Preface

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In 2010, just a year into Barack Obama’s first term as president, the President’s Council of Advisors on Science and Technology submitted an ambitious 142-page report that outlined the challenges and opportunities related to revitalizing science, technology, engineering, and math (STEM) education in the United States. The council operated from the widely accepted premise that the nation must redesign education for a world that is undergoing steady and profound social, economic, and technological change.

As president of the United States, Mr. Obama led several high-profile initiatives that were intended to bolster America’s technological and economic future by improving the quality of STEM education. The president consistently used his bully pulpit to rally educators, tech enthusiasts, industry leaders, and community activists around the movement to prepare the next generation of leaders in STEM.

Composed of leaders from tech giants such as Google and Microsoft, vice presidents from the National Academy of Sciences and the National Academy of Engineering, and university presidents, researchers, and scientists, the President’s Council of Advisors on Science and Technology identified what it believed were the essential challenges to creating the educational strategy and school system the nation needed in a tech- and knowledge-driven economy. In its report to the president, the council wrote that “to meet our needs for a STEM-capable citizenry, a STEM-proficient workforce, and future STEM experts the nation must focus on two complimentary goals: preparation and inspiration.”

Many of the council members were intimately familiar with the rise and impact of intelligent machines and the increasing demand for highly skilled labor in the global economy and the U.S. workforce. The president had also emphasized the need to not only build the tech workforce of the future but ensure that it was inclusive and diverse.
Accordingly, the council was attentive to the equity challenges in STEM and the startling lack of gender, racial, and ethnic diversity in the innovation economy. The report added, “We must prepare all students, including girls and minorities who are underrepresented in these fields, to be proficient in STEM subjects.” The council wrote that the nation must “inspire all students to learn STEM and, in the process, motivate many of them to pursue STEM careers.”

Among other things, the extensive report addressed the federal role in K–12 STEM education, the need for improved standards and assessments, the importance of a well-trained corps of teachers, advances in educational technology, students, and school systems. Buoyed by a team of respected experts, data, and insights, the explanation of the problems prohibiting the creation and implementation of a more robust STEM curriculum was largely unassailable. However, among the thousands of sentences in the report, this one is especially peculiar: “Despite its transformative role across the global economy, technology has not played a major role in K-12 education to date.” The statement is peculiar largely because you could make a strong case that nothing has influenced public education more over the last thirty years than technological transformation. The tools and applications that have flowed into the classroom—computers, smart boards, the Internet, mobile devices, tablets, social media, and advanced software—influence how we deliver and even define education today. Since at least the 1990s there has been a persistent and largely uncontested view that every school must have computers and the Internet and that students should learn to use them.

The technological capacity of U.S. public schools underwent a profound transformation between 1994 and 2005. In 1994, a student attending a lower-income school was unlikely to see a computer in her classroom. Only 3 percent of U.S. instructional classrooms offered access to computers. Roughly ten years later, in 2005, a student attending a lower-income school was almost as likely as her more affluent counterpart to see a computer in her classroom. By 2005, 94 percent of the instructional classrooms in the United States had computers.

In recent years the Internet, mobile platforms, massive data-based networks, and a new generation of software applications have nudged education toward a new but uncertain future. The big tech companies, led by Google and Apple, are engaged in an epic battle to exert wide influence
in U.S. classrooms. In other words, technology plays a major role in our schools, just not the one that many believe it should be playing.

A more penetrating statement might be that technology has not adequately addressed the equity issues that continue to produce unequal opportunities to learn in our nation’s schools. In fact, some argue that technology has actually made the educational and economic disparities in the United States worse. Technology, from this view, has primarily served to more deeply entrench the social, educational, and economic advantages of the privileged classes. And this is all true despite the fact that black, Latino, and poor students are today just about as likely as their white and more affluent counterparts to attend schools that offer access to computers and the Internet.

For more than five decades a variety of experts including economists, sociologists, and futurists have been predicting the coming of a new society and a new economy. Much of the forecasting has been influenced by technological innovation and related economic transformation. But even as smart machines, robots, and artificial intelligence grab considerable attention, the most important skills of the twenty-first century are turning out to be thinking skills rather than technical skills. Computational thinking, design thinking, critical thinking, and expert thinking, for example, are vital assets in our innovation economy. The challenge, as some researchers have pointed out, is not that black, Latino, and lower-income students do not have access to technology. The real challenge is that they often lack access to the instructional expertise and curricula resources that develop the cognitive skills that drive our knowledge-based economy.

Students from more affluent households not only benefit from superior educational opportunities—opportunities to grow their human capital. They also benefit from more diverse social ties—opportunities to grow their social capital. Schools that are rich in human and social capital offer their students extraordinary advantages compared with schools that struggle to cultivate these assets.

As part of an ethnographic study our research team conducted in a high school located on the suburban fringes of Austin, Texas, we witnessed the social and educational disparities that lower-income students face. We were in the high school just as a number of President Obama’s efforts to scale up the initiatives to remake STEM education began to
take form. The president and his team worked diligently to bring the ethos of the innovation economy—experimentation, a bias toward action, failing fast, rapid prototyping, and creative problem solving—to the staid world of education. Our fieldwork also coincided with the rising call to make skills like coding and design thinking central components of our nation’s educational curriculum.

Much of the debate about STEM, education, and equity is shaped by a number of problematic claims. No claim may be more imprudent than the view that black, Latino, and poor students and their families undervalue education in general and STEM education more specifically. During our research we observed a community of black, Latino, and lower-income students who were heavily interested in STEM. Moreover, they invested in a variety of creative practices to pursue their educational and aspirational interests in the domain, even though school resources were limited.

These students, as you will learn in the following pages, did not suffer from a lack of interest in STEM. Rather, they suffered from a lack of opportunities to learn STEM skills in the classes available to them.

The parents that we met also ran counter to type. Though many of them struggled with low-skill, low-paying, low-status jobs, they understood the value of education and STEM. Many of them labored hard and made personal sacrifices to provide their children access to computers, smartphones, and the Internet. These parents knew better than anyone what it meant to try to make a life for a family in today’s world without the vital education and skills that are closely linked to economic opportunity and social mobility.

The story that we tell is one of the first attempts to see up close how the debates about technology, equity, and the future of learning take shape in the real world. It is one thing to theorize about the future of learning. It is one thing to prepare reports that envision a more robust STEM education system. It is another to be charged with building that future in a community and a school bereft of crucial resources. In the world that we observed, students, families, and schools faced a string of hard choices. For example, we personally witnessed classrooms that had the resources to purchase technology but not to develop the instruction, curricula and learning opportunities that prepare students for a rapidly evolving society and economy. We also observed parents in working
poor families make sacrifices to afford computers and Internet access even as they typically lacked the financial resources to expose their kids to the out-of-school enrichment activities that are routinely available to children in more affluent households.

But the story that we tell in this book is also influenced by students who in the face of unprecedented challenges and widening disparities struggled earnestly and creatively to find their pathways to better futures. Many of the students that we got to know worked hard to make school a more relevant place by transforming their classrooms, after-school life, and social relations into a vibrant ecosystem for exploring, tinkering, and learning with technology. We believe that if the president, tech leaders, high-powered councils, and policy makers could meet the students that we met, they would see the challenges in education through a different lens. Rather than labeling black, Latino, and lower-income students as disinterested in learning STEM—lacking inspiration—they would come to appreciate how the most diverse student body in U.S. history is eager to participate in building tomorrow’s world.

Our research team did not know it, but the site for our fieldwork—the school, the city, and the state—emerged as a powerfully emblematic place to think about many of the challenges and (missed) opportunities in STEM education addressed by the President’s Council of Advisors on Science and Technology. Many of the issues that are connected to the crisis in our schools (the lack of educational opportunity) and the crisis in the tech industry (the lack of diversity) were on vivid display throughout our fieldwork. The school that we were fortunate enough to gain access to placed us on the front lines of the future—a future marked by increasing diversity, uncertainty, and complexity.

This is the world that we share with you in the following pages.