JerseyCAN

PREPARING THE
CHILDREN
OF TODAY

FOR THE
JOBS
OF TOMORROW

A WINDOW INTO STEM EDUCATION IN NEW JERSEY

PSEG
We make things work for you.

Executive Summary

Overview

What is the purpose of this report?

JerseyCAN was created in 2013 to address two big issues and opportunities: excellence and equity in New Jersey's K–12 education system. For the last four years we have been advocating for policies that we believe will advance excellence and equity, such as enhancing quality school options, expanding pre-K access and setting high academic standards paired with accountability. While we've seen important successes, the nature of this work, and the challenges of driving change, have caused us to think about finding new ways to discuss excellence and equity—and to question if we are thinking big enough. To do this, we went back to our roots.
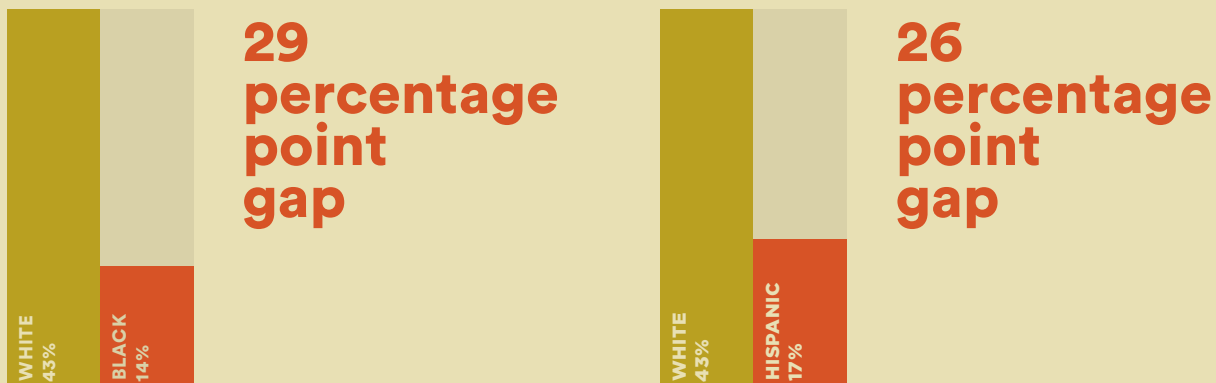
New Jersey was the original center for innovation and scientific progress before Silicon Valley. We have a rich history in STEM (science, technology, engineering, math) leadership—home to Thomas Edison who invented the light bulb and Bell Labs that invented the transistor—and yet, today, we see a growing skills gap between students interested and prepared for the growing STEM job sector.

When you look at how our students are performing academically, it is clear we are not adequately preparing them for STEM fields. And the data also shows that many children are left behind. Let's keep this simple by just looking at 2015 NAEP science exams for 8th grade children in New Jersey, where we rank 24th in the nation.

As shown on the graph that follows, only 43 percent of white students score at or above proficient in the science exam. The graph also illustrates that only 14 percent of black students and 17 percent of Hispanic students score at or above proficient in the science exam, respectively. This data on overall performance and equity is alarming. (See Appendix for additional New Jersey data.)

With New Jersey's rich STEM history, and our very diverse state, we decided to explore the conversation around excellence and equity using STEM education as our framework. We are very encouraged by the many pockets of innovation and the pioneer leaders who are working to improve excellence and equity in New Jersey STEM education. However, the complexity of driving change and the need to scale this work is evident.

NAEP 8TH-GRADE SCIENCE—2015. PROFICIENCY GAPS BETWEEN STUDENT SUBGROUPS (IN PERCENTAGE POINTS)

29 percentage point gap

WHITE 43%
BLACK 14%

26 percentage point gap

WHITE 43%
HISPANIC 17%

WHAT IS STEM? STEM stands for science, technology, engineering and math, not only as individual disciplines, but also as an interdisciplinary area of study. The STEM field today is shifting away from rote memorization and procedures and moving more into design thinking, investigation and inquiry. To add further emphasis to the multi-disciplinary approach, some practitioners refer to the field as STEAM (adding in an A for the arts). When done best, STEM and STEAM can transform learning into a vehicle for students to learn the four C's—collaboration, critical thinking, communication and creativity—which constitute 21st-century skills[1] that many employers believe are missing from today's younger workforce.

Why STEM is important?

In the 21st century, technological and scientific innovation is a vital engine of the U.S. economy. Unfortunately, we are not preparing our students to grow our innovation economy in this fast-changing global landscape. In the United States alone there are three million more STEM jobs than the number of available trained professionals to fill them.[2] In New Jersey, there are 1.4 open jobs in STEM for every unemployed person.[3] STEM-related jobs are expected to grow at almost twice that of other jobs in the market, and the vast underrepresentation of women and minorities in these fields illustrates equity issues and challenges that we must address. This challenge and opportunity is only going to grow over time. The U.S. Department of Labor estimates that 65 percent of today's grade-school students will end up in jobs that do not yet exist.[4] Our current education system was built for an industrialized age of standardization. In our globally connected and fast-changing world, we need to free the education system to innovate.

Report Overview

In this report, we will examine New Jersey's STEM education landscape, with a focus on evidenced-based innovations. Districts and schools around the state have championed STEM education, as well as personalized and blended learning, with some leaders reimagining education in even bigger, more holistic ways. We shine a light on the pioneers and early adopters that are showing results with outcomes supported by improvements in excellence and equity. Although research on this topic is limited due to the recent nature of these innovations, we were able to find evidence in specific programs and strategies.

1 P21 Partnership for 21st Century Learning. "The 4CS Research Series." Accessed July 3, 2017, http://www.p21.org/our-work/4cs-research-series

2 New American Economy. March 29, 2017. Sizing up the Gap in our Supply of STEM Workers. Available online at http://www.newamericaneconomy.org/research/sizing-up-the-gap-in-our-supply-of-stem-workers/
3 "Reports on the condition of STEM learning in the US." Change the Equation.org, Accessed August 8, 2017, http://changetheequation.org/stemdemand.
4 ISTE Connects. "Here's how you teach innovative thinking." Last modified January 19, 2016, www.iste.org/explore/articleDetail?articleid=651

We focused on best practices at the local level, scalable models and obstacles to advancing K–12 STEM education. To do so, we conducted a listening tour with over 70 individuals and organizations including visits to schools and programs throughout the state. We spoke with superintendents, principals, technology and science leaders, teachers and students. We met with think tanks, foundations, corporate leaders, scientific institutions, the military, state leaders and academics. We reviewed countless news articles, studies and reports. We also explored the world of "off-the-shelf" national programs and curriculums that have taken root here in our state.

In the following report, we highlight compelling examples of innovation in K-12 STEM education in New Jersey. Examples include personalized and project-based learning, out-of-school time STEM programs, STEM-rich institutions, STEM teacher preparation and important systems level change work. We also address the importance of equity, with examples of proactive work showing results. Finally, we close with a series of recommendations.

"The U.S. Department of Labor estimates that 65 percent of today's grade-school students will end up in jobs that do not yet exist."

Examples of STEM Innovations in New Jersey

1. In-School: Personalized and Project-Based Learning

Teach to One Math	This is a personalized/blended-learning math program found in 10 northern New Jersey middle schools. Technology is used to strengthen traditional best practices in teaching and learning.
Project Lead The Way, The Full Options Science System and i2 Learning	These three innovative examples illustrate the application of project-based learning. Project Lead The Way provides curriculums in computer science, engineering and biomedical science along with professional development for teachers. Currently, 137 Project Lead The Way programs are active in 90 New Jersey school districts. Full Option Science System provides an active learning science curriculum and extensive professional development to support schools. i2 Learning brings STEM learning to middle schools and just completed a STEM week in Newark with 26 schools.
Freehold Township School District	This elementary and middle school district integrates both personalized/blended and project-based learning. The district has proactively transformed itself to create a strong culture where students are leaders of their own learning.

2. Out-of-School Time STEM Programs

FIRST Robotics	This is a mentor-based, national program designed to inspire and help students learn and apply engineering, technology and important life skills by designing and building their own robots.
Girls Who Code	This organization teaches girls to code with a curriculum for school clubs and summer immersion programs. Through nationwide sites, including 48 in New Jersey, Girls Who Code aims to close the gender gap in technology.
Crazy 8s	This organization supports math clubs for elementary-age students, with a curriculum designed to make math fun, providing a non-competitive option for extracurricular math clubs.

3. STEM Rich Institutions

Liberty Science Center	This is a world-class science learning center that makes science and technology fun for its more than 650,000 annual visitors. As a leader in STEM education, Liberty Science provides significant professional development for teachers and dynamic activities for students. The Science Center is a premier field trip destination, and STEM educators bring programs directly to schools.
Students 2 Science	This program allows kids to engage in hands-on experiments in state-of-the-art labs side by side with scientists in the field. Students can go to the East Hanover Technology Center or participate in virtual labs. Newark Public Schools and Students 2 Science are in the process of building a dedicated Newark facility to increase access and scale.

4. STEM Teacher Pipeline

Woodrow Wilson Teaching Fellowship	This program offers a new, innovative way to prepare STEM teachers. Five New Jersey universities partner with the Fellowship to provide redesigned curricula and clinical experiences. Graduates commit to teaching in underserved communities for three years.
New Jersey Center for Teaching and Learning	This program is a top producer of physics teachers in the country. Their novel approach includes curriculum that flips the traditional order of teaching the science sequence.

5. Systems Level Change

New Jersey Department of Education	**Next Generation Science Standards.** In 2014, these new academic benchmarks in science were adopted and are driving change in how students engage in scientific learning. **Future Ready Schools.** New Jersey has joined in with the Future Ready Schools movement, designed to improve teaching and student outcomes through the effective use of technology. The framework to drive systematic change is embedded in the new Future Ready Schools New Jersey certification program. **Career & Technical Education.** Some county vocational technical schools have a STEM focus. These schools, as well as other CTE programs embedded in comprehensive high schools, include relevant work-based learning opportunities. Many of these public schools are in high demand, have competitive admission and rank among some of New Jersey and the nation's top STEM schools.
Higher Education— STEM Pathways Network	This network supports the creation of STEM ecosystems, where communities can cultivate cross-partnerships and create STEM-rich, 24/7 learning environments.

Each of these innovative examples will be explored further in the remaining report. Where possible, we identify the New Jersey schools, districts or communities involved in these initiatives. Despite this extensive review, we know that in a state with over 600 school districts, we missed many gems. We also recognize the vital role of institutions of higher education and the business community in advancing STEM across the state, which is not fully covered in this report.

We also examine equity issues within STEM and highlight some clear examples of proactive strategies to ensure more women, black and Latino students are represented in the STEM talent pipeline moving forward.

Recommendations

Based on our extensive discussions with education experts, practitioners and policymakers, we have developed several recommendations that can help our state advance STEM education.

- ***Create a gubernatorial-sponsored task force on K-12 STEM education.*** JerseyCAN recommends that the Governor create a diverse task force to develop a comprehensive plan for strengthening K–12 STEM education in New Jersey. It is time to step back and understand where we are, the vision of the future and what actions must be taken to get there. Clearly some building blocks are in place, but we need a vision owned by key stakeholders and a leader that can bring resources to execute the plan.

- ***Invest in STEM teachers.*** New Jersey has a shortage of teachers trained in STEM fields. Two of the programs we profiled in this report address this issue, but more can—and should—be done. More STEM-focused preparation and resources, for example, could be provided to elementary school teachers. We believe the New Jersey Department of Education and the Office of the Secretary of Higher Education should continue to work together to develop strategies to address this talent gap.

- ***Expand access to computer science.*** Digital technologies are now reshaping many parts of our global economy. Computing jobs are growing at three times the national average, and yet only 40 percent of our schools teach computer science nationwide.[5] We must increase investment in teachers and other creative strategies to expand computer science offerings in our schools so that all students have access.

- ***Expand access to career and vocational technical education and work-based learning opportunities in STEM fields.*** A recent McKinsey report identifies a growing labor-market mismatch between the demand for middle-skills workers and the supply of workers with the appropriate skills. New Jersey's Career and Technical Education schools and programs were created to provide rigorous programs of study aligned to workforce needs and career pathways. JerseyCAN recommends that the STEM education task force evaluate the best strategy to expand existing CTE schools and programs.

- ***Leverage personalized and blended learning.*** Technology has the potential to transform education. We are seeing some of the transformational possibilities with personalized and blended learning, as shown in Freehold Township where students are becoming leaders of their own learning. We support the New Jersey Department of Education's collaborative effort to create a path for systemic change around digital learning with the Future Ready Schools certification program. The long-term potential for school transformation here is significant, and New Jersey is creating evidenced-based proof points. Policy changes can also help enable growth over time.

- ***Establish an Innovation Fund.*** Many of the recommendations we suggest here require new resources. These start-up costs alone can create barriers for schools even considering change. JerseyCAN sees significant potential in forming an Innovation Fund that leverages public and private resources to support pioneers leading evidenced-based innovations. JerseyCAN will continue to evaluate optimal ways to organize such a fund.

- ***Implement targeted STEM strategies for women and underrepresented minorities.*** There is a growing list of educational strategies and discrete programs that support girls and underrepresented minorities in STEM education. An advisory council should be created to help grow this work and track results.

We have an opportunity in New Jersey to reclaim our leadership in today's innovation economy. To do that, we need to change the education paradigm to effectively prepare all children for 21st-century jobs.