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SPOTLIGHT:

All IN for Science, Technology, Engineering and Math

In collaboration with:

girl scouts of central indiana

with generous support of Lilly Foundation, Inc.

STEM is...

an interdisciplinary approach to learning, where rigorous academic concepts are coupled with real-world applications and students use STEM in contexts that make connections between school, community, work, and the wider world.[1]

A growing number of jobs in Indiana are in the fields of Science-Technology-Engineering-Math (STEM); this requires a coordinated effort to create an educational system able to skill up Hoosiers to unlock the 21st century economy.[2] Indiana has a history of STEM innovation and infrastructure building in pockets, but gaps in access, equity, and quality remain with no clear policy to address them. A bright future that benefits all Hoosiers depends on the actions collectively taken to improve and advance STEM opportunities while ensuring equitable access to quality experiences.[3]

What is STEM?

STEM has been around since the founding of our country and has made the United States the leader in the world for discovery and innovation. STEM is comprised of the four disciplines: Science, Technology, Engineering, and Math. STEM is not about focusing on each of the disciplines alone, but rather the interconnectedness and the real-world applications of those disciplines. In today's information age, access to the internet makes locating information easy and memorization of facts is no longer as relevant. The ability to troubleshoot, problem solve, and innovate is paramount for Indiana and thus developing a pathway, cradle to career, to develop these skills is needed.[4]

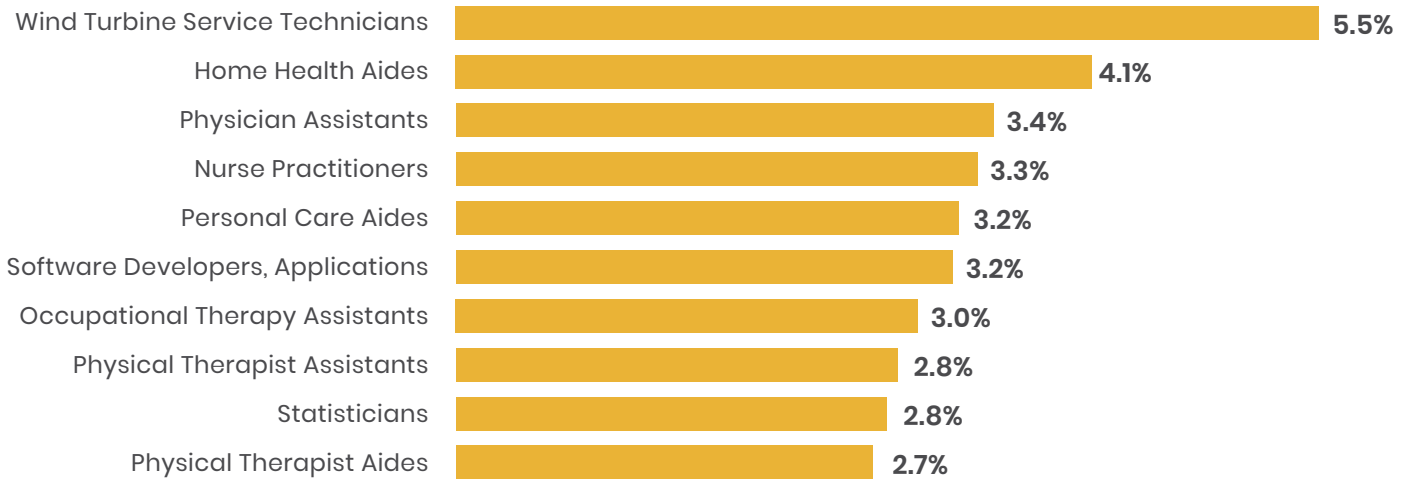
Why is STEM important?

Children must be able to grow, learn, adapt and thrive in a quickly evolving world. STEM is not only about economic prosperity but also establishing a good quality of life for our children. The world economies have become more knowledge intensive which has increased collaboration as well as competition. The global economy is highly reliant on research and development, new technology, and discoveries in medicine, manufacturing, space, etc. "An innovative, knowledge-based economy requires a workforce with high-levels of S&E (science and engineering) skills and an education system that can produce such workers in sufficient numbers."[5]

High quality STEM education provides students skills of critical thinking, innovation, entrepreneurship, problem solving, and collaboration that are necessary for life and for the future success of Indiana's workforce. There is a significant need for STEM education if Indiana's children and future leaders are to have the ability to acquire well-paying careers to support enriched, happy lives.[6] **Nationally, between 2018 and 2028, STEM professions are expected to grow by 8.8% while all non-STEM professions will only grow by 5% over the same time period.**[7]

All of the top 10 occupations projected to increase in Indiana between 2016–2026 are STEM jobs.

Occupations by Projected Growth, Indiana: 2016–2026



Source: Indiana Career Connect

What is the current state of STEM Education in Indiana?

Progress is being made, in pockets. Indiana is making great strides in STEM by recognizing the need and adopting strategies to grow STEM. In the case of computer science, Indiana has been a national leader, becoming only the 3rd state to adopt all the Code.org recommended statewide policies and has the highest concentration of robotics teams impacting the largest number of students.[8,9] However, these efforts are often undertaken in silos to address an individual STEM need without the support and interest from cross-sector groups to develop collective capacity to address the greater systemic need of STEM.[10]

Indiana Government is taking steps to grow STEM. The 2019 STEM Six-Year Strategic Plan, "guides the vision of ensuring all K-12 Indiana students graduate with critical thinking skills. Indiana students must have access to a world-class STEM education necessary to compete in an innovation-driven economy."[11] Indiana also has a STEM school certification that provides criteria and a pathway for schools to build out their STEM programs. Indiana has certified 78 schools in elementary, middle and high school.[12] Additionally, the legislature changed the graduation requirements so all graduates must have a pathway to a career. Schools need reliable funding in order to implement STEM programs every year.[13]

How do Hoosier students fare in STEM?

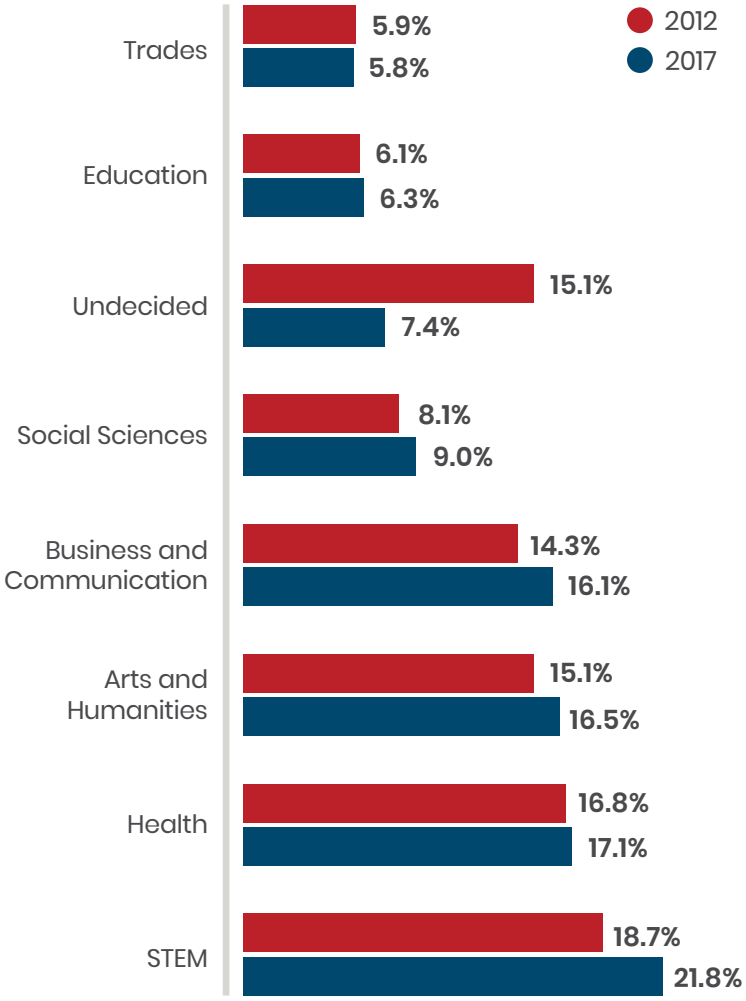
Indiana can track the achievement of students through a variety of assessments and has traditionally used math assessments to indicate STEM ability. The National Assessment for Educational Progress (NAEP), also referred to as the Nation's Report Card, and Scholastic Aptitude Test (SAT) are often used to determine how Indiana performs relative to other states. Indiana has the second highest percentage of 8th grade students scoring at or above proficient in math (37%) among neighboring states: Ohio (38%), Illinois (34%), Michigan (31%), and Kentucky (29%).[14] This is a good sign as research indicates math is a large barrier to entry for STEM, making it also a strong indicator for STEM achievement results.[15]

High school coursework matters greatly and is often a predictor for not only college success but success in STEM. Students who graduated with an Honors Diploma (most rigorous diploma), 93% enrolled in college within a year of graduating high school, while only 53% of those with a Core 40 Diploma and 18% of students with a General Diploma (least rigorous diploma). Indiana needs to ensure all students have access to advanced coursework and associated supportive services.[16] Developing the ability to take advanced coursework starts early, long before high school. When girls, especially, have confidence in math, they are more likely to

pursue pathways in STEM fields.[17] Indiana has seen an increasing number of students pursuing STEM programs of study based on enrollment data from 2012-2017.[18]

STEM programs grew by more than 3% in span of 5 years, equaling more growth than any other program of study.

Percentage of Students Indicating Program of Study, Indiana: 2012 and 2017 College Cohorts



Source: Indiana Commission of Higher Education

Is Indiana Serving ALL Students?

Not all Indiana students are able to maximize their STEM potential, especially students of color, females, students from high poverty and rural areas.[19] This occurs for a variety of reasons; including the fact that many teachers lack the resources (Including but not limited to curricula, lab materials, and tools) needed to teach underserved groups of students.[20]

Teacher Resources: According to the Education Commission of the States, many students reported their science teachers do not have the resources including but not limited to curriculum and lab materials, needed to teach. Not having resources can translate in lower performance, indicated on the Indiana NAEP, which continues to show racial achievement gaps.[21] This is an issue among all students, but it is largest within schools that have a majority of black and Hispanic students. Schools that have a majority of black and Hispanic students reported that 36% of teachers had enough resources to teach, compared to 69% in predominately white schools. It is important to note from the NAEP data, progress has been made to nearly close the achievement gap between males and female students from 4th to 8th grade. However, the gap between white and black students grew slightly over the same period.[22]

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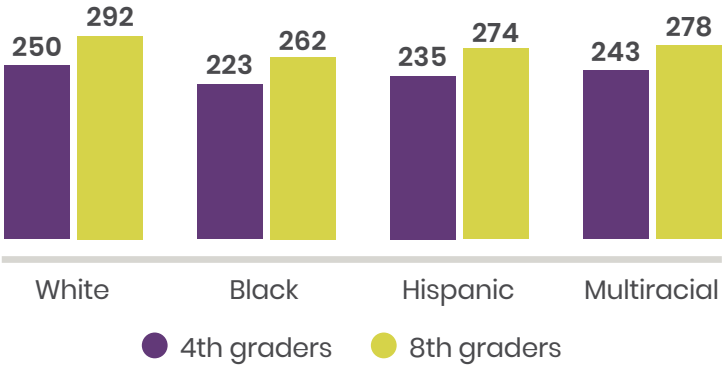
Average 4th and 8th Graders Scores Assessed in NAEP Mathematics by Race/Ethncity, Indiana: 2019



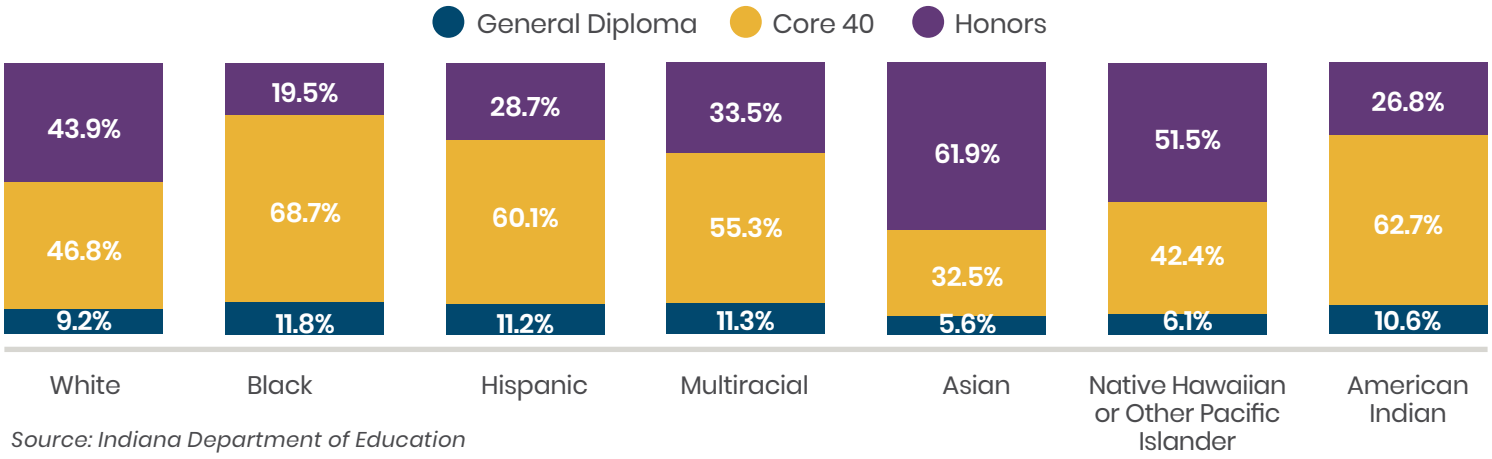
Source: National Assessment of Educational Progress

NOTE: NAEP scores may fall between 0 - 500

Diplomas: Indiana has three different diploma options for students until 2023, at which time the new pathways diploma takes effect. Data and research from the Indiana Commission for Higher Education shows that students receiving the Honors diploma perform better in college and are more likely to graduate.[23] Only 20% of black students receive the honors diploma making this a great opportunity for growth.[24] Diploma type is relevant to STEM because 93% of Honors diploma recipients go on to post-secondary education while just 18% of General diploma recipients move on to higher education after high school.[25]

Disparities exist among high school diploma achievement.

Diploma Type for High School Graduates by Race/Ethnicity, Indiana: 2019



Source: Indiana Department of Education

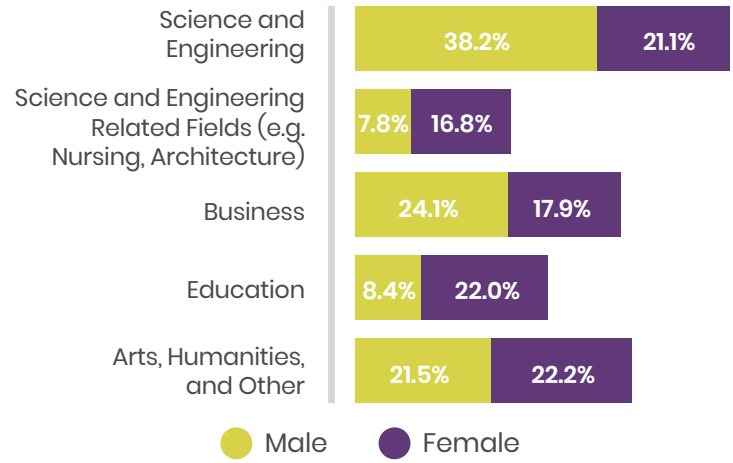
Post-secondary Education: Most, if not all, STEM careers require some sort of post-secondary education (degree or certification). According to the Indiana Commission for Higher Education, about 79% of Asian students, 65% of white students, 57% of black students and 53% of Hispanic students go straight to college after high school. While black and Hispanic students represent the fastest growing high school populations, college-going rates remain lower than their peers. Once students get to college, many (one in four black students) often need remediation. Although rates of remediation are improving in Indiana, students needing remediation are less likely to finish college on time.[26]

Workforce: Education, race, gender, and location affect who succeeds and persists in STEM careers. Women comprise almost three-fourths of the healthcare workforce and have been increasing in the share among the biological sciences since 1990 from 34% to 47%. However, women are still underrepresented in engineering (14%), computer (25%), and physical sciences (39%) jobs. In fact, even with the focus increasing STEM access for women, women's representation in computer jobs has declined since 1990, from 32% to 25%.[27] In the United States, "employment in computer and information technology occupations is projected to grow 12 percent from 2014 to 2024, faster than the average of all occupations."[28] Black and Hispanic STEM workforce representation varies greatly. Of Licensed practical nurses, 37% are either black or Hispanic but only make up roughly 10% of pharmacists, surgeons, dentists, and physical therapists.[29]

While women are making gains academically and closing achievement gaps, they are not making up an equivalent share of the STEM workforce outside of the health careers sector.[30] When looking at bachelor's degree majors between males and females, the largest gap is in science and engineering. More males (38.2%) hold a bachelor's degree in science and engineering while 21.1% of females have a bachelor's degree in science and engineering, a 17 percent point difference. This is consistent with the trends shown in the workforce.[31]

Women are substantially outnumbered by males in the science and engineering fields.

Percentage of Field of Bachelor's Degree for First Major by Gender, Indiana: 2018



Source: American Community Survey, Table S1502

CALL TO ACTION:

What can be done to grow and improve STEM in Indiana?

STEM education needs to remain nimble and evolve with the ever-evolving needs of the world. Exemplary programs improve student outcomes and are constantly evaluating their strengths and challenges in order to appropriately adapt. In addition, exemplary programs are student-centered, responding to the needs of the students. Too often programs fail students by imposing a one-size fits all approach rather than providing multiple pathways to success.[32]

Successful STEM implementation happens when motivated individuals, through cross-sector collaboration, create and commit to implementing a common vision for STEM. Model implementations have adopted a local growth and advocacy strategy with a centralized leadership body to drive the mission, direct policy and legislation, and maintain accountability through data and research.[33]

Promising Practices:

The Washington State STEM network has been a leader in the country for improving STEM through grassroots and through research driven efforts. In many ways, Washington is very similar to Indiana. It is a diverse state both racially and geographically, it has one large urban center, manufacturing rich industry, and similar student population. The STEM network is "an independent nonprofit comprised of connected and well-respected STEM experts, trusted to identify and foster innovative STEM programs and partnerships". They have 10 regional networks that pull information from the local level to guide state level work, research, and policy. To date, 550,000 children have participated in their early math work and according to polling, awareness and support for STEM education has tripled in Washington.[34]

The Tennessee STEM Innovation Network believes in "local innovation, statewide impact," and that is reflected in the state's model of STEM. Tennessee's STEM network has STEM hubs around the state that flow up to an Executive Council. They also provide the STEM School designation which is different from Washington and Indiana. Tennessee has seven Hubs around the state to provide experts in the classroom, job shadow opportunities to students and teachers, workplace learning, and professional development.[35]

Take the Lead: In 2021, the Governor will have a historical opportunity in Indiana; positioned for the first time ever to appoint the leader of the Indiana Department of Education. In doing so, this may align all government agencies that impact the cradle to career pipeline around a common mission/vision for education with a heavy emphasis on STEM. [36] Many states including Tennessee, Washington, Arizona, Arkansas, Iowa to name few, have clearly identified an accepted STEM leader to implement strategies.[37]

Fund it: For students to develop STEM skills needed for careers of the future, they need the curricula and resources to gain that experience. STEM curricula are more expensive, having mixed, diverse funding avenues that are equitable can enable all schools to gain competence in STEM.

Start Early: STEM disciplines are no different than art, sports, music, etc., a strong foundation early increases the odds of success in those fields later in life. "Students as young as two use STEM skills on a daily basis, whether it's building towers with blocks to using water tables or observing and interacting with their environments through play."[38] A concerted effort at the early ages can change student perceptions of STEM. Children are natural scientists learning about the world around them through observation but get much of their STEM opinions from adults. It is very important for families to reflect on language and how perceptions are communicated to children. Local organizations and schools can train staff to use appropriate language, communicating the belief that all can achieve in STEM and pursue STEM careers if they so choose.[39]

Focus on Equity: To provide STEM for all, all must be represented in decision making. "Tested interventions in developed countries that have made role models available to girls, introduced inclusive language in the classroom, brought in non-stereotypical role models, and given information about STEM workplaces show a lot of promise." These strategies have shown promise to encourage girls as well as all students.[40]

Increase Retention, Training and Development: Increased training for individuals that are working with children and young adults can provide the necessary skills to implement evidence-based teaching techniques and focus on issues of equity. Training across the spectrum, from pre-service to in-service workers, especially in underserved areas, will require an enormous, resource intensive effort.

STEM Ecosystems initiative has been identified as a top priority by the White House to improve STEM literacy, workforce readiness, and global competitiveness.[43] The STEM Ecosystems can be statewide or community-wide, in-school or out-of-school, business or higher education. All stakeholders are invited to the table to plan and implement strategies that are locally focused. Indiana was in the first cohort to adopt this model.[44] The Ecosystems model is making community-based connections and aligning around a common vision for STEM. Growing in 7 communities over the past 5 years (Columbus, Indianapolis, Bloomington, Michigan City, Evansville, Lafayette, Terre Haute), this model is good start but needs support and resources to accelerate the work.[45] The main purpose of this model is making community-based connections and aligning around a common vision for STEM.[46]

To learn more, visit stemecosystems.org

Alabama, for example has made great progress with their Alabama Math, Science, and Technology Initiative (AMSTI). AMSTI provides professional development to current teachers and pre-service teachers, online support, and curricular resources. Schools that participate agree to clearly defined terms to ensure fidelity of implementation.[41]

Encourage Cross-Sector Partnerships: For students to engage early and often, partnerships and collaborations among organizations along the cradle to career pipeline play a critical role. Employers can develop programs that bring students into the workplace and show them how the products and services are impacting the community. Companies can showcase their technical talent by allowing, or encouraging, time to volunteer in schools or afterschool programs. Organizations can create or sponsor events or program within the community to bring awareness and excitement to STEM majors and careers, e.g. Science Olympiad, Robotics, etc.[42]

What resources are available?

Indiana Resources:

Indiana STEM Resource Network is a partnership of Indiana's public and private higher education institutions, K-12 schools, businesses, and government. It is dedicated to measurably improving K-12 student achievement in science, technology, engineering, and mathematics. Subscribe here to follow this dialogue regarding STEM in Indiana. *https://www.istemnetwork.org/*

National Resources:

National Girls Collaborative Project brings together organizations throughout the United States that are committed to informing and encouraging girls to pursue careers in science, technology, engineering, and mathematics (STEM). *https://ngcproject.org/*

P21's mission is to serve as catalyst for 21st century learning to build collaborative partnerships among education, business, community and government leaders so that all learners acquire the knowledge and skills they need to thrive in a world where change is constant and learning never stops. *http://www.battelleforkids.org/networks/p21*

STEM Education Coalition works to raise awareness amongst policymakers at every level about the critical role that science, technology, engineering, and mathematics (STEM) education plays in enabling the U.S. to remain the economic and technological leader of the global marketplace of the 21st century. *http://www.stemedcoalition.org/about-us/*

INDIANA YOUTH INSTITUTE RESOURCES

www.iyi.org

The **Indiana KIDS COUNT® Data Book** is the premier data resource on Hoosier youth. Developed with you in mind, it provides an in-depth profile on child well-being across the four key areas of Family and Community, Health, Economic Well-Being and Education.

Submit a **Custom Data Request.** Curious about a youth issue? Do you need data for a grant application, report or presentation? We are here to help! We work with you to get the data and research you need.

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