4 Are You Ready for a Career in Science, Technology, Engineering, or Math?

Just before I (Shaun) sat down to start this chapter, NASA announced the discovery of a nearby solar system with seven planets that are close to the size of Earth, all of which could have water and temperatures that are suitable for life. I watched a live video feed as researchers explained with excitement the painstaking scientific process behind their inspiring find. It was a beautiful mix of astrophysics, mathematical deduction, and clever software engineering to repurpose a space probe that wasn't even designed to look for planets. As the story unfolded, I couldn't help but feel a wave of emotion because science was the first subject in school that sparked a true passion in me, and that passion led me to start college as a physics major, bent on unlocking some secret of the universe with an almost religious zeal.

My life and career since that time have strayed far from that earnest dream. A Nobel Prize or even just the deep satisfaction of revealing a small piece of nature's inner workings will never be a part of my story. Things have worked out just fine for me, but studying science in college was nothing like I expected, and the realities of a career in science, technology, engineering, or math (STEM) do not always line up with the recruiting pitch that promises that going into a STEM career will help you change the world. The world of STEM careers is a vast topic, which is part of its appeal, but we focus in this chapter on how to think about STEM careers in a more general sense, how to ensure your child is prepared for a STEM education and how to help your child determine if STEM is a promising pathway or a mismatch between reality and expectations.

STEM Pathways

Many people assume that a STEM degree will make it easy to find a high-paying job after college because there is a shortage of qualified graduates entering most scientific and engineering fields. The truth is that for many scientific, technology, and engineering jobs, there are plenty of qualified candidates, and the most desirable and high-paying jobs are highly competitive. This doesn't mean that a STEM degree is a bad idea. In fact, a STEM degree is statistically more likely to result in higher starting salaries out of college and higher earnings on average than many other areas of study. But the details matter. There are some big differences in job prospects and earning potential depending on one's specific career interests, and students should give some thought to these differences as they plan their education and career. Let's look, for example, at the difference between what I'll call a scientific pathway and a technical pathway.

If I said that someday I wanted to be an astrophysicist, a marine biologist, or a genetic researcher, I would generally be on a more scientific pathway. A scientific pathway typically begins in college with a four-year undergraduate degree in core fields like physics, biology, or mathematics and most often then requires extensive postgraduate education such as a master's degree, a doctorate, and then a postdoctoral fellowship where I would participate in research and be mentored until I could find longer-term employment in my field. If I were truly driven by furthering scientific research, my employment after my postdoc would then typically be with a research institute, a project funded by a large grant or a teaching position with a college or university that may or may not include a requirement on my part to continue advancing my field and getting my work published on a regular basis. I might be doing fundamental research on the big bang theory or studying what makes our cells age and our bodies grow old. The best of these jobs at the best of these institutions are extremely competitive. These are literally the smartest people in the world. In this pathway, it would be quite common for me to be in my late twenties or early thirties before I found sustainable long-term employment and was earning a decent salary to support a family.

These are truly some of the most important, interesting, and meaningful careers in the world today. This is the type of career that inspired me to work hard in high school and achieve admission to one of the world's top scientific research universities. To this day, I admire with longing the scientists who make mind-blowing discoveries and advance human knowledge. But students need to have their eyes wide open going into such a path because it can take a long time to achieve the kind of career stability, financial well-being, and work-life balance that their peers may achieve much earlier in other career fields. In addition, the federal government has substantially reduced funding levels for pure scientific research over the past several years and with the current administration, this trend may accelerate dramatically. Unfortunately this has directly reduced research opportunities, and therefore employment prospects, for those with advanced STEM degrees. In fact, I have observed a common pattern among friends and colleagues who earned an advanced scientific degree in a subject like math or physics. They jumped from the research world into the corporate world with a well-paying role in which they could leverage some of their scientific expertise and mathematical skill to solve business problems such as designing products (e.g., self-driving cars) or increasing sales (e.g., statistical analysis of the most effective marketing channels).

In contrast to the scientific path, the technical path is about obtaining technical skills that can be immediately useful to employers that need to solve practical problems. These are careers like making robots that manufacture microchips, programming computers to track financial transactions, designing car engines, or building a mobile phone app like Instagram. Parents tend to like the idea of these careers for their children because they perceive that there are plenty of interesting and well-paying jobs waiting for students with these kinds of degrees. In a broad sense, this is true. On average, a student graduating with a degree in electrical engineering will be a lot more likely to find a well-paying job than a student graduating with a degree in philosophy. But it's important for students to understand that a technical path does not come with a guarantee that the work will pay well or be fascinating.

Entry-level technical jobs at top companies are highly competitive, and that means that companies will be looking for students with excellent grades and may prefer students who have already interned with them during summers.

Getting admitted to a good engineering or technical program in college is just the first step and in some ways the easiest. These are demanding degrees with intense mathematical course work and a lot of project-based learning that requires teamwork, open-ended problem solving, and self-discipline. The engineers designing self-driving cars are the ones who made it through that gauntlet with flying colors. The good news, which I discuss more later in this chapter, is that a STEM degree is also great preparation for careers outside scientific and technical fields as well, so even students who realize they are not cut out to be hard-core technical engineers and are not at the top of their graduating class are still well prepared to find a good career in many areas that are growing and paying above average.

A common assumption about STEM is that you need a STEM degree to pursue a STEM career. This may be true with a field like nuclear physics or biomechanical engineering, but there are now many ways to enter a field like software engineering or information technology without a formal STEM degree. The world of computer technology, in particular, has a long tradition of successful members who were self-taught or transitioned unexpectedly from careers such as a jazz musician, history PhD candidate, and even the unfairly maligned philosophy major. "Coding boot camps" allow someone with zero experience to quickly prepare for an entry-level position in fields such as web development, video game development, or mobile app creation within less than a year. In addition, many business degrees include specialized tracks for information technology, which can provide an entrée into a technical field with the added bonus of a business background that can boost long-term career growth prospects. Of course, a highly coveted and highly paid software engineering position at Google or Facebook will be much more likely to go to someone with at least a bachelor's degree in computer science, but today's top employers are increasingly screening for talent and putting less emphasis on the degree.

If there is any lesson we would like to repeat throughout this book, it's that career success is ultimately about what problems you can solve for others, not what kind of degree is on your résumé. If you can help solve important problems, you will be valuable, and your career success will reflect that in the long run.

Another assumption about STEM is that if you get a STEM degree, you will work in a STEM job. According to a 2011 study from the Georgetown University Center on Education and the Workforce, 58 percent of STEM graduates had moved to a career outside STEM within ten years of completing their degree.[1] In fact, about 75 percent of STEM degree holders work in a field outside STEM. What's going on? Why would someone go to all the trouble of completing a challenging science or engineering degree and then not work in a STEM career? The reason is that a STEM education can be strong preparation for success in many career fields.

Despite the immediate practicality of a STEM degree and the higher prospects for finding an entry-level job as a scientist or engineer, some people might end up outside their field of study for a number of reasons why. First, it's not uncommon that by the time a student realizes that she is not really as passionate about environmental engineering as she thought, she may be halfway or more through her degree and it would be expensive or just exhausting to change at that point. Unfortunately some college programs are better than others at giving students more practical real-world exposure to their future career early in their education. Students may not truly understand the day-to-day work of a mechanical engineer until they do a summer internship or work on real-world projects in their junior or senior year.

A second big reason for not entering a STEM career is that many industries recruit STEM graduates for nontechnical careers. A large bank, a consulting company, or even a candy manufacturer may recruit students graduating with science and engineering degrees for jobs that are non-technical because they know that getting into a STEM degree program and finishing that degree requires a lot of raw intelligence, self-discipline, team-work, and critical thinking skills. These are the attributes they know from experience that tend to be associated with employees in their company, and the rest of what they need they can learn on the job. Fair enough, but why would someone actually leave a STEM career? Does that indicate some kind of exodus from STEM fields that the media are not reporting?

There are at least two common reasons that someone would move out of a STEM field. Five to ten years after starting a career as an electrical engineer, biologist, or software developer, the opportunities to increase pay and get promotions may be less about your technical skills and more about your potential to combine your technical knowledge with other areas, such as management, marketing, or communications. Alternately, you may realize after a few years of exposure to the real work of your field and from talking to older people in the field that you don't see yourself enjoying the long-term career path of a dedicated scientist or technologist. And finally, in some fields, you simply can't advance much after a while without achieving some kind of major research success or winning patents for your employer. None of these reasons implies failure, and working a few years as an engineer or scientist can make you just as attractive to other types of employers.

Middle School Conversations

Now that you know some of the nuances of STEM careers, what should you discuss with your child? Middle school is often where a child truly begins to develop a meaningful and long-lasting passion for scientific or technical fields. It was the age when I began to see that there were interesting puzzles to be solved and also realized that some people were actually paid to solve them. Middle school science is just technical enough to show the beauty of experimentation, technology, and mathematical reasoning without getting overly bogged down in math. It's when kids fall in love with electric motors or astronomy or the power of making computers do their bidding with an exotic language. At this age, a small group of students will show a blazing passion for science or technology. If so, your primary job at this point is to feed that passion by exposing them to as many opportunities as possible to explore and advance their learning without discouraging them with how challenging it can be to prepare for a scientific career.

When I was in the eighth grade, I fell in love with physics. In a bout of enthusiasm, I went to my local community college and checked out a massive ten-pound textbook on nuclear physics. The next day I plunked the book down on my math teacher's desk, opened it to a page overrun with mysterious mathematical formulas, and asked, "What do all these Greek symbols mean?" The teacher replied curtly, "You don't need to worry about that right now," and it was clear that further discussion on the matter was unwelcome. This is the worst possible response, even if your child doesn't seem to be particularly good at math or science, because achieving a career in science or technology is a long-term challenge that requires enthusiasm and grit. That kind of passion will help students push through many obstacles along the way, and it's very easy in middle school for a single boring science teacher or a bad math teacher or an offhanded, dismissive remark to blow out the tiny flame of interest that could someday grow into a fulfilling career.

There are many ways that math is taught poorly in schools today, so you should never assume your child cannot do math well enough for science until you've tried to get him help. (See the additional resources section at the end of the book for some recommendations.) Unfortunately, middle school can also be a time when girls in particular begin to incorrectly perceive that deep interest or competence in science and technology might be more of a boy's thing or that all the "geeks" are boys so a girl feels unwelcome to share interests or talk shop with the others. Therefore, at this age, your primary challenge is to be on the lookout for any spark of interest in your child and keep it alight until things can get sorted more clearly in high school. If you have local programs or summer camps that teach coding, robotics, geology, or other scientific subjects, these are effective ways to nurture a budding interest with hands-on experiences that bring science to life.

Your second challenge is to make sure your child is on track with math course work or to help get her back on track if she seems to be struggling with math but remains interested in science. The ability to perform well in math and to complete advanced math such as trigonometry and calculus is usually required for pursuing a STEM degree. It is also highly correlated with successful completion of a college degree in general, so it is a good indicator of college readiness. If your child seems to enjoy science or is explicitly interested in a STEM career at this age, you can start a conversation with her that works backward in sequence from a hypothetical career to a STEM degree, to high school course work, to the choice of math course in the eighth grade.

As a general rule, students who want to pursue a STEM degree should be on track for completing calculus in high school. It may be difficult to do so without completing algebra before the end of eighth grade. Most schools and districts offer course planning software or guidebooks that will help you and your child map out a long-range plan of study for math course work through the end of high school. These tools are a great way to get your child thinking about how his near-term choices will affect his opportunities down the road. As a parent of two children, I often hear the common lament "When will I ever use this stuff I'm learning?" This is doubly true with a demanding subject like math. When responding, I try to focus on opportunities and keeping as many opportunities open as possible until they really need to make a choice. There are few other things kids can do in school that will keep more opportunities open than taking a challenging, college-prep mathematics course of study. Even if they want to study poetry at Yale, an A in calculus will give them a leg up in admissions and provide them with an analytical skill set and perspective that will likely enrich their mind and career.

What do you do if you see a strong interest in science or technology but are worried that your child is behind in math or not on track to complete algebra by the eighth grade? First, remember that math is highly dependent on foundations. Your child may be struggling with his current math course because the foundational skills that enable him to grasp that subject were taught poorly or your child struggled with that foundational concept and his teacher felt pressured to move on to the next topic (unfortunately, this is quite common due to the pressures that teachers are under to cover all the concepts taught on a state test in time for the test). You can meet with his current math teacher and ask that person directly, "Is my child weak in certain foundational skills that are necessary to be successful in his current math subject?" If the answer is yes, ask if the school can provide any resources to allow your child to review those foundational skills, seek tutoring, or seek free outside resources such as Khan Academy, a free online collection of high-quality instructional videos covering many core academic subjects.

The best kinds of discussions with your child at a younger age will be about his interests in science ("What are your favorite subjects?" "Do you want to learn more about that?") and how he is experiencing math ("Are you doing okay? Is it too easy [or too hard]? Do you think you need some help?"). If he is not already on track to complete algebra in middle school, and he has expressed genuine interest in STEM careers, you need to talk with your child and his math teacher about why and whether it's worth getting him on a faster track to support calculus in high school so that he has as many options as possible to pursue his interests in science or technology.

High School Conversations

By the end of their sophomore year of high school, students should have a solid sense of whether they can handle the mathematical and analytical rigors of science and engineering. Any deficiencies in mathematics that were due to poor teaching, rushed instruction, or learning differences should have been addressed in the freshman and sophomore years so that the final two years of high school can be focused on as much college preparatory math and science course work as the student can reasonably handle. She is running out of time to fix those and have the foundation she needs for moving forward. Don't let your child give up if she is still very passionate about science or engineering but struggling with the work. Just be prepared to get her additional support with tutoring or some of the resources listed at the end of this chapter.

This is also a good time to have more detailed discussions about your child's specific areas of interest and connect these to your child's thoughts about the importance of meaning from work and her attitudes about money. There is a spectrum of meaning and money in STEM fields. On the positive side, the average wage for all STEM occupations is approximately twice that of the average for all occupations. But there can be wide differences depending on the field and some of these differences may not make sense to a teenager yet. Seven out of the ten largest STEM occupations are related to computers, and wages in computer fields can vary dramatically. An experienced software engineer with a computer science degree from a leading university might be making well over $300,000 per year at a company like Google. But a computer systems analyst with a two-year degree in information technology may be earning less than $50,000 per year depending on her experience and location.

Your child can probably understand why there would be such a difference because the preparation and skill level for that Google engineer are at a much higher level and the competition for such a job would be intense. But what about scientists?

The average annual salary for a postdoctoral researcher in the United States is approximately $45,000. This is after competing for admission to a challenging undergraduate degree program and then completing a rigorous PhD program, during which the student barely earned enough to pay living expenses. How will that student feel watching peers graduate from less challenging academic programs and go on to earn twice as much money in half the time? This could easily be the case if one of their classmates completed a computer science degree or marketing degree from the same university. What about a life in academia as a professor or university researcher? This can seem to younger minds like an idyllic life where they can focus on the intellectual pursuits they enjoy and not be distracted by more practical concerns. Tenured teaching positions at top research universities, however, are intensely competitive and may take years of teaching at smaller colleges and constant pressure to publish new research. Scientific research grants are also highly competitive, and the funding for research scientists dependent on grant money for their job may literally be up for grabs by some other lab every three to five years.

Students who are passionate about scientific work and driven by the meaning of that work should know about some of the challenges they may face and the time horizon of achieving that dream. This is not meant to discourage them at all. Rather it is meant to help prevent them from getting discouraged because they will have given prior thought to what matters to them and will know that these are issues they may encounter if they choose the path of true scientific work. The silver lining in this potential cloud is that people who are smart enough to be in this situation will be smart enough to pivot their career if they come to realize that they want to earn money faster or take their career in a different direction. There are plenty of physics and math majors who have high-paying jobs in other fields because these are smart, analytical, hard-working people. Instead of worrying that they may not achieve their dreams of scientific discovery, young people who are interested in STEM should feel that they will wind up with a great education no matter what.

Superskills

We have just discussed how a quality STEM education will provide an excellent foundation for many careers both inside and outside STEM fields. But if you really want to help your child turbocharge her long-term career opportunities and immunize her from the perils of automation, recessions, mergers, and research funding shortages, you should talk to her about how to combine "superskills" with her STEM knowledge and interests. Software coding is a superskill. For example, we are in an unprecedented time of opportunity to apply software to problems other than selling software for its own sake or building photo-sharing applications. Many of the smartest entrepreneurs and venture capitalists believe that the big growth engine of the next fifty years will come from bringing software together with other technologies to dramatically improve productivity or solve problems we once thought were not possible to solve. Self-driving cars are a classic example of artificial intelligence software embedded within driving hardware to provide a transportation solution that once seemed like it would only ever be science fiction. This revolution is not limited to machines. It's also happening in biology, medicine, and many other fields.

Some of the most recent start-ups participating in Ycombinator, Silicon Valley's hottest start-up incubator, are applying software and data science to farming, one of the oldest technologies in human history. The innovators who will be most successful in the future will be fluent with both some kind of scientific or engineering background and software development. If you have deep subject matter expertise in a technical field and fluency with applying software solutions to the problems in that field, you will be much more valuable than if you must rely on translating your ideas to others who can implement them for you.

We can tell you from our own experience building an education technology product that having the capacity to understand market problems and then immediately turning around and writing code to solve those problems ourselves made it possible for our company to move much faster and provide better solutions to our customers during the early stages of our business when we were most vulnerable to competition. This same logic applies to scientific and technical domains, not just business products.

Another superskill is communication. If you can communicate effectively with others, you can learn from people with different perspectives and see problems that others may not be aware of. If you have deep technical expertise and the ability to code, you can now quickly solve problems that others cannot solve. If you can communicate your ideas and solutions to others, you can now sell those ideas to an investor or manager, and you can lead a team of people to help scale those ideas into the real world.

A third superskill is self-directed and continuous learning. Science and technology are constantly evolving, and the areas of expertise most in demand can change rapidly. Those who know how to proactively seek out new knowledge and add new skills after entering the workplace will be more likely to advance by working on cutting-edge projects in their field or by acquiring supplemental expertise like digital marketing, which could help them in starting a business.

There are many ways to acquire new skills outside of a traditional college classroom today, especially with online courses from sites like Udacity, Coursera, Udemy, edX, Khan Academy, and many others offered directly by colleges through their online divisions. There are even online courses about learning itself, which can help students learn more rapidly, master material more deeply, and retain information longer. Spend some time talking with your child about how he could build coding, communication, and continuous learning skills to go along with his core passion in science or engineering.

Sample Earnings Outlook

Following is a sample of 2015 median annual earnings for various jobs in science, technology, engineering, and math according to the Bureau of Labor Statistics:

- Microbiologist: $67,550
- Data scientist: $110,620
- Software developer: $100,690
- Physicist: $110,980
- Mechanical engineer: $68,142
- Actuary: $97,070

For wage information on other careers in the field not listed here and for more detailed local wage information or job prospects, we recommend using the online *Occupational Outlook Handbook* provided free by the Bureau of Labor Statistics at https://www.bls.gov/ooh/home.htm.

Keep in mind that we are showing median pay, so some people in these roles may earn substantially less and others may earn substantially more. Generally pay is higher in locations where the cost of living is higher and in fields that are growing more rapidly or require more specialization and experience. In addition to using the *Occupational Outlook Handbook* website, we recommend that your child conduct an Internet search using terms like "future job prospects for [career name]" to get the most current outlook on industry growth potential.