

The background of the entire page is a blue-toned microscopic image of cells, likely from a plant or animal tissue, showing various cell walls and internal structures. The cells are arranged in a somewhat regular pattern, with some larger and some smaller, creating a textured, organic appearance.

# *the* **BIG** **PAY** *theory*

**Science | Technology | Engineering | Math**

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# STEM: Science, Technology, Engineering & Math

## TOMORROW'S JOBS TODAY

The numbers are convincing – students who choose a STEM major (encompassing science, technology, engineering and math-oriented disciplines) earn more than non-STEM majors. In fact, the top ten bachelor degree majors with the highest median paychecks are all in STEM fields, according to the National Governor's Association Center for Best Practices.

“To put this further in perspective, the nationwide unemployment number right now is just about 6.5 percent, and it's about that in Virginia overall,” says James Brown, executive director at the Washington, D.C.-based STEM Education Coalition ([www.stemedcoalition.org](http://www.stemedcoalition.org)). “But for someone with a STEM background, it's more like 4.5 percent. While the country is still sort of struggling in this economy and trying to find their way, if you're a STEM worker, you're going to do better across the board. And the numbers get better the higher your level of education.”

Along with benefits like economic security, STEM fields offer many intangible rewards as well, such as the opportunity to contribute to the community and to be front and center for exciting new discoveries, from breakthrough medicines to new, earth-friendly power sources.

With all this to recommend it, you'd think STEM classes and career paths would be filled to overflowing, yet STEM is an area that remains underserved. Brown identifies two contributing factors: interest and preparation.

“There are lots of people who may be interested in the STEM fields but are not prepared to succeed,” he says. “There are also lots of kids who have the preparation but don't realize they might be interested in a STEM field.”

Brown points to studies demonstrating that hands-on learning opportunities and mentorships, especially in minority and rural communities, are important keys to turning this around.

“One area where this is really taking off is in high quality afterschool experiences,” says Brown. “That’s where companies and foundations are investing, so there’s a lot of energy and creative growth in this space.”

Ron Taylor, founder and president of Men of Faith ([www.mofvb.org](http://www.mofvb.org)), a Virginia Beach organization that works with young people, has seen firsthand the difference an afterschool program can make. He welcomes middle schoolers twice a month to his Saturday Innovation STEM Academy and watches as imaginations spark and career ambitions ignite.

“We have a lot of good partners,” says Taylor. “NASA has worked with the kids on a Mars project, dealing with heat shields and purifying water. They just went on a field trip to the Wright Brothers National Memorial in North Carolina, and they’re going to be working on robotics. We took them to Jamestown to learn how to plant and gave them seeds that NASA had sent into space and seeds from Walmart to compare growth rates. The STEM instructors expose them to a lot of different areas.



“All middle school students in Virginia Beach can participate,” Taylor says. “This is a free program that was created to reach groups that are underrepresented in STEM fields.” Taylor is quick to add that he never turns away any child who is interested in participating. “We’re inclusive, we have males, females, black, white, purple, anyone who wants to be part of this is welcome. We have a flyer and we send out registration forms that parents have to sign,” he says. Taylor is available to answer questions about the program at 757-237-6257. Donors who are interested in helping fund the program can also reach him at that number.

STEM Summer Camps that cater to young people are another great way to draw kids into the sciences. ODU has an excellent week-long summer camp that demystifies engineering for students ages 11-13, and a one-day camp for ages 7-10 ([odu.edu/partnerships/business/gateway/programs/pdc/camps](http://odu.edu/partnerships/business/gateway/programs/pdc/camps)).

“Each day we have a different theme,” describes Patti Ball, program administrator. “One day we might have an engineer bring his GPS equipment and show how they plot a project in places all over the world and how they bounce a signal off satellites. How we know we’re really getting to them is when they ask a lot of questions.”

ODU has run the camp for six years now. “There is a lot of discussion here at the university about how to bring more students into STEM and how to keep them,” says Ball. “We think that beginning young with this type of introduction is an aid to that. It gets them thinking about STEM and helps them develop a genuine interest. It also takes the fear factor out of a field like engineering.

“We also make the college campus a comfortable place for them to be. Not every one of our students comes from a family that has them on a college track. But during camp, engineering becomes fun and the campus feels accessible.”

Ball says some of the camp-goers have indeed ended up at ODU in engineering programs. Taylor has success stories as well.

“We just learned from the school system that every one of our STEM Academy kids passed their SOLs in math and science last term; in fact they passed all their SOL subjects,” Taylor says. “I’ve had students tell me they were interested in becoming engineers and I’ve seen leadership traits develop. I look at them and tell them you can be the next Bill Gates, you can be the next Steve Jobs.” His students look back and believe him. Making science and math relevant, even exciting, clearly pays off for young people who learn there really are no limits to what they can achieve when it’s full STEM ahead.

## By the Numbers:

- STEM majors earn more, in any field they choose.
- The top 10 bachelor degree majors with the highest median earnings are all in STEM fields.
- 47% of bachelor’s degrees in STEM occupations earn more than Ph.D.’s in non-STEM occupations.
- Stem occupations will grow far more quickly than the economy as a whole (17% versus 10%).
- We face a chronic shortage in STEM competencies as the demand for STEM talents grows outside traditional STEM jobs.
- For women and minorities, STEM is the best equal opportunity employer.
- STEM occupations will provide 2.4 million job openings through 2018, including 1.1 net new jobs and 1.3 replacement jobs due to retirement.

Georgetown University Center on Education and the Workforce & National Governor’s Association Center for Best Practices)

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# Engineering

Most kids outgrow the sandbox phase – Bruce Duvall never did. “When I was young, I was always playing in the dirt,” he recalls, happily devoting hours to shaping, molding, building and constructing. Today, Duvall is a civil engineer and project manager for VDOT, where he’s still playing in the dirt, albeit at a far grander scale, building and improving our roadways. “In high school I looked at engineering as an opportunity and it just seemed to fit,” he says.

Other engineers enter the field because they are intrigued by the possibilities of improving fuel cell technology, launching more powerful rockets, refining nanobots or creating next-generation medical devices, but despite their varying specialties, engineers tend to have two things in common: curiosity and creativity. If you like solving problems, engineering is a great career choice.

“There are so many different facets of engineering you can focus on,” Duvall notes. Just within his area of expertise – civil engineering – you’ll find a number of subspecialties. “You can go into structural engineering,” he says, “and that would be someone who wants to design bridges and buildings.

“In that same civil engineering area you have people who spin off into traffic engineering analysis, where they look at traffic projections and historical patterns,” Duvall says. “There is also surveying.” And it’s civil engineers who design and optimize our roads, canals and dams.

“You can stay more on the design side or work in the field overseeing projects,” adds Duvall.

“While civil engineers get into hydraulic analysis, naval architect engineers take it to a whole new level,” he says. “They specialize in the design of marine crafts and systems. There is also mechanical engineering, and many of these engineers get into areas like industrial engineering where they are designing mechanical systems or robotic elements, such

as in the automobile industry.”

Chemical engineers design processes that harness chemical properties to create everything from more effective medicines to longer lasting lipsticks, while aeronautical engineers work with aircraft and spacecraft. In fact, engineering accommodates a variety of interests, including aerospace, biomedical, infrastructure, electrical, mining, health and safety, agricultural, industrial, materials, petroleum, computer and environmental.

“One of my engineering professors at Old Dominion University turned and looked at us on the first day of class and asked us what an engineer was,” says Duvall. “We just started raising our hands and listing different things. Well, you’re a manager, you’re a designer, you’re a surveyor, it could be a legal role because you have to understand and work within certain regulations, and so on. I think engineering is such an open field. Once you get here, you have an opportunity to work across the whole discipline or chose a more narrow area of interest.”

Along with working on some of the most interesting projects being done in science today, engineers also impact their communities. For instance, the engineers at HRSD, (Hampton Roads Sanitation District), are charged with safeguarding our environment.

“It’s not only job security and excellent benefits, but you also have the added benefit of a purpose in your job,” says Chris Stephan, an engineer and HRSD’s chief of interceptor operations. “You can go into a lot of jobs, and they’re good jobs, very honorable, but here we’re actively working to protect the environment.”

Duvall agrees that serving the people who live in this region is an added bonus. “I get to have some input on their quality of life, how the roadways are built, designing safety standards, and there’s a little bit of a high with that.”

One barrier to engineering is the false notion that only math geniuses need apply.

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Yes, you need a solid math background, but it's a skillset that is obtainable, says Duvall. "I was sort of an average high school student," he says. "I think what intimidates people about engineering is more how it's marketed. We do more math than some of the other majors, but just like everyone else, we sit in a classroom and a professor teaches us what we need to know. If you're willing to dive in and do the work, you can achieve that goal."

David Ekker, dean of engineering, mathematics, and industrial technologies at Tidewater Community College's Virginia Beach campus, feels that students often experience trepidation over math simply because they don't use it enough to become comfortable with it. "Once you get into it, it becomes second nature," he says. "You lose that fear once you begin using it on a day-to-day basis."

He regularly watches that happen as TCC engineering students tackle their required math classes. "Most finish their math training in their first year, then are ready to use it in a hands-on way during their second year," he says.

The entry credential for a career as a professional engineer (PE) is typically a bachelor's degree, and there are several pathways a student can take, including entering a four-year university program or starting at the community college level.

"What many of our students who want to be engineers do is start here and earn their associate's degree, then transfer to a university," says Ekker. "We have many articulated agreements with surrounding schools – in fact, we send a lot of engineering students on to Old Dominion University and Virginia Tech," he says.

Students who take this approach can save money by completing their first two years of courses at TCC with the reassurance that everything they take will transfer directly to the engineering programs at partnering universities. "What that associate's degree

in engineering will get you is guaranteed acceptance at the universities we have agreements with," Ekker says.

Another benefit of starting at a community college is the typically smaller classroom size, says Ekker. "When it comes to a very technical course, a large class size can be a challenge. Here, you can have more individual attention."

The community college to four-year university path is the one Duvall chose. "I went to Thomas Nelson Community College and earned my associate's degree in engineering technology, then on to Old Dominion for my bachelor's degree," he says. "Whichever route a student pursues, if they have the mindset that I'm willing to do the work, if they know what they want to accomplish, whether it's designing robots, airplanes or roads, they're going to reach their goal."



## EARNINGS SNAPSHOT

### Bachelor's Degree

Aerospace Engineers: .....	\$103,720
Agricultural Engineers:.....	\$74,000
Biomedical Engineers:.....	\$86,960
Chemical Engineers:.....	\$94,350
Civil Engineers:.....	\$79,340
Computer Hardware Engineers: ...	\$100,920
Electrical Engineers: .....	\$89,630
Environmental Engineers: .....	\$80,890
Industrial Engineers:.....	\$78,860
Naval Architect Engineers:.....	\$88,100
Mechanical Engineers: .....	\$80,580
Nuclear Engineers: .....	\$104,270
Petroleum Engineers:.....	\$130,280

### Associate's Degree

Drafters:.....	\$49,630
Mechanical Engineering Tech: .....	\$51,980
Electrical and Electronic Engineering Technicians: .....	\$57,850

*(Bureau of Labor Statistics)*

HRSD #24083213

# Computers & IT

It's been a fairly quick revolution as far as workplace upheavals go – electronic records are now a business mainstay, colleagues regularly Skype to cut down on travel expenses, merchants have set up shop on the Web, auto mechanics diagnose a car's maladies with a computer, robots fetch, sort, assemble, weld and even perform surgery. Need to track a rush shipment of critical equipment? There's an app for that.

The home front surrendered just as completely. Houses have become high tech havens of networked devices, computerized appliances, and electronic playthings galore.

All of that e-wizardry supports millions of computer and information technology (IT) jobs at good to superior pay levels in industries that range from business, healthcare and defense contracting to communications, marketing and entertainment. It's difficult to find a field that doesn't rely on computer and IT professionals.

Software developers – who create the programs and underlying systems that transform a machine whose native language is 0s and 1s into a usable device – earn a median salary of \$93,350. The Bureau of Labor Statistics expects to see 222,600 new developer jobs by 2022. A large number of software developers design custom programs for individual businesses, such as educational materials, healthcare records, software for HVAC technicians and intricate programming that runs manufacturing equipment.

Information Security Analysts protect an organization's computers from cyberattacks, earning a median \$86,170 a year, according to the Bureau of Labor Statistics. The position has become a crucial one, with a projected growth rate of 37% through 2022.

Computer systems analysts optimize an organization's computer systems and procedures; they bring in an annual paycheck of \$79,680/yr. There were over half a million system analysts employed in the United States in 2012, and those jobs should increase by an impressive 25% through 2022.

Computer and network administrators, who earn \$72,560 a year, are tasked with installing and running a company's computer and network systems, while computer programmers can expect median salaries of \$74,280 – top earners make more than \$118,000/yr.

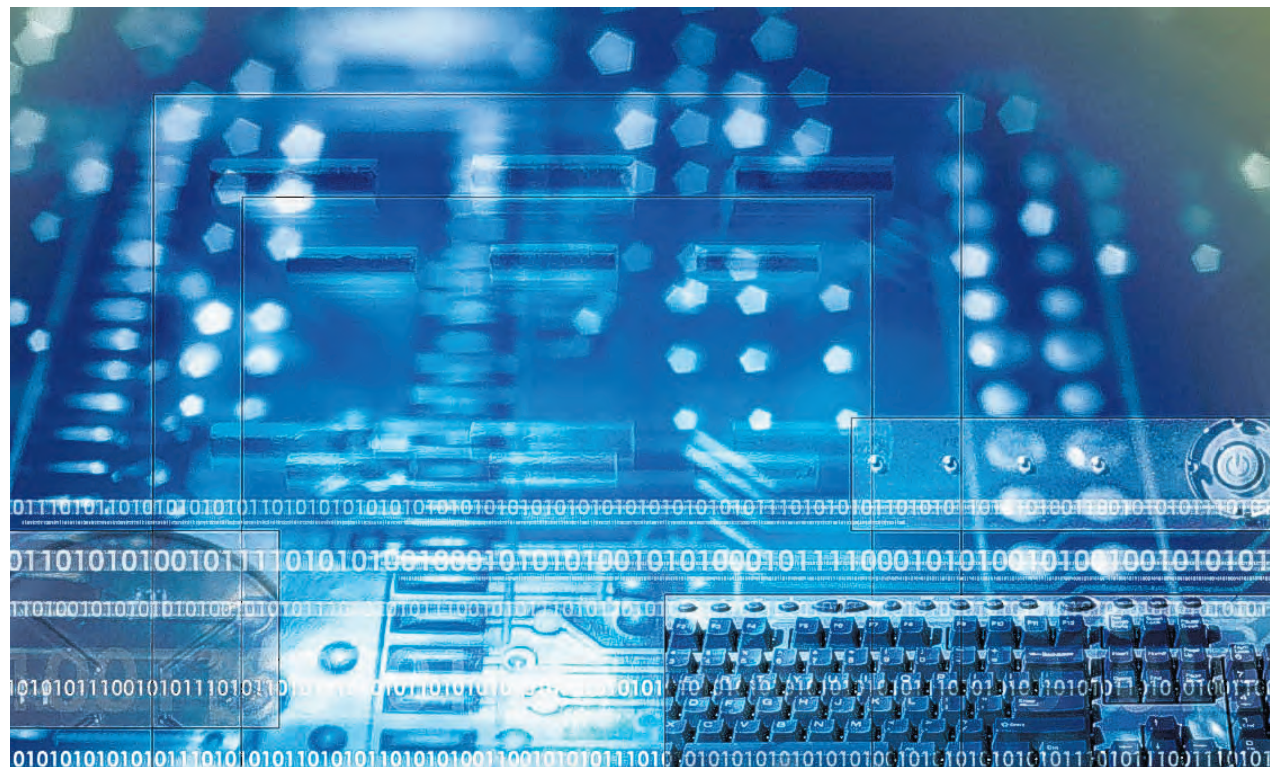
It takes a small army of database administrators to organize and manage all the information stored on computers today; they earn a median \$77,080 a year. Computer network architects, who earn \$91,000/yr., design and maintain data communication networks that connect two desks sitting side-by-side in a small office all the way up to hundreds of thousands of desks in multinational firms spread across the globe.

Technical support specialists often hold bachelor's degrees, but many enter the workforce backed by an associate's degree or job-specific certification. The median salary is \$48,900 and typical work duties include manning a help desk or advising businesses on computer and software issues. The Bureau expects the demand for technical specialists to create 123,000 new positions through 2022.

Other computer-related jobs include analyzing online data to help businesses refine marketing strategies; harnessing computer technology with biometrics to create next generation medical devices; simulating disaster and emergency events to improve community response efforts; developing cloud computing solutions; improving robotics technology; creating animation and special effects for film; and translating technical jargon into well-written, understandable handbooks and manuals.

Along with excellent pay, IT professionals enjoy a broad choice of workplace environments. You'll find openings at startups, established tech firms, the military, schools, government, large organizations, small mom and pop businesses, and increasingly, companies that specialize in performing IT work for businesses that outsource those functions.

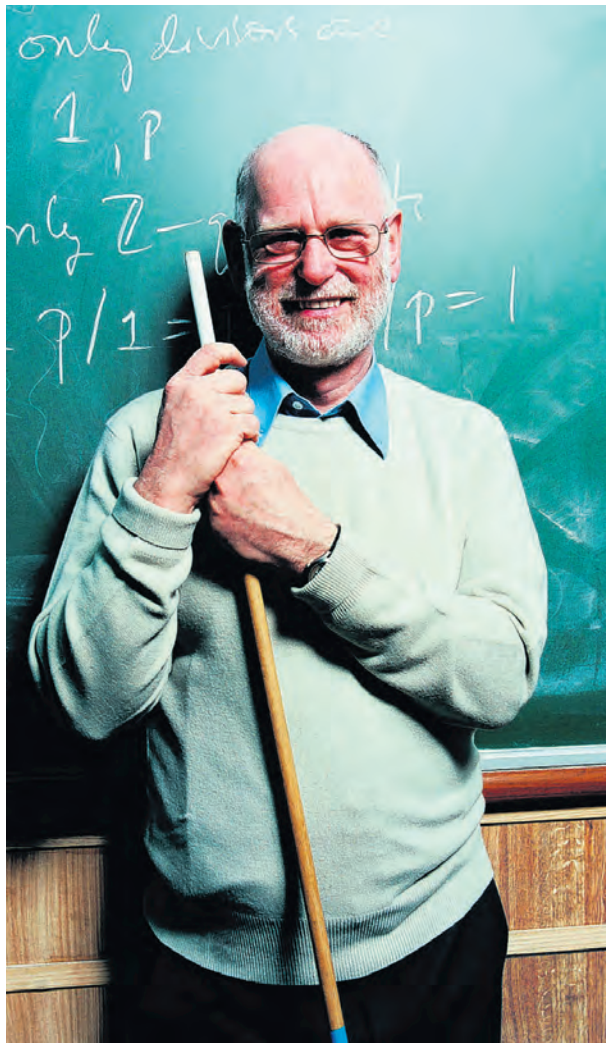
So if you're looking for an expanding field that is financially rewarding, diverse enough to accommodate a wide variety of interests, and professionally satisfying, then IT is a smart career move.



# Education Opens Door to STEM Careers

## ASSOCIATE'S AND BACHELOR'S DEGREES LAND JOBS

If STEM is the answer to a well-paid job in a rewarding field, then education holds the key. And because STEM workers are in such high demand, there are a number of educational paths that will position you for success. Bachelor and master degree programs or higher are excellent choices, but associate degree and certification



programs are also producing valued STEM workers.

In fact, a recent study by the Brookings Institution found that Hampton Roads boasts slightly more STEM jobs than the national average and that over half can be performed with less than a bachelor's degree.

"Many of these jobs have been around for a while, but now require greater STEM training to be effective," explains David Ekker, dean of engineering, mathematics, and industrial technologies at Tidewater Community College's Virginia Beach campus. "And these are jobs that are critical to our economy."

Tidewater Community College (TCC.edu) has an array of STEM-related programs, including engineering and engineering technology. While many of TCC's engineering students go on to four-year universities, others prefer to finish their degree in two years, Ekker says. And that associate's degree is opening doors.

"We absolutely hire people with an associate's degree," confirms Bruce Duvall, an engineer and project manager with VDOT. "A two-year degree in engineering or engineering technology will put you on the higher end of opportunities. We have what we call an engineering design technician, and they support our engineers, helping with design. You can do quite well in that position."

TCC also offers computer aided drafting and design programs (working with CAD software),

and mechatronics.

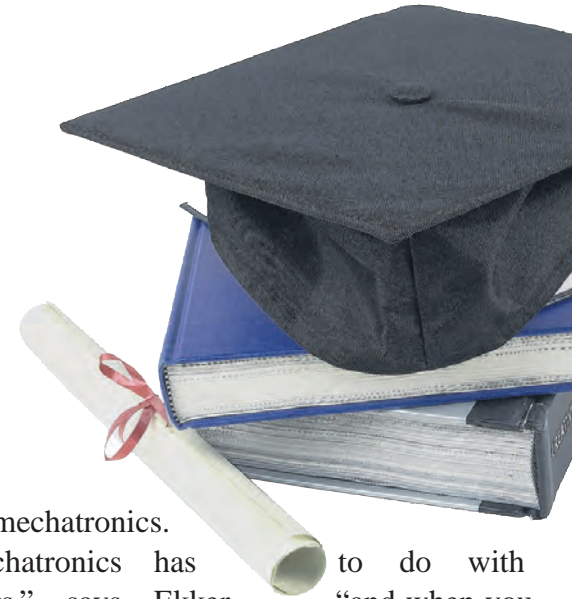
"Mechatronics has to do with robots," says Ekker, "and when you think about it, there are over a million robots being used in manufacturing in the United States. The robots require someone who can program them, maintain them and troubleshoot them when they break."

Even their auto mechanic program has gone high tech. "You've got computer chips running components of the car, so we have to teach our mechanics a lot more electronics," Ekker says. "And Dominion Virginia Power is updating their power grid by placing little electronic devices on all the major components of the grid. They need people who are trained to handle that, so that's where we send some of our electronics graduates."

Renewable energy technologies (solar and photovoltaic cells), GIS (geographical information systems), fiber optics, a large computing program – there are dozens of STEM-related options at the college, and all of them can be completed in two years or less.

"We've been trying to figure out a way of exposing more people to these opportunities," says Ekker. "These are jobs that are right here in our area and they are high-paying jobs."

If the idea of an interesting job with strong earning power interests you, there's a very simple formula to keep in mind: investing in a STEM-related degree equals a great career.



ODU

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