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The Technology Association of Georgia Education Collaborative (TAG-Ed) strengthens the future workforce by providing students with relevant, hands-on STEM learning opportunities and connecting them to Technology Association of Georgia (TAG) resources.

Formerly the TAG Foundation, TAG-Ed is a 501(C)(3) non-profit organization formed by TAG in 2002. Later, the organization's name was re-branded to TAG Education Collaborative to facilitate our role as the leaders for K-12 STEM education in Georgia.

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Tech Career Potential

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Career Counselor And You

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SHELLY A MUNOZ

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PROF. DR. JULIEN GAGNEUR

High School Students Exploring Tech Careers

Imagine a world where innovation fuels every industry, from groundbreaking healthcare solutions to innovative manufacturing technologies—this is the exciting realm of STEM!

High school students considering a technology-based career should be guided to understanding how STEM (Science, Technology, Engineering, and Mathematics) is and will impact the operations and development of many vital industries, including software, healthcare, finance, FinTech, and many others vital industries. Newly created positions in technology are rapidly expanding and are projected to continue to experience significant growth due to substantial investments in artificial intelligence and cloud computing.

Almost 11 million workers in STEM occupations were employed in 2023, a total expected to grow by 11 percent by 2033, exceeding the growth rate of non-STEM occupations by almost 7 percent (BLS 2024). LinkedIn's "Jobs on the Rise 2025" report also identified artificial intelligence engineers and consultants as the two fastest-growing jobs in the United States. The accelerated growth in these industries has created a supply-demand gap, making qualified tech professionals valuable assets.

The current average salary for an artificial intelligence engineer in the United States is \$131,000, with entry-level employees earning around \$70,000 annually (BLS 2024). Cybersecurity is another profitable occupation, in which the average salary for professionals begins at around \$85,000 and can exceed \$160,000 in senior roles (Glassdoor



2024). Similarly, data scientists' salaries range from \$95,000 to over \$150,000, depending on specialization and experience (Tripleten). Given the increasing prevalence of artificial intelligence and cyber threats, the demand for capable workers is expected to grow, providing job security and financial stability.

Students planning their education should consider the earning potential of those who develop competencies in STEM skills. Obtaining relevant college degrees, attending coding camps, and acquiring other credentials are excellent ways to make yourself an attractive candidate for these positions. In addition to these careers' financial incentives, technology positions often offer opportunities to work on innovative projects that will help shape the future. By investing in the right skills and education today, students can position themselves for success in these dynamic and rewarding fields.

Larry K. Williams
President
TAG / TAG-Ed

Larry K. Williams serves as the President and CEO of the TAG and the TAG Education Collaborative. TAG-Ed's mission is to strengthen Georgia's future workforce by providing students with relevant, hands-on STEM learning opportunities by connecting Technology Association of Georgia (TAG) resources with leading STEM education initiatives.

Tech Career Potential

By Wayne Carley



Careers in technical fields are vast and varied, encompassing an interesting array of applications and industries. A brief look at some of the most popular, their salary potential and responsibilities can be eye opening as you consider these pathways and gain a more complete understanding of what a tech career is.

As you'd imagine, the more education you have, the greater the earnings potential. It's been said of course, don't pursue a career path solely for the money...make certain the field deeply interests you in the long run.

Here are five of the leading tech career fields and insight into what it will take to be rewarding both financially and in daily work responsibilities. These are the most critical factors in deciding if you'll be satisfied with the career field.

1. Technical Support Specialist

Primary duties: The Technical support specialists assist clients with using computers and other devices. They typically work within a company's information technology (IT) department and may be responsible for managing computer servers, install software and handle technical problems that arise when employees have challenges with their computers. They often provide customer support to home users who have problems or issues with computer hardware or software purchased from a company.

You'll find this position in the customer support arena providing assistance in software crashes, installation issues, functionality, serial number and version challenges and more. This is done via telephone and chatbot.

The national average salary in the U.S. is about \$54,916 annually and would usually include a package of medical, some kind of retirement prep, vacation and sick leave.

Education: Some companies hiring technical support specialists accept candidates with a high school diploma or GED and proficiency with computers. Other companies may require candidates to have a bachelor's degree in computer science, information sys-

tems or another closely related degree.

Companies hiring for this position will be clear about their requirements and expectations. Keep in mind, companies vary widely in size, from large corporations to the local mom and pop startup with just a few employees.



2. Computer Programmer

Computer programmers write instructions (codes and algorithms) that direct operating systems to execute tasks.

They use a range of computer languages such as Python, Java, JavaScript, C++, C#, Ruby, Swift, Kotlin, TypeScript, and PHP, being among the most popular, but there are many more. The post-ed job within a company is clearly note the languages needed to be successful in developing, testing and fixing software applications. They also work

closely with software developers and engineers to create user-friendly programs.

National average salary: \$68,620 per year with benefits.

Those seeking employment in computer programming usually pursue a bachelor's degree in computer science to help them learn foundational topics such as programming methods, statistics and advanced math. Often, programmers have an obligation to take continuing education classes or additional courses to learn new languages and stay up-to-date on industry developments and this field is ever changing.

Plan on continuing education and study of new computer languages and modifications to what you've already learned. There will be a lifetime of screen time.

3. Database Administrator

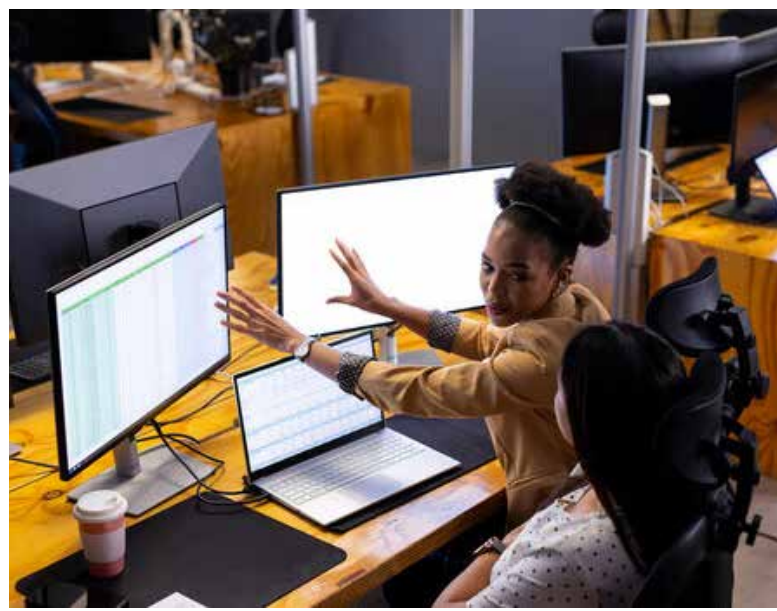
Database administrators manage and maintain software databases, such as library catalogs, user accounts, census information, statistical surveys and client records. You'll always find this focus in the medical fields, from hospitals, to local doctor, dentist and veterinarian offices. They provide secure access to databases and manage backup solutions to prevent data loss in the

event of system failure. Other duties of database administrators include diagnosing and troubleshooting system issues, updating anti-virus software and installing updates.

The average national salary is about \$94,537 per year, and does vary with the region of the country.

Many database administrators have at least a bachelor's degree in computer science, computer engineering or information systems. Some choose to pursue an advanced degree to broaden their knowledge in their field and increase their earning potential. The average salary mentioned include advanced educational benchmarks.

Most DBA training takes place on the job upon their hiring where they learn specifically about the databases and procedures particular to their employer. A variety of continuing education opportunities are available as well, including conferences and seminars.



4. Cybersecurity specialist

This certainly a rapidly growing and urgent field of technical expertise in demand amongst dozens of companies. Cybersecurity specialists are responsible for maintaining the safety of a company's software and network system which may be under constant attack. This work entails developing, testing, applying and analyzing the effectiveness of a variety of security measures. It often involves making recommendations for threat intervention and prevention while monitoring emerging threats from home and abroad.

\$98,832 per year is the national average, with the expected credentials and passion for the field.

Most candidates seeking a job as a cybersecurity specialist earn a bachelor's degree in cybersecurity, IT or computer science. Many companies prefer to hire cybersecurity specialists who have several years of work experience in IT and computer science as these are the foundations of cyber applications and innovation.

Every major industry has the need for exceptional cybersecurity...not just the financial market. Healthcare, aerospace, law enforcement and the military all hold cybersecurity as vital.



5. Software engineer

Software engineers apply the principles of engineering (decision making and problem solving) to develop computer applications. They often collaborate with developers and other engineers to create software programs. Their responsibilities also include recommending upgrades for existing systems and documenting an application or system in detail to write operating instructions.

National average salary run about \$108,896 per year, with the need for good communication and wriing skills. With a high salary comes high expectations.

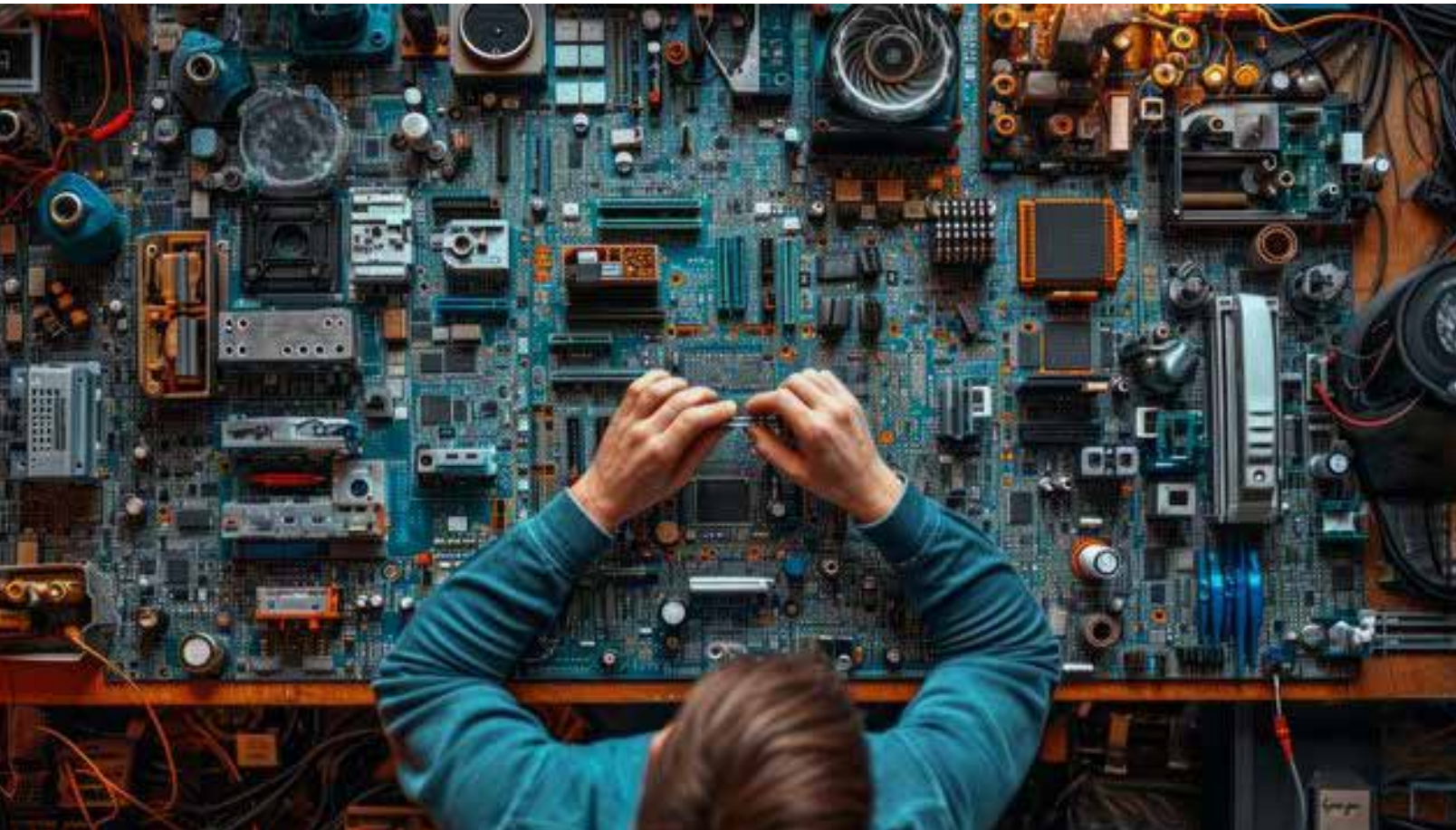
Educational requirements include a bachelor's degree in software development, computer programming, mathematics or a similar field. Some software engineers can obtain employment with a high school diploma or relevant work experience with the understanding that continuing education is a must.



Should you decide to remain in your current location after graduation, these tech fields and a dozen more related careers await you. Tech fields are usually **not** interchangeable, as hardware, computer languages, system resources and company focus can vary widely, so due diligence by you as you research the best fit for you is critical to your success and the employees.

Company websites within the Tech community are usually very transparent about the skill sets needs, and by the process of elimination, you can quickly cut down the number of possible areas of interest.

The best time to start is now.





Share this issue with your students, peers, parents and industry professionals you know. Make this a new monthly connection for curiosity, interaction, college prep and career development.

Many parents really enjoy this content as they too pursue their personal life-long learning goals.

Local industry and government leaders need to know about this resource as their future employees decide and prepare how to spend their careers.



What Your School's Career Counselor Can Do For You

By Joanne Tucker

When Starting high school it's normal to feel a mix of excitement and nervousness. With new courses and options available to you, high school is the time to start thinking about what your interests and even career goals truly are.

One of the best resources to help you through this process over the next four years is your career counselor. But what exactly can they do for you?

1. Help You Explore Career Options

Your career counselor can introduce you to a wide range of careers you might not have considered. They can help you understand what different jobs involve, what skills are needed,

and what kind of education or training is required. Whether you're interested in becoming a doctor, an artist, an engineer, or something else entirely, your counselor can provide valuable insights.

2. Guide You in Choosing Classes

Choosing the right classes in high school can set you on the path to your future career. Your counselor can help you select courses that align with your interests and career goals. Or, maybe it's something you just want to explore but are unsure about. They can also advise you on advanced placement (AP) or honors classes that might be beneficial, CTE pathways, and other pro-

grams that may exist at your particular high school.

3. Assist with College and Scholarship Applications

If you're thinking about going to college, your career counselor is a great resource. They can help you research colleges, understand the application process, and even assist with writing your personal statement.

Plus, they can guide you in finding and applying for scholarships to help pay for college. They can also help you navigate the world of vocational schools and certificate programs, considering a budget if you're heading straight into the workforce and more.

4. Provide Support and Advice

High school can be challenging, and it's important to have someone to talk to, even if it's to help point in the right direction of another resource or person on campus who can help. Your career counselor is there to listen and provide that support.

Whether you're feeling stressed about school or unsure about your future, or just aren't sure who the right person is that you need to talk to, they can offer advice and resources to help you navigate these challenges.

5. Connect You with Opportunities

Your career counselor can connect you with internships, volunteer opportunities, and extracurricular activities that can help you gain experience and build your resume. These opportunities can be a great way to explore your interests and develop new skills. They can also help you develop the basics of a resume and provide that second set of eyes.

6. Help You Develop Skills

From resume writing to interview preparation, your career counselor can help you develop the skills you need to succeed. They can provide workshops and one-on-one coaching to help you feel confident and prepared for the future.

7. Plan for the Future

It's never too early to start planning for your future. Your career counselor can help you set goals and create a plan to achieve them. They can help you think about what you want to do after high school and how to get there.

How to Make the Most of Your Career Counselor

- **Schedule Regular Meetings:** Don't wait until senior year to meet with your counselor. Start early and check in regularly.

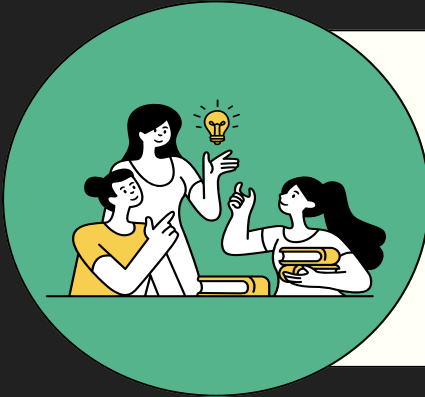


- **Be Open and Honest:** Share your interests, goals, and concerns. The more your counselor knows about you, the better they can help.
- **Take Advantage of Resources:** Attend workshops, use career exploration tools, and participate in any opportunities your counselor offers.

Remember, your career counselor is there to help you succeed, even if you don't know what it is exactly that you want or need. They are there to help you explore through various programs and help you find your interest and future pathway toward success, now!



How Highschool Students Can Prepare for a Tech Career in the Medical Field



01. STEM COURSES AND SUBJECTS

Focus on excelling in life and physical science courses like biology, chemistry, and physics. Exploring health science can provide a solid foundation of medical concepts.

02. COMPUTER SCIENCE & CODING

Gaining a solid foundation in computer science and coding is also an essential part of the modern medical field, with languages like Python, Java, or C++ being particularly useful.



03. SOFT SKILLS

Developing soft skills like communication, teamwork, and problem-solving through group projects or leadership roles is also crucial.



For more STEM Education
resources, visit tagedonline.org

Empowering Educators:

The Intersection of Teacher Efficacy and Proactive STEM Programs

by Shelly A Munoz



When examining the elements of an effective STEM program, research continually points to one critical factor: teacher efficacy. Renowned researcher John Hattie identifies teacher efficacy as the most significant determinant of student achievement, with an effect size of 1.57—well above the “zone of desired effects” in his meta-analyses of educational interventions. The strength of teacher efficacy lies in its ability to inspire educators to innovate, adapt, and create rich, meaningful learning experiences. When applied to STEM education, fostering teacher efficacy becomes essential to building and sustaining a proactive and successful program.

The Power of Teacher Efficacy in STEM

Teacher efficacy, at its core, refers to a teacher’s belief in their ability to positively affect student learning. Hattie’s research demonstrates that when educators believe in their own capacity to overcome challenges and adapt instruction to meet diverse needs, they achieve far greater outcomes in the classroom.

In STEM fields—where teachers must navigate complex, rapidly evolving content, engage students in problem-solving, and integrate interdisciplinary approaches—this belief is especially crucial.

For a proactive STEM program to flourish, teachers need to feel confident not only in their content knowledge but also in their ability to design and deliver lessons that ignite curiosity and foster critical thinking. Teacher efficacy empowers educators to embrace innovative practices like inquiry-based learning, project-based STEM activities, and technology integration.

Connecting Bandura's Theories to STEM

Albert Bandura's foundational work on self-efficacy provides valuable insights into how teacher efficacy can be developed and sustained. Bandura posits that efficacy beliefs are shaped by four key sources:

1. **Mastery Experiences:** Success in implementing STEM activities, such as engineering challenges or coding lessons, builds confidence in teaching these disciplines.
2. **Vicarious Experiences:** Observing peers successfully lead STEM programs



encourages teachers to replicate similar strategies in their classrooms.

3. Social Persuasion: Positive reinforcement and encouragement from administrators and colleagues strengthen teachers' belief in their capabilities.

4. Emotional States: Providing professional development that reduces anxiety around new technologies or unfamiliar STEM content creates a supportive environment for growth.

Integrating these principles into STEM programming can help teachers develop a sense of personal efficacy, equipping them to take risks, collaborate with peers, and tackle complex challenges with resilience.

Supporting Teachers in STEM: Strategies for Success

Building a proactive STEM program requires more than just providing resources or curriculum; it involves creating systems that nurture and sustain teacher efficacy. Here are three critical strategies to achieve this:

- **Invest in High-Quality Professional Development** Professional development (PD) tailored to STEM needs should focus on hands-on experiences and collaborative learning. Workshops on engineering design challenges,

coding bootcamps, and interdisciplinary lesson planning equip teachers with the tools and confidence to integrate STEM into their classrooms.

- **Foster Collaborative Learning Communities** Encourage STEM educators to engage in professional learning communities (PLCs) where they can share successes, troubleshoot challenges, and learn from one another. These communities create opportunities for vicarious learning and build a culture of mutual support.

- **Provide Leadership Opportunities** Empower teachers to take on leadership roles in STEM initiatives, such as facilitating PD sessions, mentoring colleagues, or leading STEM clubs. These opportunities reinforce mastery experiences and enhance their sense of efficacy.

The Ripple Effect: Teacher Efficacy and Student Success

When STEM educators feel capable and supported, the impact is transformative. They create dynamic, student-centered learning environments where curiosity thrives, and students engage deeply with STEM concepts. This ripple effect extends beyond the classroom, as empowered teachers inspire the next generation of problem-solvers, innovators, and critical thinkers.



As we design STEM programs, let us remember that the key to success lies in our teachers. By investing in their efficacy, we lay the foundation for sustainable, proactive programs that equip students to excel in a rapidly evolving world.

Conclusion

John Hattie and Albert Bandura's work highlights a universal truth: confident, supported teachers are the cornerstone of educational success. In the realm of STEM, where innovation and adaptability reign, teacher efficacy becomes

the linchpin of effective programming.

By prioritizing teacher growth, we can build a future where STEM education not only meets the challenges of today but also prepares students to lead the way into tomorrow.

KEY TIPS FOR HIGH SCHOOLERS AIMING TO BECOME TECH PROFESSIONALS



DR. LORETTA DANIELS
EXECUTIVE DIRECTOR, TAG-ED

Written in Collaboration with, Win Cawthorne
Marketing Coordinator
TAG Education Collaborative



Q: In your experience, what are the common misconceptions high school students have about the tech industry, and how can we address them?

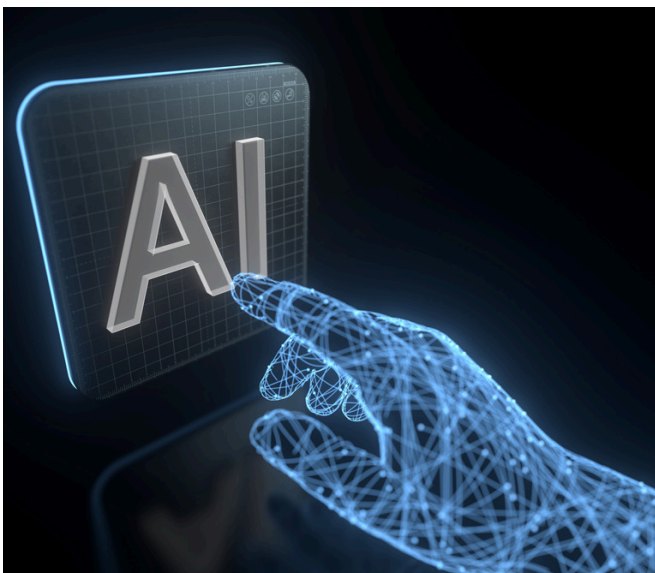
A: Often, high school students have several misconceptions about tech careers. The most common belief is that to secure a tech job, you will need to take advanced math and science courses. Although some tech jobs require these types of skills, others only require communication, problem-solving, and a creative way of thinking. To address this misconception, educators can provide information regarding various roles during career days, business guest speakers, and tech information systems.

Another misconception is that tech professionals are introverts who lack social interaction and the ability to communicate with others. However, several tech positions require the capability to work with a team through collaboration, creativity, and interpersonal skills to provide experiential opportunities for students to learn about their level of interest and aptitude by introducing them to coding camps, internships, and mentorships.

Q: How important is having a technology degree when entering the tech workforce?

A: As an educator, I advocate for higher education and additional specialized credentials (i.e. tech certificates). However, a technology degree is not always a requirement to enter the tech workforce. It is important to recognize that because of the high number of projected tech positions during the next five years, many employers recognize the need to hire non-traditional tech talent, which includes those who do not have a tech degree. According to a 2024 Intelligent.com report, forty-five percent of companies plan to eliminate bachelor's degree requirements for some positions in 2024. In 2023, 55% of companies removed degree requirements for entry-level and mid-level roles. These companies include IBM, Accenture, Delta Airlines, and Walmart.

Career pathways for tech jobs, including online certifications, have become increasingly popular and recognized as viable alternatives. A growing innovative path to attaining an entry-level tech position is through a registered tech apprenticeship program. The Technology Association of Georgia (TAG) is the first registered tech apprenticeship program in Georgia and the Southeast. The registered apprenticeship program offers job experience and begins with the intent to retain.



Typically lasting at least one year, the registered apprenticeship commitment includes competency benchmarks with structured technical and on-the-job training. Completing a registered apprenticeship results in a transferable, nationally recognized credential certifying competency as a fully qualified worker in a specific occupational role. competency benchmarks with structured technical and on-the-job training. Completing a registered apprenticeship results in a transferable, nationally recognized credential certifying competency as a fully qualified worker in a specific occupational role.

Q: How important is it for tech professionals to continuously upskill or specialize in new technologies to stay competitive in terms of salary?

A: Because of the rapidly evolving technology advances, continually upskilling and reskilling is essential for career growth and stability. However, it is necessary to understand the difference between the two. Upskilling involves enhancing existing skills to meet new demands while reskilling focuses on acquiring new skills to transition into different roles or take advantage of new career opportunities.

Upskilling and reskilling are essential in today's job market because artificial intelligence (AI) technology will be present in most technical and non-technical jobs. The role of AI in upskilling and reskilling is vital because it can help employees and organizations identify future skill needs.

As an entry-level employee, continuous upskilling and reskilling are vital to competitiveness in an innovative technology job market because AI automates routine tasks and helps organizations anticipate future skill needs. Acquiring new tech skills allows employees to quickly develop the technology skills necessary to succeed in their current role, gain a competitive edge in the job market, and be ready for career advancement within the organization. Upskilling and reskilling can lead to significant increases in salary. According to [US News](#), the job market is constantly changing, and upskilling or reskilling should be a priority. Whether securing a degree or completing a tech certification, investing in yourself allows you to earn a higher income.

Additionally, the [O'Reilly Report](#) shares that respondents acquired certifications such as cloud certifications, specifically in AWS and Microsoft Azure, were most strongly associated with salary increases.

Based on an Amazon Web Services survey, employers are willing to pay an average of 30% more for AI-skilled workers in the IT department, but as in other departments. Employers are willing to pay workers with AI skills a 29% higher salary in research and development, followed by sales and marketing (28%), finance (28%), business operations (27%), legal, regulatory, and compliance (24%), and human resources (24%).

As you can see, the research reveals that employers are ready to increase pay for employees who acquire AI skills, regardless of position within the organization.

Q: What resources (e.g., online courses, textbooks, open-source projects) do you recommend for high school students to strengthen their programming and problem-solving abilities?

A: Fortunately, there are multiple resources for high school students to gain or strengthen their programming and problem-solving abilities. First, TAG offers no-cost technology skill-building courses, Pathway Tracks, through our partnership with SkillStorm. These micro-courses provide pathways to high-value careers for students at no cost to the school or your students.

The courses are self-paced (which allows students to learn during the evenings and weekends) and mentor-supported intro courses designed to provide foundational knowledge to students. Also, platforms like [Create & Learn](#) offer free computer science classes for students of all ages on fun and state-of-the-art technologies. Experts from Google, Apple, and Stanford present these courses.

Equally crucial for tech careers is the ability to problem solve, and various approaches and resources are available. Students can explore summer coding clubs, the programs offered as extracurricular activities, and through high school internships.

One of the most effective methods of problem-solving exercises is to participate in experiential learning. Experiential learning is hands-on learning where students can learn and apply what they have learned in real-life situations. This method is also referred to as project-based learning.

Q: What are some emerging tech roles that are seeing significant salary growth?

A: Studies show that tech jobs that leverage computer and information technology to solve problems are seeing significant salary growth. The [U.S. BUREAU OF LABOR STATISTICS](#) reports that the median annual wage for this group was \$104,420 in May 2023, which was higher than the median yearly wage for all occupations of \$48,060.

Top entry-level tech positions include web developer, data analyst, UX Designer, digital project manager, and software developer.

Because of the rapidly changing tech workforce, review reports like the [CompTIA Jobs Report](#) to learn which tech careers are in demand.

Q: What role do you think diversity plays in the tech industry's future, and how can we encourage a more diverse student population to pursue tech careers?

A: Diversity equals innovation, and companies recognize the benefits of a culturally diverse team. Educators can encourage underserved students (minorities and girls) to prepare for a career in technology. One of the most effective ways to encourage diverse students to seek technology careers is to incorporate STEM activities and resources that are culturally relevant, interactive, and collaborative. By incorporating lived experiences into projects and exercises, students can apply STEM programming to their experiences.

According to the authors of "[Culturally Responsive Pedagogy, Science Literacy, and Urban Underrepresented Science Students](#)," a chapter in a book titled International Perspectives on Inclusive Education, culturally based best practices in teaching science literacy can aid in the achievement of underrepresented science students.

Q: What advice would you give to someone starting in tech who wants to maximize their earning potential in the long term?

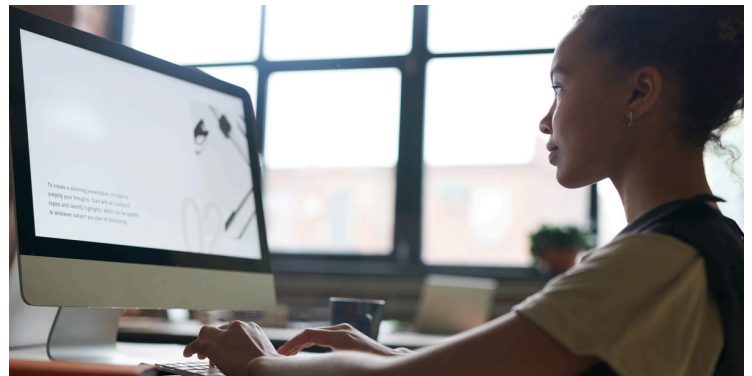
A: I advise students to consider mapping out a pathway to reach their pinnacle of success. Because the technology field is consistently evolving, it is important to focus not on job titles but on responsibilities.

To maximize your earning potential in a long-term tech career, students should focus on evolving in-demand skills such as AI, cybersecurity, and machine learning. As previously discussed, acquiring valuable skills by upskilling and reskilling through online courses and certifications is crucial. I also encourage individuals to participate in projects offered on the job, which helps build skills and increase experience levels.

Q: How can educators create a classroom environment that fosters creativity and innovation, which are essential for tech careers?

A: As a university professor and instructor, I understand that, as educators, we strive to prepare our students to explore options for their future careers. As a result, we need to recognize the options available to them through ongoing research and industry trends, whether they decide to continue their education through college or opt to go directly into the workforce. One of the key skills we need to instill in each student is the ability to adapt to changing circumstances. To do so, we must create a culture of innovation in the classroom, where we are intricately involved experientially.

"TO MAXIMIZE YOUR EARNING POTENTIAL IN A LONG-TERM TECH CAREER, STUDENTS SHOULD FOCUS ON EVOLVING IN-DEMAND SKILLS SUCH AS AI, CYBERSECURITY, AND MACHINE LEARNING."



TAG-Ed
Education Collaborative

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education resources?
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HIGH SCHOOL INTERNSHIP PLACEMENT PROGRAM

**Help build the
future technology
workforce: today's
STEAM students!**

The TAG-Ed Internship Program offers exceptional high school students with a technology career path, the opportunity to learn in a real-world environment and get hands-on experience in a field of study relating to Science, Technology, Engineering, Arts, or Math (STEAM). Students are matched with participating companies based on related interests and qualifications. The internship is for a minimum of eight (8) consecutive weeks.

Who Can Apply:

- High School Juniors and Seniors (Age 17+)

Benefits:

- Valuable workplace experience
- Mentorship opportunities
- Workforce readiness skills
- Clarity for future careers

Program Overview:

- Interns receive a \$1500 stipend upon completion of their internship
- The internship spans eight consecutive weeks during the summer, starting June 2nd.



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For more information, visit
tagonline.org

Two ORNL staff receive 2024 Great Minds in STEM Luminary award

By Angela M Gosnell / ORNL

Verónica Melesse Vergara and Felipe Polo-Garzon, two staff members at the Department of Energy's Oak Ridge National Laboratory have been honored with Luminary Awards from Great Minds in STEM, a nonprofit organization dedicated to promoting STEM careers in underserved communities.

The Luminary Award is presented to engineers, scientists and technology professionals who represent corporate and government agencies from multiple industries and sectors. The award recognizes their achievements leading, collaborating and initiating key programs and research in their respective



Verónica Melesse Vergara and Felipe Polo-Garzon receive Luminary Awards for their achievements leading, collaborating and initiating key programs and research in their respective fields. Credit: ORNL, U.S. Dept. of Energy

fields. All Luminary honorees were chosen through a competitive peer-review selection process by the Hispanic Engineer National Achievement Awards Corporation, or HENAAC.

Verónica Melesse Vergara, head of the Operations Section in the National Center for Computational Sciences at ORNL, was honored with the 2024 Luminary Award for her exceptional technical expertise in high-performance computing, or HPC, her national and international recognition as a leader in the field, and her dedication to broadening participation in HPC.



Verónica Melesse Vergara, head of the Operations Section in the National Center for Computational Sciences at ORNL, has been awarded the 2024 Great Minds in STEM Luminary Award. Credit: ORNL, U.S. Dept. of Energy

Melesse Vergara brings over a decade of experience to the industry and has played a pivotal role as the acceptance testing lead for two of the world's most powerful supercomputers: Summit and Frontier. Both systems, housed at ORNL's Leadership Computing Facility (OLCF), were recognized as the fastest supercomputers upon their launch in 2018 and 2022, respectively.

"I was honored to nominate Ms. Verónica G. Melesse Vergara for the 2024 HENAAC Awards," OLCF Program Director Ashley Barker said. "Her exceptional technical expertise in HPC, her national and international leadership in the field, and her unwavering commitment to broadening participation in HPC are just a few of the reasons she is so deserving of this prestigious recognition."

Melesse Vergara is also dedicated to advancing the Hispanic and Latin American community in HPC. She co-leads the cross-institutional initiative Americas HPC Collaboration, which aims to connect researchers in Latin America and the Caribbean with resources and mentorship opportunities in the United States while raising awareness about the opportunities available at DOE national laboratories.

Through her partnerships within the Americas HPC Collaboration network, she has hosted virtual tutorials on HPC

topics in Spanish for undergraduate students, served as an invited speaker at the Conference and played a vital role in establishing an official chapter for Women in HPC in Latin America.

Felipe Polo-Garzon, catalytic chemist at ORNL, received the 2024 Luminary Award for his outstanding research expertise, self-teaching ability and passion for his culture and community.

After completing a postdoctoral fellowship at ORNL, Polo-Garzon has been on the chemical sciences research staff since 2019, working on the fundamental understanding of catalytic mechanisms and kinetics in energy conversions. Polo-Garzon's research interests deal with the development of reactivity descriptors for heterogeneous catalysis, as well as the elucidation of governing reaction mechanisms through in-situ and operando characterization techniques, kinetic analysis and computational tools.

“Felipe carved his reputation as a driver of science at ORNL, and has played a critical role in our collaborations, bringing a personal, congenial attitude along with research acumen that far exceeds many of his contemporaries.

Our group relies on Felipe to make both personal and professional connections that build confidence and trust

among all contributors,” said Zili Wu, group leader of surface chemistry at ORNL. “It is this built trust, which permeates our organization, that has fast-tracked scientific results and advances and improved workplace well-being and job satisfaction among all of those who have the opportunity to interact and collaborate with Felipe.”



Felipe Polo-Garzon, catalytic chemist in ORNL's Surface Chemistry and Catalysis group, has been awarded the 2024 Great Minds in STEM Luminary Award. Credit: ORNL, U.S. Dept. of Energy

Polo-Garzon has volunteered with Centro Hispano, an organization that works to raise awareness for the exceptional contributions of the Latino community in Appalachia. One of his involvements has been through the Latinos Empowered to Advocate and Dream Mentorship program, which serves to foster leadership development skills, public speaking, teamwork and advocacy while exploring postsecondary education and career options.

The Great Minds in STEM Conference, formerly the Hispanic Engineer National Achievement Awards Conference, has been a national leader in STEM for more than 35 years.

UT-Battelle manages ORNL for the Department of Energy's Office of Science, the single largest supporter of basic research in the physical sciences in the United States. The Office of Science is working to address some of the most pressing challenges of our time. For more information, please visit:

energy.gov/science





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Judges Needed for **Future City® Competition:** Help Shape the Next Generation of Innovators

DiscoverE (Discover Engineering), a nonprofit organization committed to inspiring the next generation of engineers, is inviting engineering and technical professionals—and anyone passionate about shaping the future—to volunteer as judges for the 33rd Annual **Future City® Competition**. Judging can be done either in person or virtually, with opportunities available in January for regional events or in February at the global finals in Washington, DC.

This year's Future City® Competition challenges middle and high school students to design floating cities that address the rising challenges of sea levels and climate change. Students present their ideas through essays, project plans, scale models, and presentations, providing judges with a unique opportunity to engage with young innovators as they tackle real-world problems.

Over 67,000 students from more than 1,800 schools and 37 regions in the U.S., plus teams from Canada and China, participate each year, with regional winners competing at the global finals. This year's finals will be held February 17-20, 2025, in Washington, DC, during Engineers Week.



Middle school students will compete for the grand prize: \$7,500 for their school's STEM program, sponsored by Bentley Systems, and an unforgettable STEM experience. High school participants, now officially part of the competition, will have the chance to compete for valuable college scholarships.

"We're excited to expand the Future City Competition to include high school students this year, giving even more young minds the chance to think and innovate like real engineers," says Kathy Renzetti, Executive Director & CEO of DiscoverE. "As a judge, you'll witness firsthand the creativity and potential of these students as they gain crucial skills like teamwork, communication, and critical thinking that will benefit both their futures and the STEM workforce."

Calling All Engineers, Technical Professionals, and Future Difference-Makers

As a judge, you'll play a vital role in evaluating student projects and select-

ing winners at the regional and national levels. You will:

- Review student essays, project plans, and models.
- Assess students' grasp of engineering principles and their ability to apply them to real-world issues.
- Provide invaluable feedback and encouragement to young STEM enthusiasts.
- Participate in person or virtually, depending on your preference.

Why Volunteer?

Judging for the Future City Competition offers a rewarding experience, allowing you to:

- Make a meaningful impact on young students' lives.
- Support the development of the future engineering workforce.
- Network with fellow professionals.
- Gain fresh perspectives from the next generation of innovators.

Join the Movement

If you're an engineer, educator, STEM

professional, or community leader who wants to inspire change, DiscoverE encourages you to volunteer as a judge. Visit futurecity.org to learn more about the competition and how to get involved.

To volunteer as a judge, register at:
futurecity.org/judge-registration

Major funding for DiscoverE's programs, including the Future City Competition, is provided by Bechtel Corporation, Overdeck Family Foundation, NCEES, Bentley Systems Inc., Northrup Grumman Foundation, TE Connectivity, PMIEF, United Engineering Foundation, UL Solutions, RTX and Shell Energy.

About DiscoverE

DiscoverE is a nonprofit organization committed to providing global STEM programs that inspire and empower the next generation of engineers. Focused on reaching underrepresented students, DiscoverE's initiatives include Engineers Week™, Introduce a Girl to Engineering Day™, and the Future City® Competition, many of which are free to participants. For more information, visit discovere.org.





Artificial Intelligence

Deciphers Genetic Instructions

By Prof. Dr. Julien Gagneur

Professorship of Computational Molecular Medicine
Technical University of Munich

Deep learning algorithms reveal the rules of gene regulation.

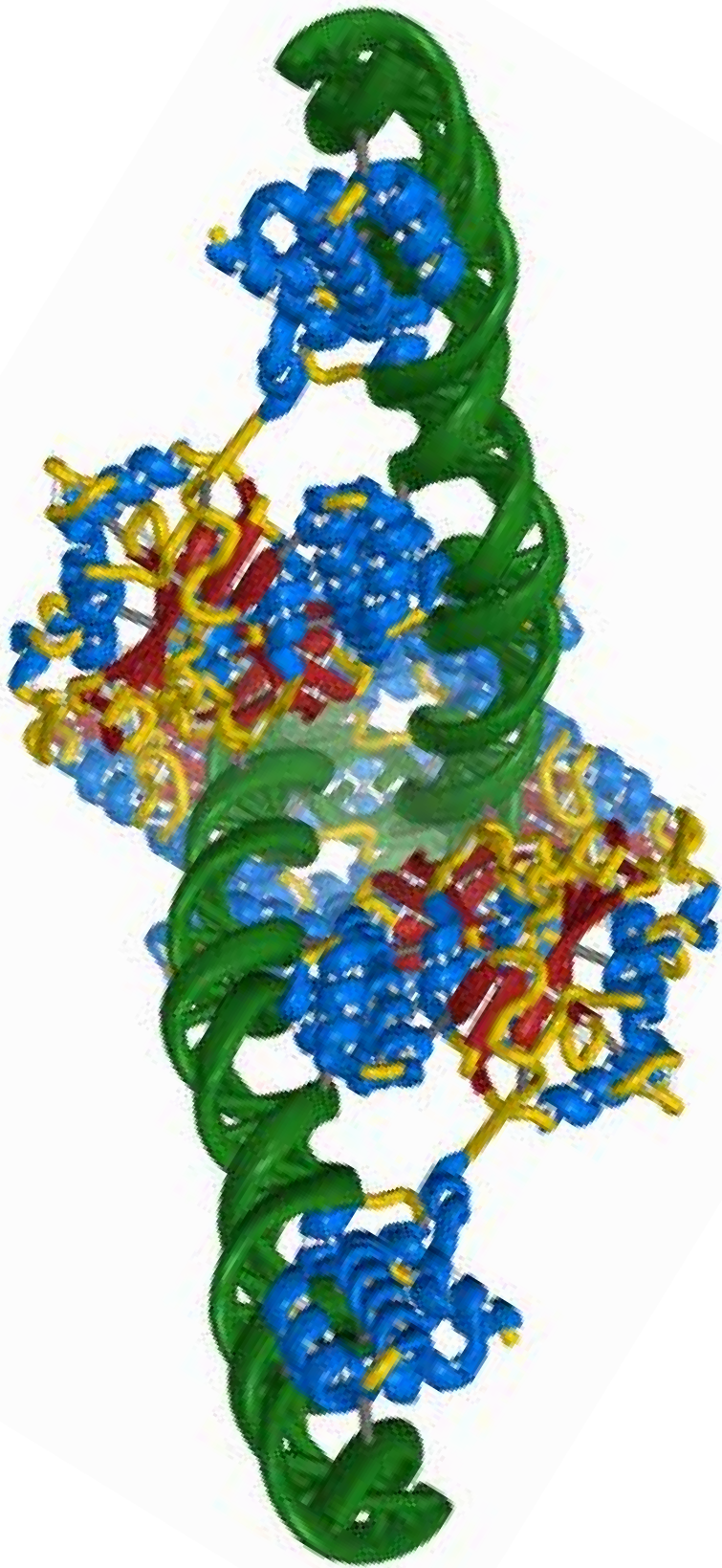
With the help of artificial intelligence (AI) a German-American team of scientists deciphered some of the more elusive instructions encoded in DNA. Their neural network trained on high-resolution maps of protein-DNA interactions uncovers subtle DNA sequence patterns throughout the genome, thus providing a deeper understanding of how these sequences are organized to regulate genes.

Artificial intelligence algorithms are extremely powerful at fitting massive and complex datasets. But their interpretation, rationalizing how the machine performs specific predictions when presented a given input, is notoriously hard. This black box behavior hampers wide acceptance of AI in

medical diagnostics, where justifications matter, and restrain their utility in natural sciences where understanding mechanisms is the goal.

Now, an interdisciplinary team of biologists and computational researchers from the Technical University of Munich, the Stowers Institute for Medical Research and the Stanford University has shown that applying neural networks, such as those used for facial recognition, together with newly developed model interpretation techniques can be used to decipher complex instructions encoded in DNA.

One of the big unsolved problems in biology is the genome's second code, its regulatory code. The DNA bases encode not only the instructions for how to build proteins, but also when and where to make these proteins in an organism.



The regulatory code is read by proteins called transcription factors that bind to short stretches of DNA called motifs. However, how particular combinations and arrangements of motifs specify regulatory activity is an extremely complex problem that has been hard to pin down.

DNA binding experiments and computational modeling going hand in hand.

The key was to perform transcription factor-DNA binding experiments and computational modeling at the highest possible resolution, down to the level of individual DNA bases. The increased resolution allowed the team not only to train highly accurate neural network models, but also to extract the key elements and patterns from the models, including transcription factor binding motifs and the combinatorial rules by which they function together as code.

“Neural networks are black boxes, but they can be interrogated digitally. So, with a large number of virtual experiments we figured out the rules the neural net learned” says first author Dr. Žiga Avsec, member of the group of Julien Gagneur, professor of computational molecular medicine at the Technical University of Munich. Together with Anshul Kundaje, professor at the Stanford University, he created the first version of the model when he visited Stanford as a guest scientist.

Applied to master regulators of stem cell differentiation and confirmed experimentally by CRISPR genomic edition, the approach revealed complex rules involving a precise positioning along the DNA double helix and specific ordering of events. “This was extremely satisfying,” says project leader Julia Zeitlinger, investigator at the Stowers Institute and professor at the University of Kansas Medical Center, “as the results fit beautifully with existing experimental results, and also revealed novel insights that surprised us.”

A pattern becomes visible: how Nanog binds to DNA

For example, the researchers found that a well-studied transcription factor called Nanog binds cooperatively to DNA when multiples of its motif are present in a periodic fashion such that they appear on the same side of the spiraling DNA helix. “There has been a long trail of experimental evidence that such motif periodicity sometimes exists in the regulatory code,” Zeitlinger says. However, the exact circumstances were elusive, and Nanog had not been a suspect. Discovering that Nanog has such a pattern, and seeing additional details of its interactions, was surprising because we did not specifically search for this pattern.”

A classic computational model is built on hand-crafted, rigid rules to ensure

that it can be interpreted”, says Avsec. “However, biology is extremely rich and complicated. By abandoning the need to interpret individual parameters, we can train much more flexible and nuanced models that capture any biological phenomena, including those yet unknown.”

A powerful bottom-up approach

This neural net model – named BPNet for Base Pair Network – is a powerful bottom-up approach similar to facial recognition in images, where a neural network first detects edges in the pixels, then learns how edges form facial elements like the eye, nose or mouth, and finally how facial elements together form a face. Instead of learning from pixels, BPNet learns from the raw DNA sequence and learns to detect sequence motifs and eventually the higher-order rules by which the elements predict the base-resolution binding data.

Both the Zeitlinger Lab and the Kundaje Lab are already using BPNet to reliably identify binding motifs for other cell types, relate motifs to biophysical parameters and learn other structural features in the genome such as those associated with DNA packaging. To enable other scientists to use BPNet and adapt it for their own needs, the researchers have made the entire software framework available with documentation and tutorials.

“It combines deep learning modeling of genome-wide assays down to single-nucleotide resolutions, together with advanced explainable AI techniques allowing to interpret what “the black box” has learned. The methodology will help biologist studying the full regulatory grammar.”

Publication:

Base-resolution models of transcription factor binding reveal soft motif syntax Žiga Avsec, Melanie Weilert, Avanti Shrikumar, Sabrina Krueger, Amr Alexandari, Khyati Dalal, Robin Fropf, Charles McAnany, Julien Gagneur, Anshul Kundaje, and Julia Zeitlinger *nature genetics*, Feb. 18, 2021 – DOI: 10.1038/s41588-021-00782-6 <https://www.nature.com/articles/s41588-021-00782-6>

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of Child Health and Human Development and the National Institute of General Medical Sciences.

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The Technical University of Munich (TUM) is one of Europe’s leading research universities, with more than 600 professors, 45,000 students, and 11,000 academic and non-academic staff. Its focus areas are the engineering sciences, natural sciences, life sciences and medicine, combined with economic and social sciences. TUM acts as an entrepreneurial university that promotes talents and creates value for society.

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AI Skills: The New Currency in Today's Job Market

The AI revolution is here. Ever since ChatGPT arrived on the scene in late 2022, artificial intelligence has been reshaping the way we live and work. What does that mean for tech professionals looking to compete in a changing labor market?

TV pundits and talking heads love to get riled up about whether robots are coming for our jobs — but the truth is that AI will probably create more jobs than it eliminates. And one thing's for sure: understanding how AI works, and mastering AI skills, will be the key to success in tomorrow's ever-changing world of work.

New research shows that a growing number of companies are asking for AI skills in job descriptions — including non-tech roles. And a survey of HR professionals released last month shows that job candidates with AI skills ask for more money during the interview process — and tend to get it once they're hired. Simply put, AI is going to be underpinning nearly every job out there. That's why staying ahead of the latest in AI development is so important.

Building AI skills doesn't just mean learning how to engineer prompts for ChatGPT. It's everything from programming to data modeling and analysis to mastering concepts like machine learning and natural language processing. And if there's anything certain in our fast-paced economy, it's that building AI fundamentals today will translate to career opportunities tomorrow and beyond.

That's where SkillStorm comes in. In partnership with TAG, we offer Microsoft Azure AI courses that are instructor-led, career-aligned tech certification courses and will help you build the AI skills that employers need. From the basics of AI and machine learning to a comprehensive understanding of how to design, deploy, and maintain AI solutions, you'll learn everything you need to accelerate a career in the economy's hottest fields.

It won't be long before all kinds of jobs, all across the economy, require AI skills. And starting now is the best way to accelerate your ascent up the career ladder. Build those skills today and you'll lay the foundation for opportunity for years to come — and set yourself up for success in an AI-driven future of work. [Register today](#) to get started with a career in tech.





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