- Learning Skills: *critical thinking, creative thinking, collaborating, and communicating*
- Literacy Skills: *information, media, and technology literacy*
- Life Skills: *flexibility, initiative, social skills, productivity, and leadership*

For more information visit: https://k12.thoughtfullearning.com/FAQ/what-are-21st-century-skills

Q: Why should parents be involved in STEM?

Your focus on STEM shows that you care about your child. You are your child's first teacher, a role that doesn't end when school starts. You have the most influence with your child.

When parents play an active role, their children are better learners, regardless of income, race or the parents' education, according to research. Teachers also encourage participation in STEM. The National Science Teachers Association believes parent or caregiver involvement increases children's interest in and ability to learn science. Children of engaged parents are more confident, do better in math and are more likely to choose and stay in STEM careers.

Not surprisingly, your children value your opinions and attitudes. In a national survey of students in STEM fields, 32 percent said a parent had the most influence on the decision to study STEM and 73 percent said that a parent had some influence on their decision.

Q: How do I talk to my children about STEM?

A strong strategy includes a discussion of STEM and future careers. Please do not feel overwhelmed if your child dislikes STEM classes or can't yet look ahead. The earlier you talk about it, from elementary to high school, the more easily your child will choose STEM. These tips, along with those in our resource section, will equip you for these conversations:

01

UNPACK THE MEANING OF STEM.
Start with the simple definition (science, technology, engineering, math) and share examples they know. Tell your story or of someone who works in a STEM field, what they do and why it matters. Using one of your child's interests, like watching TV, talk about how STEM makes it work. Explain STEM is a helping choice that improves lives around the world with safe drinking water, devices for better hearing and vision and communication to distant places.

02

PUSH YOUR CHILD'S NATURAL CURIOSITY.
Remember their early why-why-why questions? Children are born curious; discover their interests and strengths by exploring their questions as they respond to the world around them. You encourage their natural curiosity with your own why-does-this-happen and how-does-that-work questions. Share and support your child even if you don't know the answers. Google, libraries and people you know are good resources.

03

HOLD UP A STEM MIRROR, SO THEY SEE THEMSELVES.
Point out how their natural interests relate to STEM. A nature and outdoor lover could become an environmentalist, maybe the young artist is a promising digital designer. Identify your child's strengths that relate to STEM. Kids are naturally drawn to STEM when they build forts, collect bugs and play computer games; point this out. Reinforce that the world depends on their minds, skills and talent to fix big problems for people everywhere. Next time your child is asked what they want to be when they grow up, steer them toward STEM, part of almost any career they can imagine. Children see themselves as STEM learners in STEM fields when we show them how STEM involves those choices. We move them closer to their dream and a fulfilling life.

The following resources can provide support in preparation for career decision-making:

- Making Connections: Helping Your Teen with Choices Ahead is an informative brochure that focuses on the connections between math and science content and careers.
- Jobs Y'all is a career exploration campaign and website launched in 2018 to raise awareness about the opportunities and benefits of Texas industries, to inspire and attract young Texans to explore careers, and understand the education and training needed to best position themselves for where the jobs will be when they enter the workforce.

STEM COMPANION:
What advice would you have for parents in getting their kids on the STEM or math/science pathway?

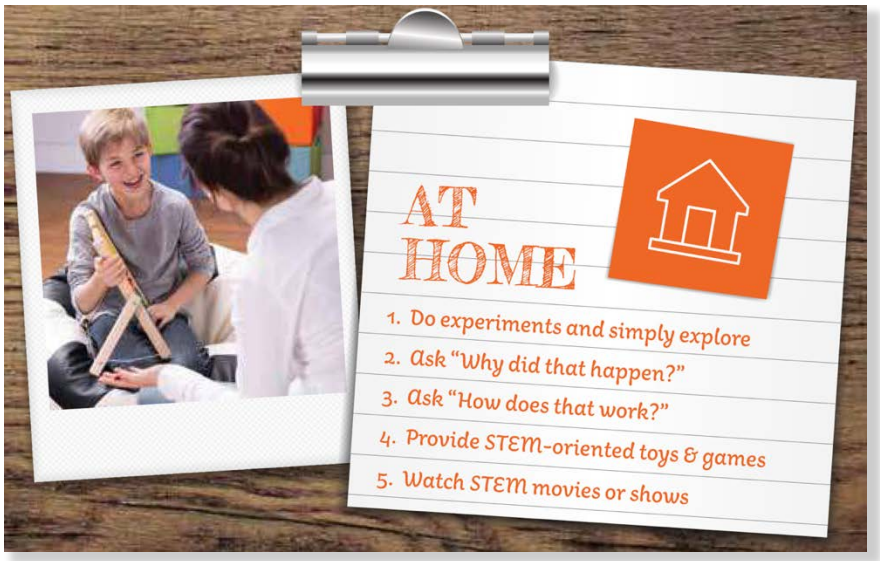
SARAH:

It was important to me that my dad always spent time with me, and it wasn't always about getting the homework done. He wanted to show me projects, like cars, electricity, and water and how they related to other things in the house and life. My mom found lots of activities around the city for us to do. We were always at the museum and in scouts I tried a lot of different things. Trying many things is just who I am.

Q: What tips do you have for engaging my child in STEM?

The possibilities are almost endless at home, school and with local STEM resources. The Texas Education Agency is included in the community of practice of the national STEM Learning Ecosystems Initiative. Learning Ecosystems provide the architecture for cross-sector learning, offering all young people access to STEM-rich learning environments so they can develop important skills and engagement in science, technology, engineering, and math.

- The Texas EcosySTEM Continuum Sample Experiences: https://tea.texas.gov/sites/default/files/Texas_EcosySTEM_Continuum_Sample_Experiences.pdf
- STEM Engagement Ideas for the Texas EcosySTEM: https://tea.texas.gov/sites/default/files/1a.__Ecosystem_Engagement_Check_List_v5_FINAL-s.pdf
- The Connectory, an online database, provides a portal to STEM/STEAM learning opportunities based on zip code: https://theconnectory.org/



Q: When do I engage my child in STEM?

You can never begin too early or too young to tap that natural attraction to rocks, dirt and questions. Sixty-five percent of scientists and STEM-graduate students say they developed their interest in elementary school, according to a study in the March 2010 International Journal of Science Education. Another study shows that students decide as early as second grade whether they like and are good at math. Without early support, many narrow their work choices well before middle school, missing promising and rewarding professions.

There are also late bloomers who discover their STEM interest in high school and college. No matter your child's age or range of interests simply plug them into STEM information and activities. It is never too late.

02
BUSTING STEM BARRIERS & MYTHS

SARAH'S STORY

Sticking with math and engaging teachers inspired STEM path

Sarah's STEM path was neither straight nor clear, but nurtured by an appreciation for nature, inquisitiveness, and a flare for the drama of erupting volcanoes.

"My dad's an engineer and always wanted to teach me about how things work and problem solving." Sarah says, *"I learned a lot about cars, even though it wasn't an interest of mine, but it taught me about hobbies and knowing about one thing."*

"He helped me with my math homework, which wasn't always my strong suit. I was decent at it; I could see numbers, connections and patterns, but still needed help. Math after eighth grade gets hard and is hard to teach. I don't think there is a math brain. I was never a straight A math student, yet my whole job revolves around it. Math is meant to be hard and the biggest hurdle is being persistent and working at it."

A junior-high biology teacher baited Sarah with an unusual request. *"I wasn't good at memorization, but Mr. Jones was always interactive and talked me into watching this snake for the summer. It didn't work out so well, I was scared, but I really liked Mr. Jones and wanted to know more about science. He was able to get me to do something I didn't think I could."* Her ninth-grade chemistry teacher Mr. Ignatz was equally enthusiastic *"like Bill Nye and really helped me remember. I gained a good foundation that helped me get A's in college chemistry. We had fireproof tables and he would take gas and create a ring of fire and play the Johnny Cash song 'Ring of Fire.' He would keep us awake and hold our attention – no boring PowerPoint presentations. Mr. Ignatz always made science relevant to other classes. I took environmental science at the time, which integrated math and writing. It made me a good writer. A teacher makes or breaks you. And, until you make connections between things and find ways to connect to your daily, it doesn't stick."*

Sarah studied a lot of science in high school, including astronomy and geology. *"The teacher suggested doing my undergrad degree in geology because she could see I was an outdoorsy person and that can really influence your job."*

Sarah's dad introduced her to cars and hobbies, which taught her to learn all about one thing as well as how cars work. She's in back of their beloved Plymouth Fury.

Q: What about the arts?

It's not a choice between STEM and the arts (STEAM). We need both as they work together to create new products and services, a healthy economy, job growth and, most importantly, a well-rounded person. Working both sides of the brain, logical and creative, STEM and STEAM ask the same, bold questions: What is true? Why does it matter? How can we move society forward? Both search deeply for meaningful answers.

Many famous inventors and scientists were also musicians, artists and writers: Galileo drafted poetry and Einstein plucked the violin. How can you encourage your child to open both sides of the brain?

STEM is not exclusive and blends easily with other subjects. For example, psychology heavily uses math and statistics; history teaches us the past and, when we apply those lessons, develops critical thinking. Spoken and written language unlock our understanding of STEM so we can relate it to our lives. Together, these subjects draw a more complete picture of the world, building a stronger base for solving problems.

Our primary STEM focus feeds a society hungry for more technology that has, until recently, left behind math and science. As a result, we almost all identify as readers, but rarely as good in math. We don't want to set STEM above other subjects, but it can't be less. STEM can drive our economy and solve big, worldwide problems.

LOCAL FAMOUS STEM PROFESSIONALS

John D. Olivas (born 1965) is an American engineer and a former NASA astronaut of Mexican descent. He flew aboard the Space Shuttle *Atlantis* and performed EVAs on both missions, totaling 34hrs 28min.	**Carl Robert Deckard, Ph.D., ME** (1961-2019) was an American inventor, teacher, and businessman, best known for inventing and developing Selective Laser Sintering (SLS), a method of 3D printing.
Brady Barr (born 1963) is a herpetologist and host of Nat Geo WILD's *Dangerous Encounters with Brady Barr*. He became the first known herpetologist to capture all 23 extant species of crocodilians in his career.	**Margaret Hutchinson Rousseau** (1911-2000), chemical engineer; designed the first commercial penicillin production plant. She was the first female member of the American Institute of Chemical Engineers.
Mary Fanett Wheeler (born 1938) is an American mathematician. She is known for her work on numerical methods for partial differential equations, including domain decomposition methods.	**Otis Frank Boykin** (1920–1982), was an African American inventor and engineer. His inventions include improved electrical resistors used in computing, missile guidance, and pacemakers.
Chesley "Sully" Sullenberger (born 1951), airline pilot, safely landed US Airways Flight 1549 on the Hudson River after a bird strike. All 155 people aboard survived.	**Charles Courtice Alderton** (1857-1941) was an American pharmacist and the creator of the carbonated soft drink Dr. Pepper.

Q: What if I am not a STEM person?

Everyone has some STEM skills. You may not be an engineer, but you can fix things around the house. You may not be a chemist, but you can cook. Even if you only know some things about STEM, you can always learn with your child. When you guide your child toward finding the answer, you model that we continue to learn at every age.

Q: My child hates math, now what?

As mentioned earlier, your child will see a STEM future when your child feels strong in math. This is key. If a child struggles with math or other schoolwork, remind your child that it doesn't need to be done perfectly, especially not ALL at once. However, if you sense there's a deeper problem, maybe evidenced by a lack of interest, check with your child's teacher, who can offer tutoring or more challenge.

The "math brain" does not exist. The genes that set academic talent control ALL subjects. Math is difficult at some point for everyone! Struggling a bit, even getting the wrong answer, is how we truly learn. We gain more from our mistakes than being perfect. Failure feeds determination, persistence and grit predict educational success. With steady effort, a child can do just as well in math as any other subject.

Share with your child that math includes abstract thinking. Looking at ideas instead of facts or what is right in front of a child may be a new skill, mastered with practice. Drive enthusiasm by making meaningful connections between math, interests and what a child cares about. Younger students may not realize they are doing math when counting money and telling time. Point that out. Ask older students to explore how math may be part of college, work or occupation goals.

> ***"The only way I can remember what I learn is to find a connection that has to do with my life or make a mnemonic that stands for each letter of a word. I can't just flat out memorize things. I still remember the quadratic formula because of a song a math teacher taught me. I would sing it during multivariable calculus class in college and other students would ask me how I could remember it."***
>
> *- Sarah, US Geological Survey geophysicist*

MATH CHALLENGE

To demonstrate that math is relevant to everyday life, challenge your family to go a whole day without using math. You'll become aware of the numerous (pun intended) ways we automatically incorporate math into daily life!

Q: What about opportunities for girls in STEM?

STEM is wide open for girls who share big dreams for making the world better. IF we shift false stereotypes, negative messages, and their own views. While women make up over half the U.S. workforce and hold the majority of college degrees, there are very few in STEM education (20 percent in engineering, computer science and physics) and careers (25 percent).

The truth is girls and boys are equally smart in STEM, and high-school girls earn even more math and science credits and have higher GPAs (grade point averages).

Girls draw their attitudes from how they view themselves instead of their real ability. When they believe in themselves and understand that hard work and effort increase intelligence, girls improve their math and science scores. They do less well when they believe boys are better at math, research says. However, when told they are equal in talent, they score equally. Girls may have these incorrect assumptions, blocking their full potential in math and science.

Girls with the same abilities as boys are more likely to give up on difficult materials and lose interest in STEM by middle school when they believe these subjects are too hard. As STEM advocates, we must reinforce the message that struggling is often how we learn, especially in math, and that girls can do well in STEM subjects.

Some parents and teachers unknowingly discourage girls with lower expectations. Research studies show that:

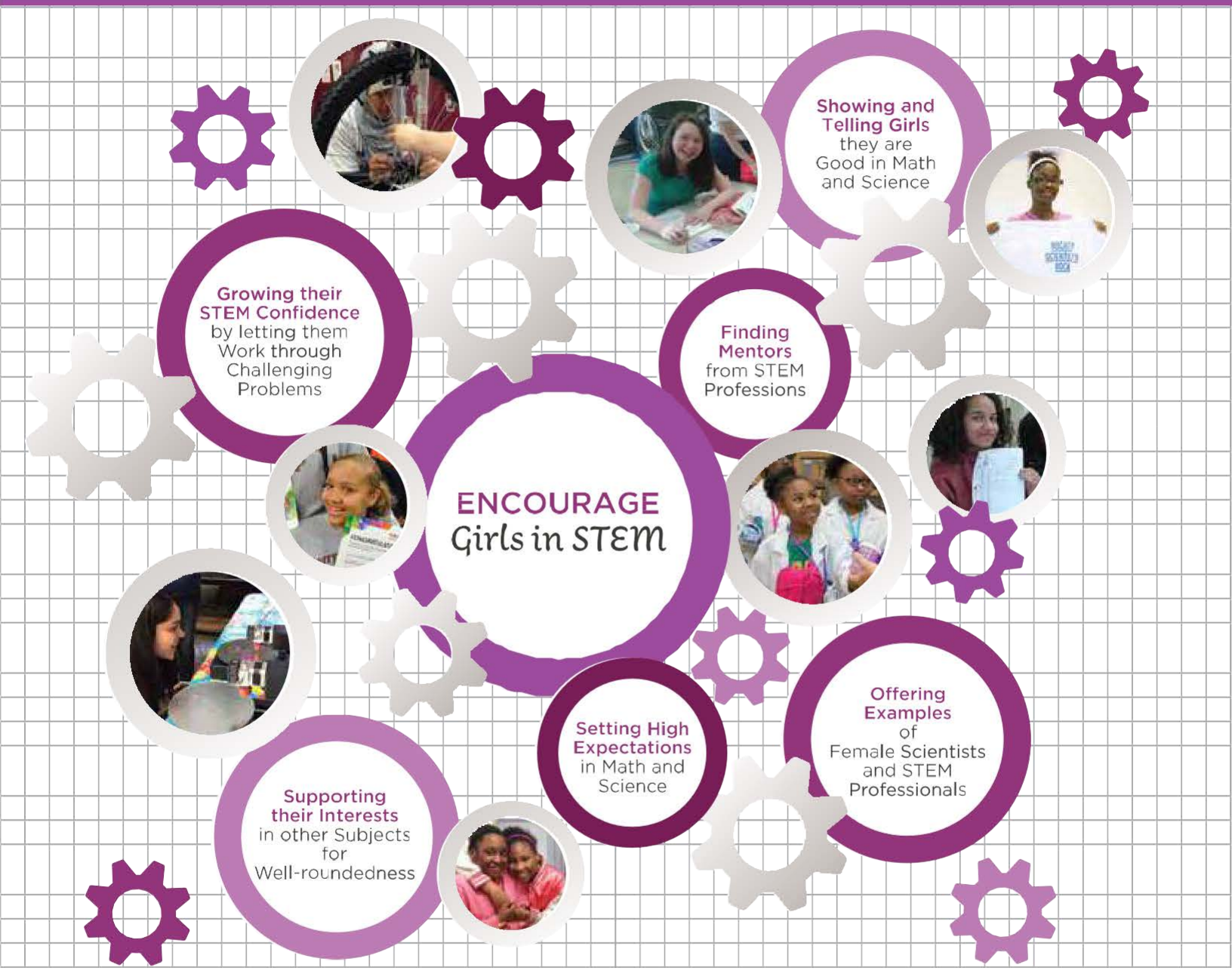
Teachers expect more in math and science from boys, guiding them to find solutions, than from girls, to whom they give answers.

Mothers encourage their sons more than their daughters in hands-on activities in science museums.

Teachers call on boys more than girls in science and math classes.

Once we become more aware, we can be sure to provide proper and equal encouragement.

We all must become more aware and more active in encouraging girls in STEM by:



More than anything else, parental support can move a girl toward STEM, which appeals to her desire to serve. ALL children benefit from exposure to STEM activities, STEM role models and mentoring. When we stress STEM for girls, boys respond positively too and understand that STEM is for everyone.

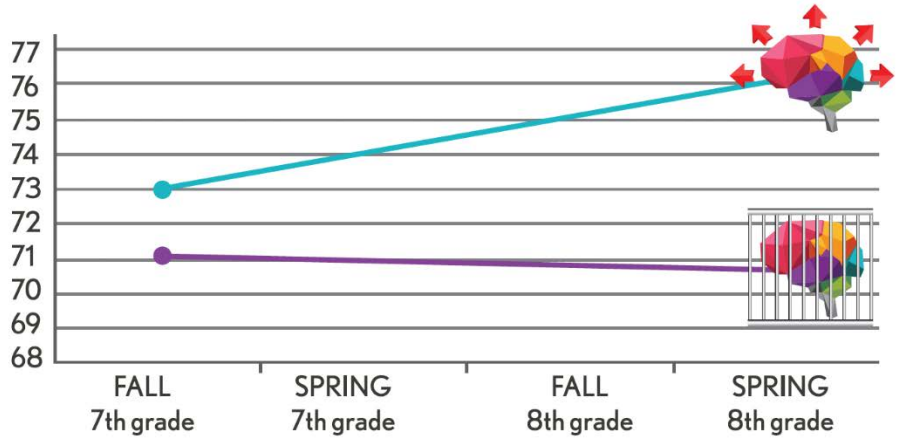
Q: I hear a lot about "mindset," how does that relate to STEM?

When students believe hard work and practice increase their basic talent, they shine. Researchers Carol Dweck and Jo Boaler call this a growth mindset that covers all learning as well as STEM subjects. Intelligence and talent are starting points. Students with growth mindsets learn more and improve from challenges and failures. This is also a life lesson. Amazingly, the brain grows just as any other part of the body when exercised.

You can easily practice growth mindset by praising your children for their effort over abilities, guiding them to work through difficult problems. Children with teachers and parents who understand growth mindset benefit most. Teachers with a classroom growth mindset report greater student progress.

GROWTH MINDSET EXAMPLE

In one study, seventh-grade math students were given a survey to measure their mindset, then researchers followed the students over two years to monitor their mathematics achievement. The results were dramatic, as the success of the students with a fixed mindset stayed constant, but rose for those with a growth mindset. *(Blackwell et al., 2007)*



Q: Homework, Help!

We have ALL been here: overwhelmed by our children's math and science homework. Don't panic, their classes are more advanced than ours were at the same grade. Fortunately, there are resources. First and foremost, speak with your child's teacher because children often don't seek help on their own. If the teacher isn't available, the local public libraries may provide homework aid in person, by phone, email and Internet free for library card holders. Often, they offer computers and free Wi-Fi at the main location and branches.

An online source, Khan Academy, listed below, posts coaching videos on most subjects.
https://www.khanacademy.org/

03
DIVING INTO STEM
IN/OUT OF SCHOOL

SARAH'S STORY

Desire advanced education, experience and mentor land rare STEM job

Sarah almost didn't graduate from high school. She struggled with attendance her senior year after experiencing the death of a close friend. Thanks to persevering parents and the desire to go to college, Sarah pulled herself together. She enrolled in geology at a local college that wooed her with food scholarships, then switched her major to nursing to appease her father. She discovered she had no tolerance for blood then begged her parents to transfer to Utah for skiing, sunshine and her real love, geology. She headed off the second year and never looked back. She uncovered departmental scholarships to erode the cost of out-of-state tuition and snagged a summer volcano experience in Hawaii, where she met her mentor.

"I found the internship doing a Google search," Sarah says, *"and spent the summer between junior and senior years at the Hawaiian Volcano Observatory, which was the most fun I ever had. I wanted to wake up and go to work. I knew those jobs were hard to come by, so I made a point to say hello to everyone and introduce myself and make connections."*

One of those was with her summer supervisor. *"Mike helped me with everything, including learning to code. He is a phenomenal teacher and always took time with me, so I was never afraid to ask questions. We co-authored a paper for the Journal of Volcanology & Geothermal Research and he helped with my thesis. He was so insightful in learning about work relationships, which are completely different from those in graduate school. I would not be where I am today without Mike."*

She left the island, completed her bachelor's degree and, *"when looking at graduate programs, wanted to study Kilauea, the most active volcano in Hawaii, where the observatory is right on the crater rim."* The volcano became the subject of her master's degree thesis. As she was finishing, *"the job opened up, but I wasn't done with school and thought I'd apply anyway. I look at everything as an opportunity – there's no such thing as a waste of time. Hundreds applied for a job, a select few were qualified and they interviewed three. The internship really helped because it was doing exactly what my job is."*

Sarah's new job is the one her mentor just left.

Flying over the lava field is one of a variety of duties in Sarah's new job as a geophysicist for the Hawaiian Volcano Observatory. Photo Courtesy of USGS-HVO.

Q: How does STEM relate to state content standards?

Texas Essential Knowledge and Skills (TEKS) identify what students in kindergarten through 12th grade (K-12) should know and be able to do in each subject.
For information about TEKS, visit: https://tea.texas.gov/academics/curriculum-standards/teks/texas-essential-knowledge-and-skills

How do you learn more about a school, in general, as well as STEM opportunities? One way is to access https://txschools.gov/ which provides an in-depth look into how a school is performing in different areas. The most direct is to speak to a school official. Teachers we spoke to suggest parents ask:

Teachers we Spoke to SUGGEST PARENTS ASK:

- [ ] Does the school have an educational philosophy or mission?
- [ ] What are some of the school's greatest accomplishments?
- [ ] What are some of the biggest challenges the school faces?
- [ ] What makes this school different from others in the area?
- [ ] What percentage of students graduate? What percentage attend a university?
- [ ] What is the average class size?
- [ ] What percentage of teachers are certified in the field they teach?
- [ ] Does the school measure and rate teaching and learning?
- [ ] What professional development opportunities are teachers offered?
- [ ] What extracurricular opportunities (sports, clubs, community service, etc.) are available?
- [ ] How do you keep parents informed of activities, homework and events?
- [ ] What resources are available for work, career and college planning

QUESTIONS Specific to STEM:

- [ ] How is technology used to support teaching and learning in the school?
- [ ] How many teachers in math and science are certified to teach these subjects?
- [ ] How are projects and hands-on activities used to teach science and math?
- [ ] How do field trips support science and math learning?
- [ ] What lab space and equipment are available for science and math classes?

TIP

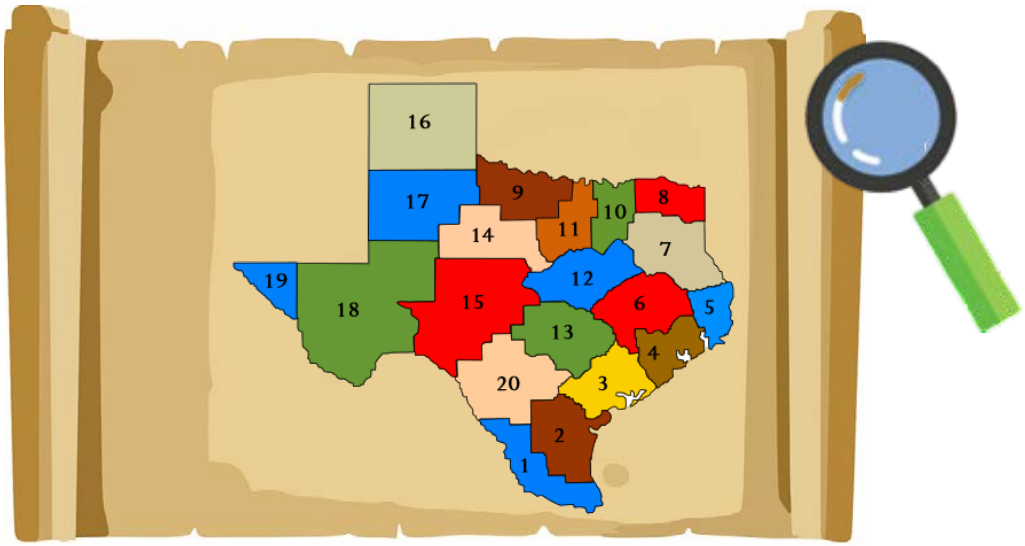
Consider recommendations from other parents and explore this website:
https://www.noodle.com/articles/what-to-look-for-in-stem-education-at-every-grade-level

Are there schools that focus on STEM in our area?

Texas is increasing local STEM education with STEM-focused schools such as middle and high school T-STEM Academies, STEM magnet schools, and public charter STEM schools. If you would like more info about schools, contact your local Educational Service Center (ESC) for local options and tours.

TIP

Check directly with your school district for the most up-to-date information about STEM in your local school or access https://txschools.gov/. To see a map of counties and districts in each ESC region, use the Texas Education Agency's School District Locator tool. You can also search for ESC statewide STEM Leads using the Texas Education Directory.



What STEM clubs and activities exist at schools?

After-school activities involve your student in STEM with others the same age and, often, mentors in an informal, fun, and relaxed setting. Many schools offer after school programming or clubs for those with an interest in STEM. Non-profits such as the Girl Scouts and YMCA also have STEM programming. Organizations within the Texas EcosySTEM sponsor a variety of STEM activities which increase interest and confidence in STEM.

TIP

The following resources can be helpful for identifying opportunities for STEM involvement:

- The Texas EcosySTEM Continuum Sample Experiences resource: https://tea.texas.gov/sites/default/files/Texas_EcosySTEM_Continuum_Sample_Experiences.pdf
- The Connectory, an online database, provides a portal to STEAM learning opportunities based on zip code: https://theconnectory.org/
- Texas Partnership for Out of School Time – STEM Resources: https://www.txpost.org/stem-resources/

Q: What activities are available for families outside of school?

You do not have to roam far for a local STEM adventure that targets kids' natural curiosity. Beyond books and experts, your local library is stocked with free information, activities, computers, and books/videos with STEM themes.

Local areas may act as STEM hubs with plenty of child-friendly experiences after school, on weekends and during the summer. Discover them in your neighborhood, downtown, or expand across state lines through digital and virtual platforms.

For example, STEM Scouts helps girls and boys learn about science, technology, engineering and math through creative, hands-on activities, field trips and interaction with STEM professionals. The Girl Scouts have several badge categories that make special use of STEM activities including naturalist, digital art, science and technology, innovation, and financial literacy badges. At more than 1,000 YMCA sites nationwide, youth are engaged in year-round STEM activities that nurture their curiosity, inspire creativity, and teach them how to succeed.

STEM play can be found in maker spaces and community areas devoted to STEM/STEAM exploration on state-of-the art equipment. Various organizations and schools house 3-D printers, green screens for video, sewing machines, vinyl and laser printers and cutters, bookbinding machines, audio and video recording equipment, video and still cameras. STEM maker spaces attract kids with engineering, robotics and coding, idea design, audio-visuals and a make-your-own area. Here, you get the full STEAM experience, pushing your child's creativity, inventiveness, project solving abilities and skills. For more diversity, check out the largest natural lab, Mother Nature, within your local park systems, their camps, exhibits and hikes.

The rewards of STEM experiences are long-term and lasting.

STEM COMPANION:
What advice do you have for students about a STEM path?

around the city for us to do. We were always at the museum and in scouts I tried a lot of different things. Trying many things is just who I am

SARAH:
Take a class that you aren't required to take. High school has more options and I took a geology class that wasn't required and it ended up being the best decision of my life all because someone told me I was good. Take a science elective. Not all science classes have to be hard. Don't be shy because you think it will be more work.

We all have a natural curiosity and science is such a broad range of subjects that accompanies us in our daily lives. Explore more in the sciences because you never know what you may end up liking.

Q: How do I evaluate a STEM club or program?

The best STEM program interests your child and fits your lifestyle. When choosing, consider one that:

GREAT!

- Includes a hands-on activity(s)
- Ties activities to real world
- Teach a key science or technology point
- Encourages students to try challenging activities
- Celebrates failures as well as successes

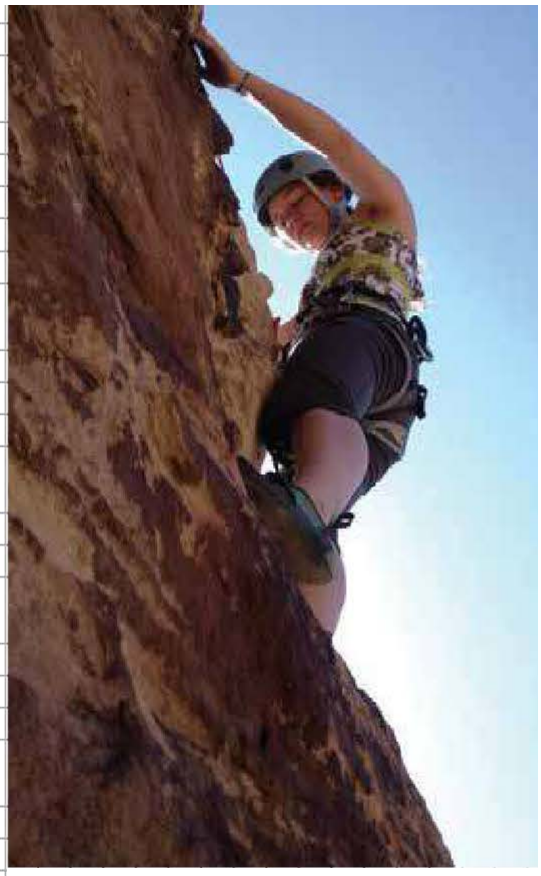
EVEN BETTER!

- Is supported by mentors who are professionals in their field, who can be role models
- Involves parents in some way
- Shares how it connects to STEM Careers

04
STEM BEYOND HIGH SCHOOL:
COLLEGE, JOBS AND CAREERS

SARAH'S STORY

Balance: hiking, helicoptering & coding during the week, beaching on weekends



Climbing is one of Sarah's passions because it gets her moving and outside.

Working for the government as a geophysicist is anything but boring according to Sarah. "I absolutely love it and am always doing something active, different and interesting. One day I may be in a helicopter flying over lava fields sampling and the next day I may be coding and processing satellite data."

Sarah "monitors the high-precision GPS (global Positioning System) network on the island to make sure everything is working and if it's not functioning. I go fix it and collet data. In SAT (Satellite Remote Sensing System) allows us to monitor the deformation," swelling, sinking or cracking of a volcano's ground surface that indicated what's happening below and warns of eruption. She downloads and accesses that data to inform the observatory.

"You can't go wrong in Hawaii, where I spend the weekend by the beach eating Poke', a Hawaiian dish of raw tuna."

> ***Geology was always on the back burner, but my dad really wanted me to be a nurse. I started in geology, then got pulled into nursing for a quick second. When I realized I would be cooped up in a hospital and not be outside, I returned. It's not always about the money.***
>
> - Sarah, US Geological Survey geophysicist

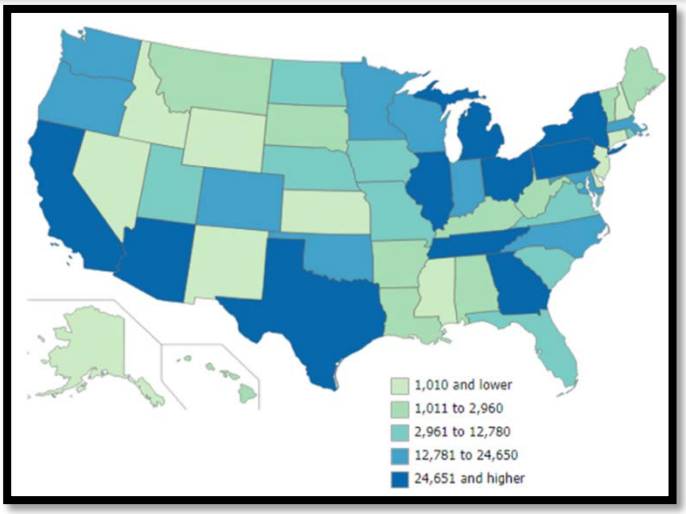
Q: What about STEM jobs?

STEM jobs are in demand, growing around the globe, nation, state, and region. Pure STEM accounts for 20 percent of U.S. jobs, while 80 percent of all work requires some STEM skills. The same is true for Texas; however, as jobs rise, many STEM positions remain open. Local employers blame fewer employees with technical skills - good news for the next generation. As of 2019, over 150,000 STEM openings were unfilled in Texas.

Ideally, we want our children to be happy and independent, with enough money and in steady jobs. Those in STEM enjoy higher pay, career growth and long-term employment over other fields.

> Employment in STEM jobs will only increase over the next decade—over 20 percent—with significant opportunities in **computing, engineering, and advanced manufacturing fields.**
>
> -Texas Workforce Commission-

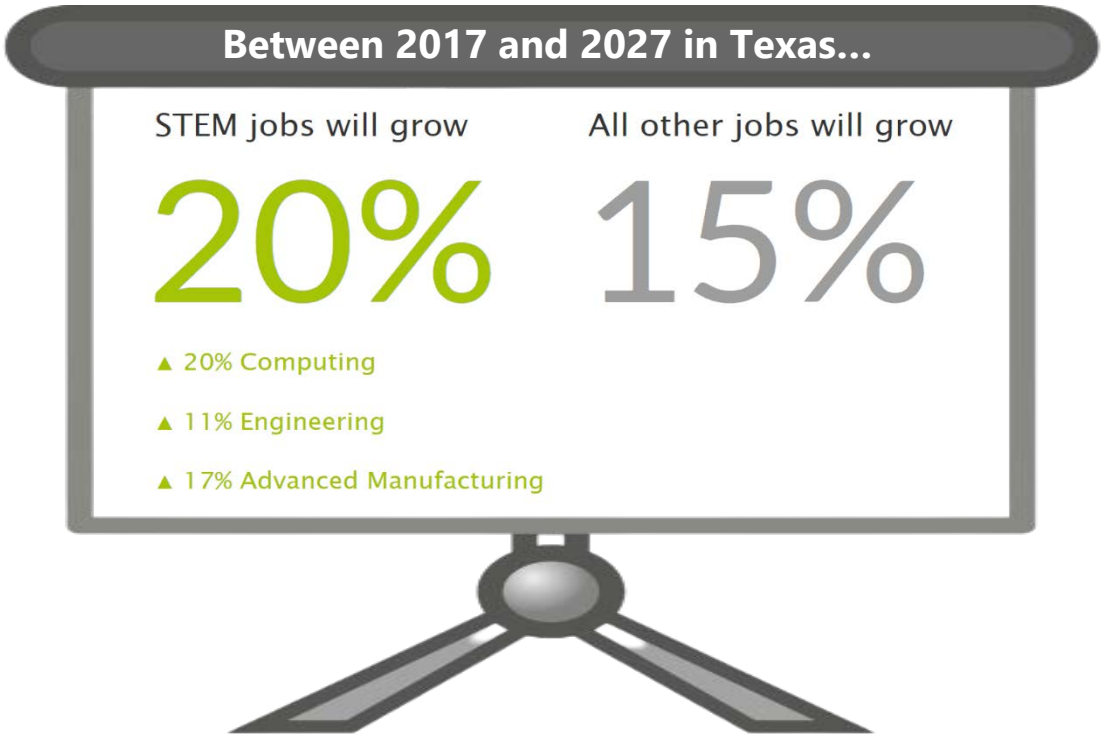
U.S. Bureau of Labor Statistics map shows Texas job market as one of the fastest growing STEM states in the nation.



Q: What degrees are required for STEM jobs?

Education and employability or STEM fluency skills are key to success in STEM professions. Ninety-five percent of jobs paying a livable salary will require some combination of education beyond high school, on-the-job training, and/or work experience over one year. According to the Texas Workforce Commission, Texas has a strong middle-skill STEM market with high demand high wage opportunities. 60% of middle-skill STEM jobs require only six months of formal classroom training. If students pursue an associate degree in STEM they will earns between $75,000 -$100,000. Slightly greater than those with a Non-STEM bachelor's or master's degrees.

STEM Jobs are Growing Fast in Texas



STEM skills and fluency are critical components that should be embedded in all aspects of K-12 education as it lays the foundation that our students so desperately need when transitioning to higher education and career readiness. Students need to be exposed to STEM at the elementary level so that they develop a strong foundation and curiosity in these critical thinking areas and then carry that interest and curiosity to middle and high school where they can develop a deeper understanding and application of STEM. This pipeline in K-12 schools will help our students transition into our colleges and universities to further their understanding and application of STEM that in turn leads to a STEM fluent workforce to serve our community.

Matthew Cushing - *Rice University, Executive Director of the Office of STEM Engagement*

Q: How can I help my child decide on a career?

Kids are always asked: "What do you want to be when you grow up?" They usually respond based on the books, TV, and people they know. These early ideas are formed from limited information, not reality. Very few make the NFL draft to play pro football or are able persevere through the pathway to becoming a medical doctor. As parents, we often expect school counselors to guide our children's work, college, and occupation choices. Realistically, counselors are overwhelmed by large numbers of students. Remember, YOU know your child best, want the best for them and hold the greatest influence in their lives.

Career decisions are often mind-boggling, difficult and depend on interests, skill, desired income, location choice and job availability. Pulling this together takes effort, thought and your support. Information, role models and experiences create better decisions. USE every tool you have: school career-test results, talking about your own job with your child and introducing your child to STEM professions. Relationships and experiences are the most meaningful in creating your child's future.

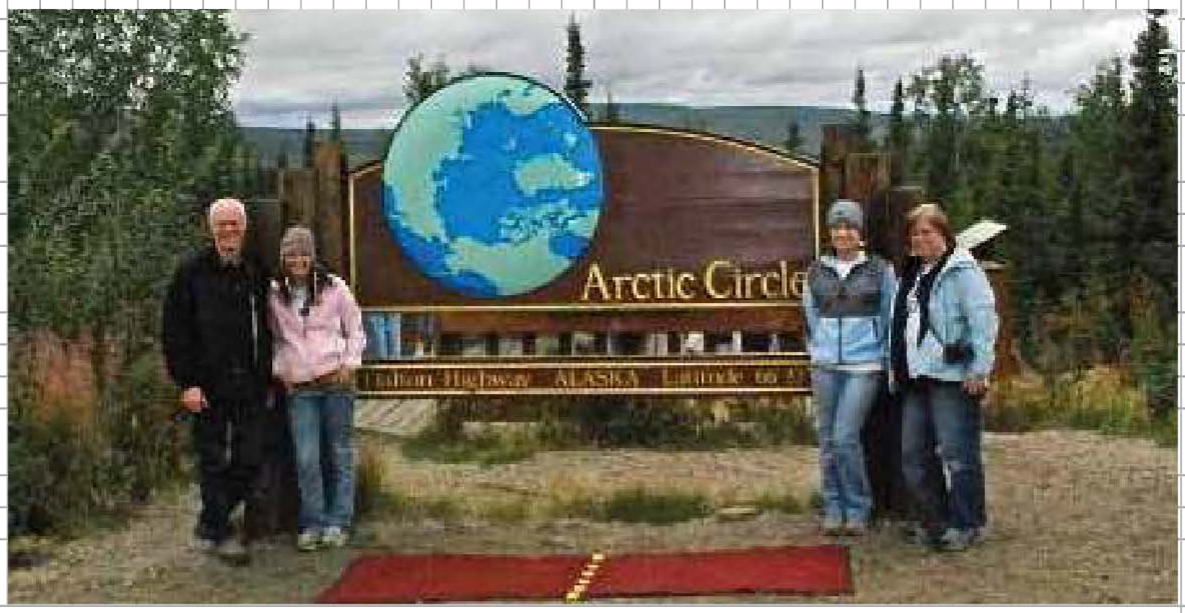
Most students experiment before finding the right direction and, even then, may change and that is OK. Research shows almost everyone picks a pretty good fit in the end. The upshot: don't worry if your child is not yet in college and/or doesn't know what they want to do when they graduate.

Be mindful that early exposure to careers improves how well children do in school and how much they value education. A study of 15-year-olds with job-related experiences (internships, job shadowing, job fairs or school ad vising) showed positive attitudes about education. Career coaching, STEM studies and exploration build a solid future for your child.

> ***Reflecting on my time in high school, I'm grateful to have taken engineering courses to fulfill my high school's technical credit. It wasn't the material that solely caught my interest, but rather my teacher's enthusiasm for engineering as a whole. He educated us on the benefits of going into STEM and highlighted different fields that might spark each of our individual interests. My favorite topic was circuits and this passion in the classroom led me to participate in my school's solar car team. This exposure to hands-on learning as a high schooler with a supportive teacher directly influenced my decision to pursue electrical engineering at Texas A&M University.***
>
> - Lily-Anne Joy Brazell

TIP

Self-survey and information about various majors/areas of study
https://www.bestcolleges.com/resources/choosing-a-major/



Sarah's family (left to right: her dad Andy; Sarah; sister Amanda, a fifth-grade math teacher, and mom Carolyn) visiting the Gates of the Artic National Park and Preserve in Alaska.

SARAH'S PARENTS POINT OF VIEW

Engagement + Problem-Solving Play + Mentors = STEM Success

"Sarah always had a mind of her own. At three, she didn't want me to dress her and often fought parental suggestions, so I learned to guide her," her mother, Carolyn says.

When a group hiked the steep Chimneys in the Smoky Mountains and half turned back, *"Sarah wanted to continue with the adults,"* her dad, Andy, recalls. *"I thought she could do it, but she was only four or five and I wasn't sure she should."* Sarah victoriously persisted.

"Our philosophy was to let our girls spend time outdoors, not be so busy and have the opportunity to daydream and be creative," according to Carolyn. *"Andy would draw big chalk mazes they would ride their bikes through, they built forts and, in winter, connected cardboard boxes inside to make tunnels. They learned problem-solving early."* Sarah's older sister, Amanda, teaches fifth-grade math and English.

Later, in scouting her daughters participated in a comprehensive skill-and-gifts survey that also focused on building character. *"It helped her see early where her strengths were."* That knowledge engaged parents who shared their careers and many mentors launched Sarah on a strong STEM pathway that suited her drive, ambition, talents, quirks and aptitude.

"Math has been essential in where she is right now," her mother says. Andy travels as an engineer, so he'd often get calls or faxes on the road from Sarah with math-homework questions.

"However, it's the right combination of field, office work and independence, the three components she needs," Carolyn adds.

COLLEGE PREP

My public K-12 education mainly taught me perseverance and how to problem solve. Those skills helped me get through my undergraduate engineering curriculum at Texas Tech. Now I'm in graduate school, and I really love my work.

- Kelsea Miller

Endorsements

Students can earn one or more endorsements as part of their graduation requirements. Endorsements consist of a related series of courses that are grouped together by interest or skill set. They provide students with in-depth knowledge of a subject area.

Students earn an endorsement by completing the curriculum requirements for the endorsement, including 4 credits in both math and science and 2 additional elective credits.

Science, Technology, Engineering and Mathematics (STEM)

(one of the following or a combination of no more than two of these categories)

- Career and Technical Education (CTE) courses related to STEM
- Computer Science
- Mathematics
- Science

For more information about high school planning, graduation and beyond: **TEA Graduation Toolkit** https://tea.texas.gov/sites/default/files/Graduation_Toolkit_Summer2019.pdf

In Summary

Whether you are a parent, caregiver or a concerned adult, we appreciate your interest in STEM. We believe that in working together we create a brighter future for our children, our families, and our state. We support STEM to build critical thinking skills for ALL careers. We grow decision makers who use information to make informed decisions. We nurture citizens to embrace science and technology. We create new businesses, jobs and economic wealth for Texas. All of this is possible ONLY with the support of parents and the example of role models for our children. You make STEM relevant, you make a difference and you WILL inspire our next generation.

TEXAS EDUCATION AGENCY
TexasEcosySTEM

The Texas Education Agency is included in the community of practice of the national STEM Learning Ecosystems Initiative. Learning Ecosystems provide the architecture for cross-sector learning, offering all young people access to STEM-rich learning environments so they can develop important skills and engagement in science, technology, engineering and math throughout PreK-20. Strong STEM Learning Ecosystems feature dynamic collaborations among schools, out-of-school time programs, STEM expert institutions (such as museums, science centers, institutions of higher education and STEM professional associations), the private sector, community-based organizations, youth and families.

For more information:
https://tea.texas.gov/academics/college-career-and-military-prep/texas-ecosystem

STEM Coordinator: Michelle Sedberry michelle.sedberry@tea.texas.gov

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greater cincinnati STEM collaborative
SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH

ABOUT THE GCSC

GCSC (Greater Cincinnati STEM Collaborative) is a nonprofit organization working with formal and informal educators, businesses, community partners, parents and students to build STEM interest, STEM capabilities and STEM professionals in our region. You can find out more about the GCSC at the following websites:

greatercincystem.org | gcscstemed@gmail.com

@GCSCSTEM greatercincinnatistemcollaborative

TEXAS EDUCATION AGENCY

TexasEcosySTEM