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REPORT

STEM and Early Childhood—When Skills Take Root

Ohio businesses and the military warn of STEM workforce skills gap and urge greater access to pre-k

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Acknowledgements

Council for a Strong America is a national, bipartisan nonprofit that unites five organizations comprised of law enforcement leaders, retired admirals and generals, business executives, pastors, and prominent coaches and athletes who promote solutions that ensure our next generation of Americans will be citizen-ready.

ReadyNation: Business, Kids, Workforce
Business executives building a skilled workforce by promoting solutions that prepare children to succeed in education, work, and life

Mission: Readiness
Retired admirals and generals strengthening national security by ensuring kids stay in school, stay fit, and stay out of trouble

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Summary

Sixty-five percent of Ohio 8th graders are not proficient in math and nearly 60 percent are not proficient in science. Approximately one-third of students entering public colleges and universities in Ohio require remedial education in math or English. As a result, employers—both in the private sector and the military—are struggling to find the STEM (science, technology, engineering and math) skilled workforce they need. That is why business and military leaders in Ohio are calling on policymakers to invest more in high-quality early education where STEM skills take root.

Importance of STEM

STEM occupations in sectors like healthcare and computer science will drive our economy—growing by as much as 20 to 37 percent nationwide.[2] Moreover, STEM jobs are typically higher paying than jobs in many other fields, with some boasting salaries more than double the median salary for all workers.[3] And this salary boost holds despite the fact that many STEM jobs do not require four-year college degrees.[4]

An adequate STEM workforce is also critical to our increasingly technology-focused military. For example, the US Army operates 16 laboratories and research centers employing more than 16,000 world-class scientists and engineers who "develop leading-edge technologies and advanced capabilities that give our soldiers...the decisive advantage."[5]

> "Nearly four in 10 [small and middle-market business owners] say it is harder to find qualified employees compared to 6-12 months ago. The biggest challenge is that candidates don't have skills needed for the job."
>
> –The PNC Economic Outlook [Ohio][1]

To better fulfill current STEM workforce needs and build a pipeline for the future, businesses and the military, as well as higher and K-12 education, are engaging in strategic partnerships to both retrain current employees and remediate/bolster STEM (and other) skills among our students. These efforts include working with middle and high schools, technical schools, colleges and universities to offer enrichment opportunities, competitions, apprenticeships and scholarships.[6]

STEM and Early Childhood

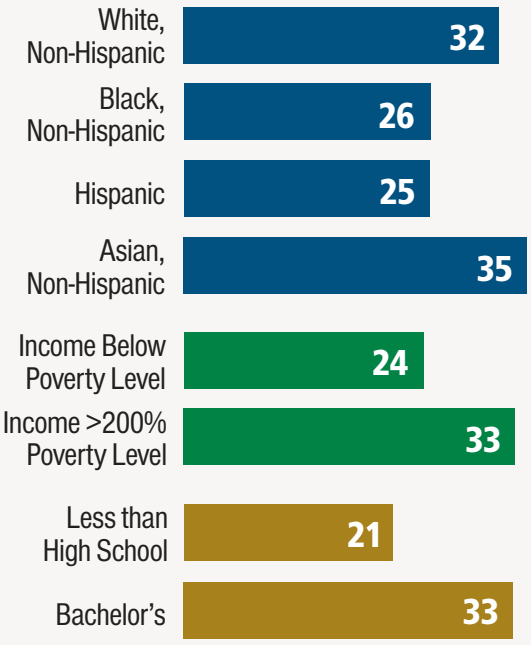
A growing body of research, however, suggests that developing STEM proficiency starts much earlier than high school, middle school or even elementary school. According to the Wall Street Journal, "Evidence is mounting about the importance of teaching math in preschool and kindergarten…if children don't have good instruction and effective teachers in early grades, they are more likely to struggle later when they face more complicated concepts."[8]

1. The math achievement gap starts early, even before kindergarten

The first three to five years of life are a unique period of growth for a child's brain. Every second, young children's brains develop one million synapses, the neural connections that support learning and skills.[9] Disadvantaged children can already be 18 months behind their peers when they start kindergarten.[10] This gap is as pronounced for math skills as for literacy abilities.[11] U.S. Department of Education data show that math scores for kindergarteners were already higher for children: who were white or Asian (rather than African-American or Hispanic); whose families had higher incomes; and whose parents were more highly educated.[12] By college age, African-American or Hispanic children, as well as children from low-income families, are much more likely to receive remedial instruction in math and other subjects.[13]

Achievement Gaps in Math Start Early and Are Highly Dependent on Social Factors

Math scores for children coming from disadvantaged homes were significantly lower than their peers when entering kindergarten for the first time in 2010.



Note: Scores range from 0-75. Skills assessed include counting, geometry, identification of patterns, and identification of shapes.

Source: U.S. Department of Education, Early Childhood Longitudinal Study math assessment, 2010-2011.

2. High-quality early education teaches real math and science

Young children can learn more STEM content than we may realize. Good early learning curricula capitalize on the natural curiosity and exploration of young children and can build an understanding of math and science concepts.[14] Children should experience this content through enjoyable, play-based activities appropriate for their age. To be able to deliver such curricula, teachers must be well-trained. The Ohio Early Learning & Development Standards: Birth to Kindergarten Entry include topics and content that help lay this foundation for STEM abilities.[15]

3. Early math affects later abilities

While it is a long road from pre-k to Ph.D., a growing body of research shows that early exposure to math is linked to later abilities in not only math but other subjects. For example:

- "Preschool children's knowledge of mathematics predicts their later school success into elementary and even high school. Further, it predicts later reading achievement even better than early reading skills."[16]
- Likewise, "[K]indergarten skills in math significantly predicted second grade math, reading, and general achievement."[17]
- "Early math concepts, such as knowledge of numbers and ordinality [sequences like 1, 2, 3], were the most powerful predictors of later learning,"[18] and "school-entry reading and math skills are almost always statistically significant predictors of later reading and math achievement...[and] rudimentary math skills appear to matter the most."[19]
- Children with "persistent" problems in math at ages 6, 8 and 10 were 13 percentage points less likely to graduate from high school and 29 percentage points less likely to attend college.[20]

4. Early learning builds the behavioral traits that STEM employees need

The development of children's brains not only supports cognitive abilities, but social and emotional skills such as focusing, persevering and working well with others. These are important for all employees, including those in the STEM field. "[M]ore than smarts is required for success in life," concluded Prof. James Heckman, the 2000 Nobel Laureate in economics."[T]he empirical literature shows high economic returns for remedial investments in young disadvantaged children...[that affect] a range of cognitive and non-cognitive skills, schooling achievement, job performance, and social behaviors, long after the interventions ended."[21]

> "A workforce with robust science, technology, engineering and mathematics capabilities is critical to the success of the U. S. military mission.
>
> Lieutenant General Thomas P. Bostick, Commanding General and Chief of Engineers, U. S. Army Corps of Engineers

Quick Facts
OH's STEM Skills Gap

190,000+
positions will not be filled with qualified in-state employees who have the educational credentials their employers seek.[24]

38%
of small- and middle-market business owners say it is getting more difficult to find qualified employees.[25]

72%
of 17- to 24-year-olds are not eligible for military service due to poor education, poor health/fitness and/or criminal activity or substance abuse.[26]

65%
of 8th graders are not proficient in math and about 60 percent are not proficient in science.[27]

31%
of students entering state public colleges or universities enrolled in remedial courses.[28]

$146 million
spent on remedial education at Ohio colleges and universities.[29]

Pre-K in Ohio

Access to high-quality pre-k is an important part of nurturing a STEM-skilled workforce. Unfortunately, far too few of Ohio's young learners have access to publicly funded high-quality pre-k. The Ohio Early Childhood Education program (ECE; formerly known as Ohio Public Preschool) serves four-year-olds whose families have incomes up to 200 percent of the federal poverty level. In 2016, ECE served just eight percent of all four-year-olds. Including children served by Head Start, 20 percent of four-year-olds were served.[22] In Ohio, 43 percent of children are below 200 percent of the federal poverty level.[23] This lack of access represents missed opportunities for these children and contributes to the STEM skills gap.

In order to bridge this gap, Ohio business and military leaders are calling on state policymakers to improve the quality of—and children's access to—state preschool programs

If America does not produce enough young people who can meet the STEM needs of both the private sector and the military, both our economy and our national security could suffer. Ohio policymakers can help build the STEM pipeline for the future by investing in broader access to high-quality pre-k today.

Endnotes

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