



# Mathematics: The Key to Empowering Tomorrow's Workforce

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*Note: The opinions expressed here are not necessarily those of Notices.*

In the African-American tradition there is a phrase, *Each One, Reach One*, that reflects the value of bringing along others once you have acquired a certain level of knowledge or success. In the context of the mathematics community, this value is often reflected in the math-related activities and events that happen outside the classroom to prepare the next generation for their chosen educational and career paths. As technology promises to change the way we work by altering the landscape of the labor market, mathematics will take on a new level of importance. The role of service and outreach and the willingness for *Each One to Reach One* to increase mathematical engagement will matter even more.

*"We will always have STEM with us. Some things will drop out of the public eye and will go away, but there will always be science, engineering, and technology. And there will always, always be mathematics."* —Katherine Johnson, NASA research mathematician [5]

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## Math Has a Central Role in the Future Labor Market

Advances in automation and artificial intelligence have resulted in dramatic alterations in the way we work, and mathematical thinking and knowledge have already become increasingly critical to jobs of the future. Statistical and quantitative skills have emerged as increasingly high priorities in workplace competencies [11]. In a recent survey of more than three hundred top executives in companies around the country, 72 percent rated critical thinking/problem solving as one of the top four important skills they look for in employees [7]. Managers and leaders will be expected to use data to inform decision making and possess a strong business intelligence to support a thriving company. The other looming change relates to the critical role postsecondary credentials will have in determining economic options for individuals. In 2020, two-thirds of jobs will require postsecondary certificates and degrees [3]. Math proficiency serves as an important gatekeeper to higher education, given the role played by standardized tests (like the SATs) and math course requirements beyond elementary algebra for college admission. People with strong math skills will have viability and resiliency in the new economy.

*"Math literacy and economic access are how we are going to give hope to the young generation."* —Robert Moses, civil rights activist and author [10]

## The New Economy Will Impact Demographic Groups Differently

The new labor market is predicted to have a disproportionately negative impact on communities of color [1,2,11]. Increases in automation will not affect the number of jobs but, rather, the types of jobs available in the workplace [9]. In particular, these newer types of job opportunities will require innovation and productivity that rely on advanced levels of education. Recent reports on the future of work cite the likelihood of unemployment or long-term displacement for vulnerable groups of workers, particularly those with lower levels of education and skills [8,9,11]. For example, the transportation industry highlights this pending disruption. Millions of truck drivers, one of the few middle-income jobs that do not require formal postsecondary education, will have their jobs altered or replaced by self-driving vehicles [1]. Education beyond high school will be critical for access to quality jobs. “Given educational disparities, Hispanic and African-American workers may be hit the hardest, with 12 million displaced,” states a 2019 McKinsey Report [8]. Additionally, despite the desirability of competitive math skills, the American adult population has fallen behind their international peers in math literacy [7], and persistent, albeit declining, racial/ethnic gaps remain in math achievement [4].

*“Our parents and teachers preached over and over again that education is the vehicle to a productive life, and through diligent study and application we could succeed at whatever we attempted to do.”* —Evelyn Boyd Granville, second African American woman to earn a doctorate in mathematics [6]

## Service as a Strategy to Increase Access to Mathematics

The classroom remains the traditional and predominant setting for learning math. For some students, this environment is an intimidating and ineffective way to understand and connect to the discipline. Outreach and service projects are valuable strategies that mathematicians can use to support math achievement in the next generation. They can provide a personalized and contextualized experience of mathematics, reinforce core competencies, expose students to research, and identify connections between math and everyday life. Math camps, summer REUs, after-school tutoring, Math Circles, special workshops, and conferences are all examples of the types of projects where mathematicians share what they know and love about mathematics outside the traditional classroom environment. Service can also be informal—there are mathematicians who facilitate math workshops for their children and their children’s friends or those that tutor math in local schools. In Margot Shetterly’s *Hidden Figures*, we learn that Mary Jackson helped girls in her Girl Scout troop with their algebra homework [12]. For interested community members not knowing where to start with these types of initiatives there are resources

like GirlsGetMath from ICERM or examples to follow like BEAM (Bridge to Enter Advancement Mathematics) or YPP (The Young People’s Project), programs focused on reaching underrepresented groups. All these activities provide a platform for increasing math awareness and providing an experience that makes math accessible and fun. Service programs can also facilitate a sense of belonging within the larger math community. Sometimes these activities are grant-funded, count towards tenure, or result in additional compensation, but more often than not, it is done by mathematicians as volunteers in response to a need, an action arising from a belief of *Each One, Reach One*.

Most of my professional career has been spent outside academia. Ironically, it has taught me how important math instruction is to accessing educational and economic opportunities across many different sectors. While the impact of math-focused outreach and service projects that support non-math majors or non-traditional careers in mathematics is less well known, what I know for sure is that math matters. I’ve known high school students who walked out of math placement exams because they feared failing, managers who avoided budgets because of their discomfort with creating formulas in Excel, and community college students who took multiple years to complete their AA degree because they were stuck in a cycle of remedial math courses. What types of opportunities will these students have in the future workforce?

## The Power of Each One, Reach One

But, I also know there is hope. Through service, I’ve seen middle school girls take pride in creating math tutorial videos in a summer recreation camp and teens at a continuation high school feel empowered when they learned statistics to design and analyze a survey focused on understanding youth violence in their community. I’ve witnessed the delight in unemployed job seekers after they learned how to use a binary number system in an IT class. I’ve watched a young man who turned his life around following his release from incarceration take pride in explaining to a group of his peers how to do unit conversions. I’ve experienced the power of *Each One, Reach One* to make a positive difference.

Strong economies can hide inequities in participation. Broadening participation in mathematics through service helps to strengthen and diversify the pipeline into math-related careers and increase economic opportunity for the labor force’s next generation. The power of math lies not only in its marketable skills, but also in its ability to create confidence and a strategic process for problem solving. Math permeates so many aspects of our lives, no matter whether you identify as a mathematician or approach the subject with caution. It also serves as a critical component of educational advancement and a key skill for success in the new economy. With this in mind, we need to figure out how to truly broaden participation in mathematics and

promote the expectation of math literacy for all. Nearly two decades ago, Bob Moses, the educator, civil rights activist, and author of the book *Radical Equations: Civil Rights from Mississippi to the Algebra Project*, was prescient when he flagged the critical role algebra would play in gaining access to a new economy fueled by technology. He called it the new civil rights issue of our time. Mathematical experiences outside the classroom help prepare a broader population for success in the workforce. We need to pursue a multitude of avenues to improve mathematical literacy and create equitable employment opportunities for all. Tomorrow's workforce depends on it.

## References

- [1] Baboolall D, Pinder D, Stewart S III, Wright J. *Automation and the Future of the African American Workforce*, McKinsey & Company, 2018. <https://www.mckinsey.com/featured-insights/future-of-work/automation-and-the-future-of-the-african-american-workforce> [Accessed: July 13, 2019]
- [2] Broady K. *Race and Jobs at High Risk to Automation*, Joint Center for Political and Economic Studies, 2017. <https://jointcenter.org/blog/race-jobs-high-risk-automation> [Accessed: July 9, 2019]
- [3] Carnevale AP, Smith N, Strohl J. *Recovery: Job Growth and Education Requirements Through 2020*, Georgetown University Center on Education and the Workforce, 2013. [https://cew.georgetown.edu/wp-content/uploads/2014/11/Recovery2020.ES\\_.Web\\_.pdf](https://cew.georgetown.edu/wp-content/uploads/2014/11/Recovery2020.ES_.Web_.pdf) [Accessed: July 9, 2019]
- [4] De Brey C, Musu L, MacFarland J. *Status and trends in the education of racial and ethnic groups 2018*, US Department of Education: Washington, DC, 2019. <https://files.eric.ed.gov/fulltext/ED592833.pdf> [Accessed: September 4, 2019]
- [5] Deiss HS. *Katherine Johnson: A Lifetime of STEM*, 2015. <https://www.nasa.gov/audience/foreducators/a-lifetime-of-stem.html> [Accessed: September 4, 2019]
- [6] Granville EB. *My Life as a Mathematician*. This article originally appeared in *SAGE: A Scholarly Journal on Black Women*, Vol 6, No. 2 (Fall 1989), pp. 44–46. It is copyrighted Sage Women's Educational Press, Inc., and is reproduced for Agnes Scott College. <https://www.agnesscott.edu/riddle/women/granvill.htm> [Accessed: September 4, 2019]
- [7] Luminary Labs, *The Math Gap: Implications for Investing in America's Workforce*, Office of Career, Technical, and Adult Education, 2017. [https://lincs.ed.gov/publications/pdf/Advancing\\_Math\\_Market\\_Scan\\_1.pdf](https://lincs.ed.gov/publications/pdf/Advancing_Math_Market_Scan_1.pdf). [Accessed: June 30, 2019]
- [8] Lund S, Manyika J, Segel LH, Dua A, Hancock B, Rutherford S, Macon B. *The future of work in America: People and places, today and tomorrow*, 2019. <https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-in-america-people-and-places-today-and-tomorrow> [Accessed: August 14, 2019]
- [9] Manyika J, Lund S, Chui M, Bughin J, Woetzel J, Batra P, Ko R, Sanghvi S. *Jobs Lost, Jobs Gained: Workforce Transitions In A Time Of Automation*, McKinsey and Co., 2017. <https://www.mckinsey.com/~media/mckinsey/featured%20insights/future%20of%20organizations/what%20the%20future%20of%20work%20will%20mean%20for%20jobs%20skills%20and%20wages/mgi-jobs-lost-jobs-gained-report-december-6-2017.ashx> [Accessed: September 30, 2019]
- [10] Moses R, Cobb CE. *Radical Equations: Civil Rights from Mississippi to the Algebra Project*, Beacon Press, 2002.
- [11] Muro M, Maxim R, Whiton J. *Automation and Artificial Intelligence: How Machines are Affecting People and Places*, Metropolitan Policy Program at Brookings, 2019. <https://www.brookings.edu/research/automation-and-artificial-intelligence-how-machines-affect-people-and-places> [Accessed: February 20, 2019]
- [12] Shetterly ML. *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race*, New York: William Morrow, 2016.



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## Credits

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