NEW AMERICA | EDUCATION POLICY

LINDSEY TEPE

Putting Learning on the Map

Visualizing Opportunity in 21st Century Communities

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INTRODUCTION

In January 1996, President Clinton declared that one of the most important and pressing challenges of our time was "to provide Americans with the educational opportunities we'll all need for this new century."[1] Those opportunities went beyond school walls: they began in the home with parents, continued through primary and secondary schools and into the halls of higher education, and extended to libraries, museums, health centers, community centers, and other vital public institutions within communities. With the dawn of the "information superhighway," Americans would have unprecedented means to connect these institutions, bridging physical environments and extending opportunities for learning both online and off.

Almost 20 years later, though, this vision remains far from reality.

Prominent voices across the spectrum of government, academic, and non-profit sectors have raised concerns about the connection between increasing income inequality and decreasing opportunity for low-income families, especially in terms of educational opportunity. Federal Reserve Chair Janet Yellen, at a recent conference on economic opportunity, spoke of the ability of the affluent to afford "homes in safer neighborhoods with good schools, . . . better nutrition and health care, early childhood education, intervention for learning disabilities, travel and other potentially enriching experiences,"[2] while children from low-income backgrounds are left without these opportunities. Research recently published by Greg Duncan and Richard Murnane—both preeminent authors, economists, and professors of education—has found that "rising residential segregation by income has led to increasing concentrations of low- and high-income children attending separate schools."[3] Concentrated poverty has "made it difficult to provide consistently high-quality learning experiences in schools serving a large proportion of low-income students."[4]

The past two decades have also brought evidence that inequality in educational opportunity starts young and has a lasting impact. Low-income households have fewer high-quality options for child care and pre-K[5] than their more affluent peers.[6] Parents are less likely to have finished high school or pursued higher education, and often do not know how to help their children build school readiness skills. Striking vocabulary gaps have been found between children from high- and low-income families, with affluent children exposed to 30 million more words by age three.[7]

In elementary and secondary schools, while students' scores in math and reading on the National Assessment of Educational Performance (NAEP) scores have been improving on average, gaps in achievement between the rich and poor have widened.[8] Though graduation rates nationally have climbed to 80 percent, those without degrees are disproportionately low-income students.[9] Low-income high school graduates are 30 percent less likely to enroll in higher education than their middle-class and wealthy peers,[10] and students from low-income backgrounds are the least likely to complete their degrees: recent data show that while 90 percent of students from affluent families go on to finish their studies, only about one in four low-income students will earn a degree by age 24.[11]

The past two decades have also brought evidence that inequality in educational opportunity starts young and has a lasting impact.

For affluent neighborhoods, community institutions—including informal learning environments such as museums, parks, and community centers—provide resources to parents of young children, host programming during the school year and throughout the summer for young adults, offer courses for non-traditional and adult learners, and more. In low-income communities, these same institutions are struggling to provide high-quality experiences with fewer resources constrained by less and less public investment.[12]

As for the 21st century challenge of connecting communities to online information and resources, low-income neighborhoods remain the least likely to have access. This digital divide persists along the same lines as the existing socioeconomic divide. New technologies have connected and extended the considerable network of learning opportunities available to wealthy and middle-income families. But for under-resourced communities, not only are physical resources—early learning centers, public schools, universities, libraries—often less robust, but many online resources may be out of reach, even with access to a smartphone.[13] Without access to robust broadband infrastructure and more powerful devices, bandwidth-intensive online courses and other rich learning opportunities remain inaccessible.

Significant national attention has been directed at each of these issues individually, but few education policy leaders are considering this network of learning opportunities as a whole. Nor are they recognizing how much place and location continue to matter. The increasing segregation of low-income families makes these issues inextricable at the community level. Advocates continue to focus on different pieces of a larger system, each vying for limited attention, funding, and resources; increasing educational opportunity too often turns into a zero- sum game. But lifelong learning requires community access to *all* of these elements.

So what can policymakers, advocates, and communities do to move beyond 20 years of rhetoric and seriously focus on achieving equitable communities of educational opportunity?

This paper makes the case for leveraging new mapping tools to spark fresh conversations and spur collaborative action. Spatial analysis and data visualization can be a powerful first step, enabling policymakers and the public to better understand the whole, interconnected network of learning opportunities within their communities. It complements research from a recent report by The Ohio State University's Kirwan Institute for the Study of Race and Ethnicity that lays out how mapping can be used to "reveal where opportunity is located geographically, and demonstrate how different groups of people are concentrated in areas of low or high opportunity."[14] Seeing communities with rich learning networks—as well as those with gaps and holes—highlights where inequalities exist and intersect. "Maps," the Kirwan researchers write, "can stimulate dialogue and consensus-building among stakeholders," and focus attention on how best to strengthen and rebuild communities. Mapping is a powerful tool for directing collective attention and investment toward closing these gaps.

To be sure, mapping cannot capture or solve for everything—there are limitations to any form of analysis. But it can prompt dialogue at a level of specificity that triggers action and a sense of responsibility among community leaders, and can illustrate what healthy networks of learning opportunities look like for today's and tomorrow's learners.

This paper makes the case for leveraging new mapping tools to spark fresh conversations and spur collaborative action.

The following sections highlight examples of how mapping and analysis have been used to understand different pieces of 21st century learning networks. These examples individually demonstrate the wide impact mapping can have: illustrating resource disparities, identifying changing needs, shaping and moving popular opinion, providing needed information, and driving community investment. They expose what is necessary to succeed in a century in which learning is dependent upon, and defined by, the formal, informal, and online resources families and students have within their reach.

WHY MAP?

The Universal Declaration of Human Rights, adopted by the United Nations General Assembly after the conclusion of the Second World War, expressed for the first time the inalienable rights guaranteed to all human beings. Signed in Paris on December 10, 1948, the Declaration included the global right to a free, public education.[15] This, in and of itself, is remarkable, given how limited access to basic education was just two hundred years ago. In 1800, no European nation could claim even half of its population was functionally literate; most had little, if any, information about the education of its population at all. The abilities of reading, writing, and counting were largely restricted to a minority of wealthy men living in more densely populated towns and cities.

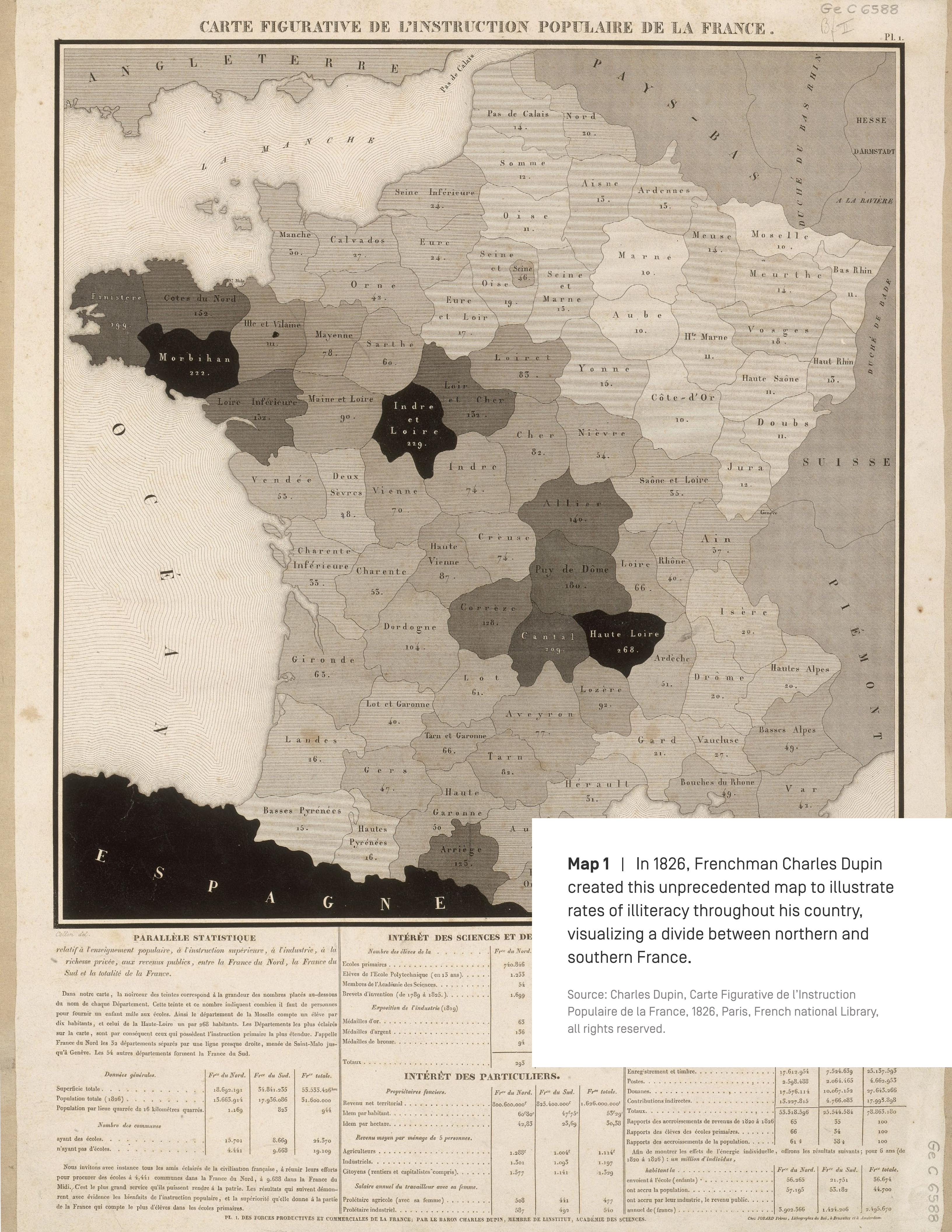
At the turn of the 20th century, however, developed nations such as England, Germany, and France were reporting that as much as 85 to 90 percent of their adult population had obtained basic literacy skills, setting the stage for literacy as a basic human right.[16] During those interim years in the 1900s, countries systematically began tracking literacy rates of their citizens. The methods and measures for determining these rates—or statistics—were new and often imprecise. During that period, literacy rates were sometimes simply determined based upon the ability of a person to sign his or her own name. Occasionally the measures were more sophisticated, looking at primary school enrollment numbers for young men or test results from assessments administered at the time of military conscription. The focus on these different metrics, however, represented the first intensive efforts to understand a social phenomenon like education.

Data visualization, which continues to spread in its popularity and use, has historic roots in the field of education.

During the early 1820s Baron Charles Dupin—a French politician, mathematician, and amateur statistician (as statistics itself was a new field in science)—wanted to use statistics to observe the social progress of his country. As French researcher Gilles Palsky notes, "instruction was chosen as an indicator of the economic development in the different parts of the kingdom, as Dupin was convinced that there were intimate relationships between people's education and prosperity."[17] Even then, obtaining an education—even in very basic skills—was starting to be seen as necessary, especially in a rapidly industrializing country. Given the focus of quantifying education at the time, understanding (and eventually expanding) population literacy rates was now possible.

The question for Dupin became how to convey the relationship between education and economic prosperity. His original writings in 1827 provide some context for his unprecedented work: "To make visible the main difference [in literacy], I had the idea to give to the various *départements* shades all the more dark since they sent less [sic] pupils to schools."[18] Breaking the country into its smaller administrative regions—*départements*—and using shadings from white to black, Dupin represented both the distribution of illiteracy throughout the country as well as its intensity within each region. The lighter regions were those to be considered "enlightened" while the rest of the country was still "in the dark."

The map illustrated a divide between the north and south of France—the enlightened northern portion of the country contrasted with the darker, illiterate southern portion. This divide reflected economic development. Northeastern France was rapidly industrializing, while southern France remained rural and impoverished. While this contrast had been observed prior to Dupin's work, its visual representation had wide reach and gained immediate popularity.[19] His new method proved to be a powerful new way to compare and contrast territories. It was widely talked about and praised throughout France in the 19th century, and data visualization has continued to spread in its popularity and use.



Map 1 | In 1826, Frenchman Charles Dupin created this unprecedented map to illustrate rates of illiteracy throughout his country, visualizing a divide between northern and southern France.

Part of the appeal for this type of mapping is that it offers a new way of seeing and understanding information about people. Representing this information geographically provided new insights about people living in different parts of the country. Viewers could begin to see patterns and start to make inferences about those patterns.

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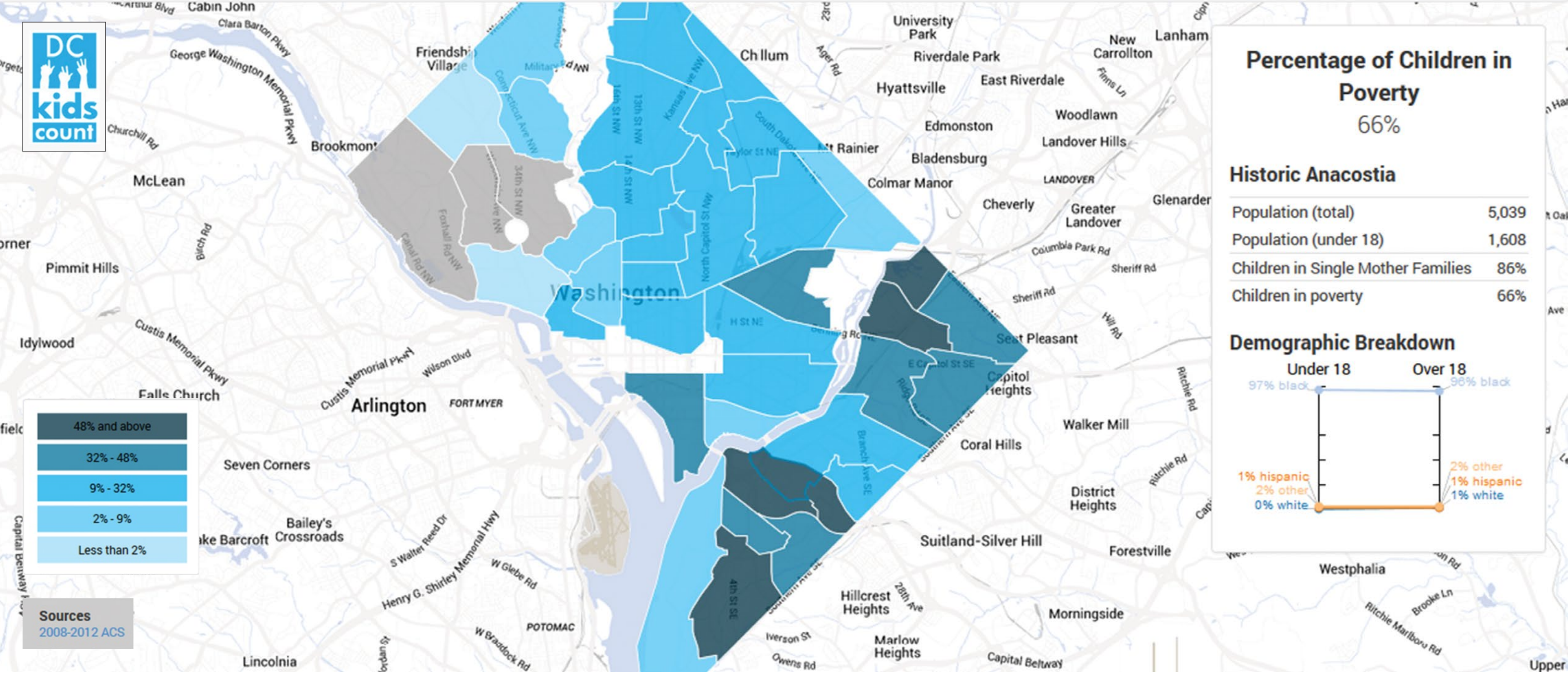
Following Dupin's work, a French lawyer named André-Michel Guerry created similar maps portraying rates of property crime and violent crime in addition to literacy. His interest was in comparing these data to begin to identify the cause of criminal behavior. Through the course of his study he mapped other data points, including rates of suicide, illegitimate births, and other population statistics, hoping to spot patterns and understand their relationship with criminal behavior. His maps went beyond illustration: as Palsky observes, "they were used as tools of spatial experimentation and scientific arguments."[20] While it is often difficult to spot patterns in columns of data, maps provided an entirely new way to compare information. "Through the relation of one map with another, the eye could catch new information," Palsky writes.[21] Almost two hundred years after these first examples of mapping, people continue to use these basic methods to understand the relationship between different kinds of information.

New technologies pioneered in the late 20th and early 21st centuries have dramatically enhanced these methods. Computing technologies have allowed for more immediate, complete, and complex collection of data about things like education, public health, and civic engagement. Information collected about people through a variety of government and non-governmental organizations is not only more accurate, but unprecedented in its level of detail and specificity. Further, these data are georeferenced—linked to specific locations or regions within countries and around the world. As data have grown more complex, detailed, and precise, the potential messages to convey through mapping have expanded. The major limitation for analysis is no longer a lack of information. Rather, it has become more about how to store, manipulate, and find meaningful patterns within these reams of data.

These same advancements also altered what it means to depict data. Maps are no longer painstakingly drawn or etched by hand, but created using computing technologies. Geographic Information Systems (GIS) have been designed specifically to allow users to manipulate and analyze geographically linked data from many different sources, depicting this information in a multitude of ways. For example, rather than comparing several individual maps to spot patterns as Guerry did, a single map today could depict all of the variables he was interested in—literacy, property crime, violent crime—and many more, to see trends and catch new information.

Focusing on the well-being of children, DC Kids Count started to piece together a picture of the area's communities.

This summer, the non-profit DC Kids Count did just that, looking at the District of Columbia.[22] Focusing on the well-being of children, DC Kids Count started to piece together a picture of the area's communities. Through a series of hackathons, bringing together teams of data scientists, the organization looked at the different characteristics of neighborhoods: the average income level, residents' age and racial background, the prevalence of crime, the educational attainment of adults. They examined each neighborhood's assets: the number of schools and libraries, parks and recreation centers, grocery stores, public transportation stops. Then they looked at the well-being of children in those neighborhoods: child poverty rates, rates for preventative medical care, and education outcomes.



Map 2 | This summer, the non-profit DC Kids Count mapped the well-being of children in the District, honing in on variables such as the percentage of children living in poverty.

Source: DC Action for Children, "Where Resources and Well-being Vary in DC," DC Kids Count, May 5, 2014, accessed September 20, 2014, http:// http://datatools.dcactionforchildren.org/.

Kids Count was able to portray many different kinds of information together, and the patterns echo Dupin's original supposition that education and prosperity were inextricably linked. This is immediately clear in the map that DC Kids Count created. A stark illustration of Duncan and Murnane's research, the increasing residential segregation throughout the District has led to greater concentrations of low-income children isolated in communities with fewer of these neighborhood assets.

DC Kids Count's analysis highlights that approximately 30,000 children—three of every ten kids in Washington D.C.—are living in poverty. The majority of those children are living in the poorest communities: the poorest 25 percent of neighborhoods house 60 percent of D.C. children living in poverty. The same neighborhoods have the largest proportions of children living in single mother households. They have the fewest numbers of residents with high school diplomas. Children going to school in these neighborhoods—predominantly located in the southeast quadrant of the city—have the lowest proficiency rates in reading and mathematics.

Kids Count mapped these data points together to demonstrate the overwhelming inequity within the District, providing a powerful tool for driving change to improve outcomes for children. It places the challenges facing low-income children and families within a geographic context, underscoring the effect residential segregation based upon income has on opportunities for learning. And as the District's At-Large Councilmember David Grosso emphasized, it is a powerful tool for accountability: "We need access to sound data to ensure legislators and advocates can track the progress we make on behalf of D.C. children."[23]

Too often, pieces of information like those made visible by DC Kids Count's analysis would be discussed in isolation from one another, each group analyzing a puzzle piece independently, removed from the whole picture. But this type of mapping, dating back two hundred years ago, can help us understand how each of these different pieces fit together.

VISUALIZING NETWORKS OF LEARNING OPPORTUNITIES

Over the years, formal and informal learning environments have expanded and grown increasingly complex, involving primary and secondary schools, universities, libraries, early childhood centers, museums, hospitals, community centers, community technology centers, and other public institutions. New technologies complement these institutions. Each is enhanced through access to a wide new array of resources online. Institutions also benefit from their connections with one another: science classrooms, connecting to local hospitals through live-streaming video, have the ability to observe open-heart surgery and question doctors during the procedure; libraries, sharing licenses with local universities, can provide access to journals and periodicals now available online. As technologies have become mobile, individuals can tap into a wealth of information anytime, anywhere in the world. New technologies have fostered an interconnected network of learning opportunities, and these different learning environments can work together seamlessly.

Ideally, all students and families would have easy access to this network. But while those in many wealthy communities have access to devices and the Internet—at school, at work, at home, in coffee shops, and through mobile networks everywhere in between—what do we know about access to learning opportunities in the many poor communities throughout the U.S.?

Research has shown that low-income families have access to fewer and less-resourced schools, libraries, community centers, and other organizations that make up their network of learning opportunities.[24] Further, the broadband infrastructure connecting them is likely to be weaker. Classrooms have connections that are no faster than in individual homes, though they serve exponentially more people, and some classrooms are not connected at all.[25] Libraries and community centers often have limited devices and connectivity, and are not always open during hours when students and families most need them. And while the affluent, and a large portion of the middle-class, have home connections, many low-income families continue to lack the resources to connect to the Internet at home.[26]

The following examples illustrate the potential of mapping for illuminating where resources are abundant and where they are lacking, identifying important levers for change within a community, and spotlighting areas in need of additional investment.

But much of this research focuses on access in the aggregate. A next step for leaders is to understand how these issues intersect locally.

The following sections highlight examples from government, other organizations, and individuals who have used mapping in new ways to gain a better understanding of local access to networks of opportunity. These examples are pulled from across the full spectrum of learning environments, from birth through adulthood. Each looks at a different type of learning environment, visualizing the needs of different communities. Our examples illustrate the potential of mapping for illuminating where resources are abundant and where they are lacking, identifying important levers for change within a community, and spotlighting areas in need of additional investment.

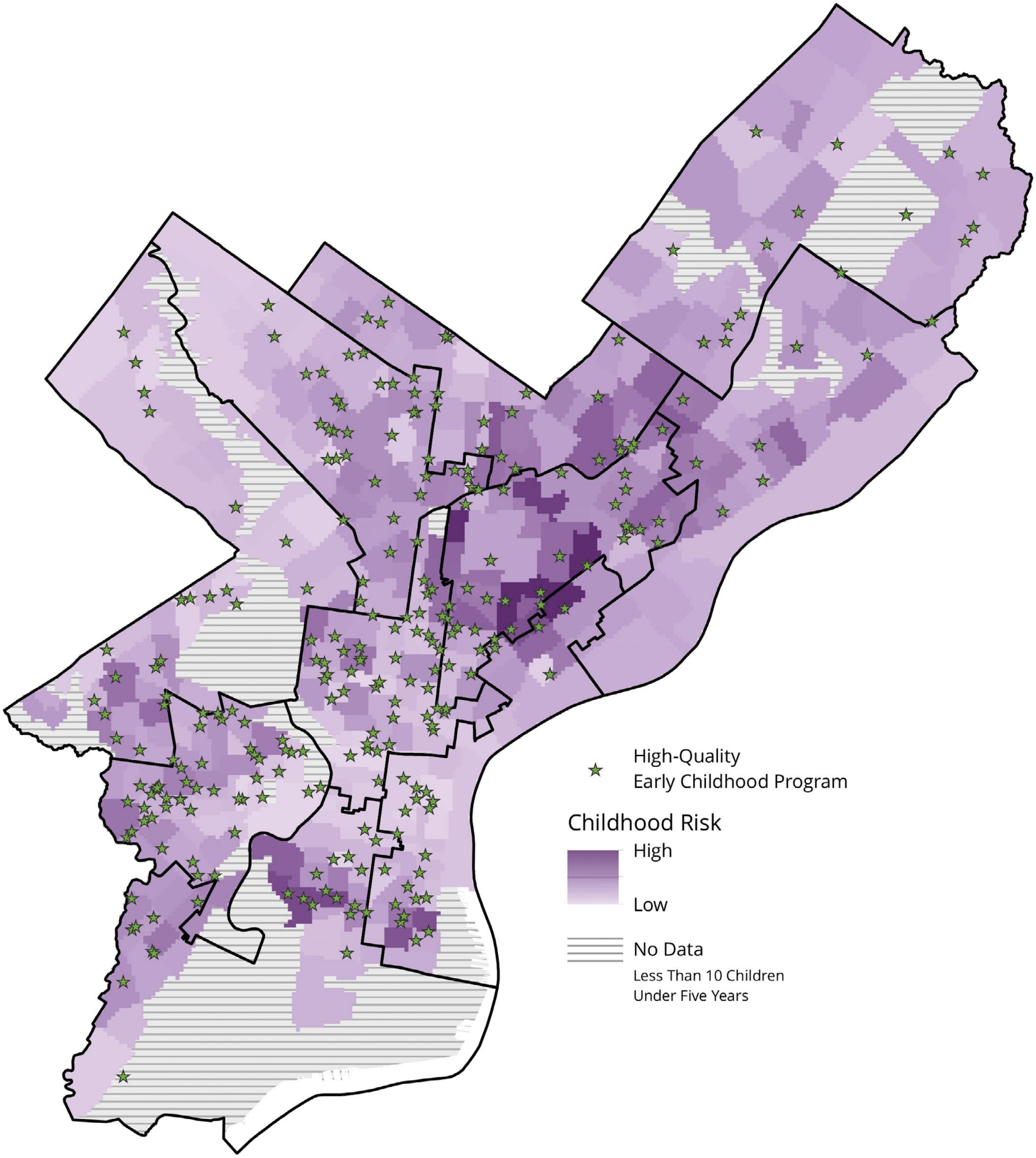
Early Learning

More attention is being focused on early learning than ever before. Science has demonstrated that healthy brain development is spurred by one-on-one interactions with nurturing and responsive adults, and many studies show the long-term positive impact of quality early learning.[27] New policies are being developed and deliberated to ensure that opportunities start at birth, continue through child care and pre-K, and are cohesively connected to good instruction in the early elementary grades.[28] These opportunities are increasingly recognized as essential for America's children to succeed in school, become life-long learners, and build the cognitive and social foundations for making good decisions throughout their adolescent and adult lives.

But access to early learning is far from universal. Affordable, quality child care is spotty and non-existent in many places and the availability of public pre-K varies from state to state and community to community. So, too, does the number of hours per week that a child is able to attend kindergarten.[29]

Recognizing these disparities, for the past fifty years the Delaware Valley Association for the Education of Young Children (DVAEYC) has been advocating on behalf of young children in Southeastern Pennsylvania for increased access to early childhood education opportunities. A regional member of the National Association for the Education of Young Children (NAEYC), the association recognizes the positive effect early learning can have on the trajectory of children from low-income backgrounds.

Last year, DVAEYC partnered with Azavea, a mapping firm that provides advanced geospatial analysis. Through Azavea's Summer of Maps program, non-profits with geospatial analysis needs are matched with students learning that skillset. Azavea paired DVAEYC with a GIS student to explore data on high-quality early childhood education locations and then visually represent their availability throughout the city. "We knew anecdotally where the absence of quality was," said Suzann Morris, assistant director of public policy at DVAEYC, "but we wanted an accurate picture."[30] High-quality locations, they suspected, would be conspicuously absent in those areas of the city with larger proportions of at-risk children.



Map 3 | Last year, early education advocates in Philadelphia mapped the dispersion of high-quality child care centers in the city, illustrating the absence of quality options in low-income neighborhoods.

Source: Azavea, "Summer of Maps: Delaware Valley Assocation for the Education of Young Children," 2013, accessed June 10, 2014, http://www.summerofmaps.com/project/dvaeyc/.

To create this kind of visual representation, the data are critical. DVAEYC approximated child poverty levels by census tract within the city, using several different indicators, including the number of young children from single-parent households, the number of children living in poverty, and those within walking distance to grocery stores. Using color shading—the lightest hue of purple representing the lowest rates of at-risk children and the darkest the highest—each area was colored.

They then mapped the locations of each high-quality child care center in Philadelphia; of the city's 2,000 public early childhood education (ECE) programs, just 14 percent—or about 280—have received a high-quality rating and are therefore included on the maps. Of course, resources to evaluate the quality of ECE programs are scarce, and information on quality is far from complete. Nevertheless, the resulting picture starkly illustrated the scarcity of high-quality public programs within the poorest areas of the city.

After representing these data citywide, they also created separate maps for each of Philadelphia's city council, house, senate, and congressional districts. These tools in hand, DVAEYC continued to engage local policymakers to encourage investment in high-quality early learning opportunities. This visual analysis presented in a new way the inequities within each policymaker's jurisdiction, in addition to the plight of the city at large.

The Philadelphia City Council responded, offering $500,000 in January to improve current facilities. The William Penn foundation—named in honor of the city's founder—offered a matching sum, for a total of $1 million in additional funds for early learning.[31] As Morris said, anecdotally they knew where the deficits in quality early childhood education centers were. For policymakers, seeing those deficits mapped within the communities they represent conveyed the problem in a new and thought-provoking way.

Through mapping, it became clear that high-quality child care locations were conspicuously absent in areas of Philadelphia with larger proportions of at-risk children.

Elementary and Secondary Education

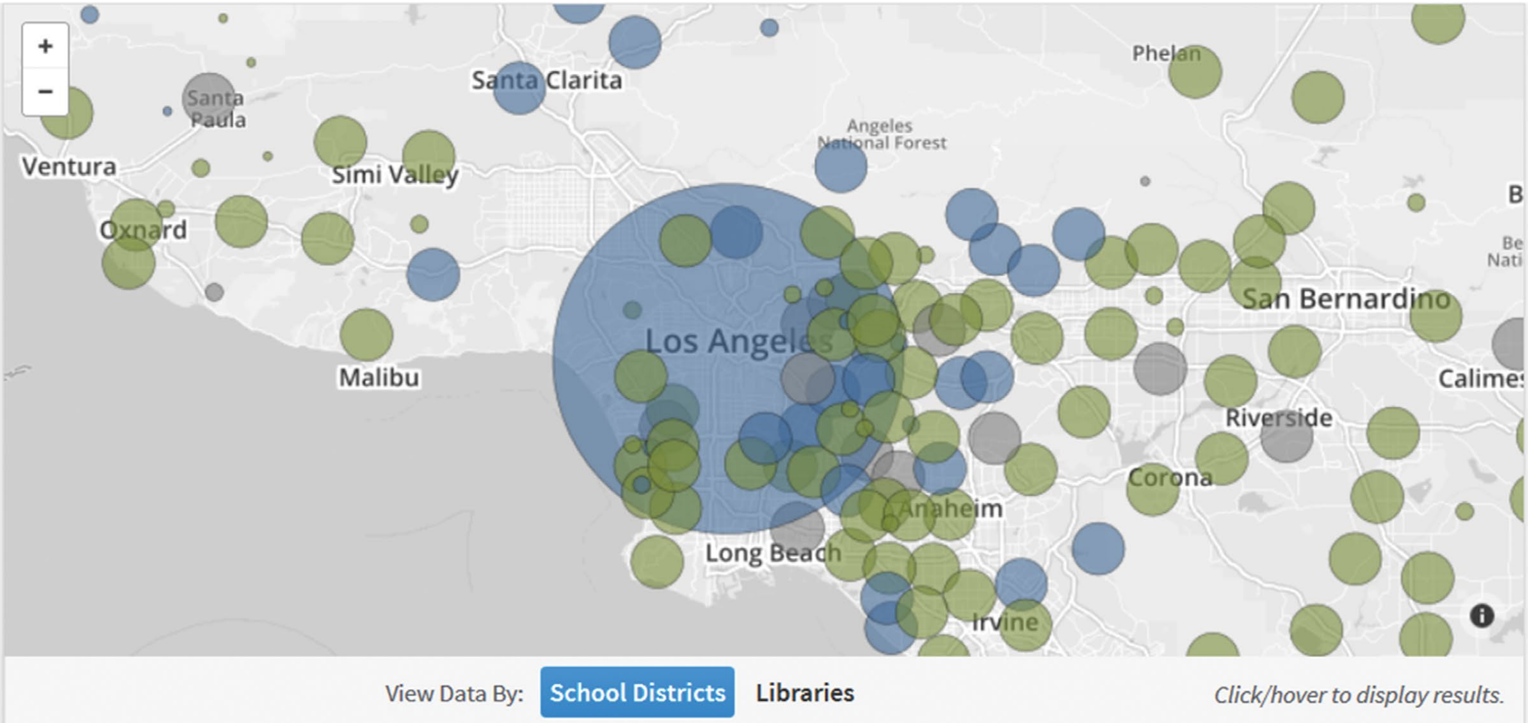
Unlike early learning, the focus on universal primary and secondary education in the U.S. has guaranteed that no matter how small, how poor, how remote the town, there will be a school for the children who live there. Today there are almost 100,000 public schools in the country, serving almost 50 million students. These institutions touch the lives of almost every child in America and have served an integral role in communities. In addition to their core mission they also promote life-long learning, greater public health, and civic engagement, among other functions.

But as research from Duncan and Murnane has indicated, "for a variety of historical reasons, our nation has not learned how to provide the consistent supports that schools—especially those serving large numbers of low-income children—must have to succeed."[32] That inconsistent support has ranged from the resources necessary to maintain facilities, provide adequate materials such as books and supplies, and attract and pay high-quality teachers. Today, that has extended to supporting the high-speed connectivity necessary for learners to access the wealth of resources available online.

As computing technologies took off in the late 1980s and '90s, educators and policymakers quickly realized that schools would need to connect to resources and learning available online. In the first of several reports published by the U.S. Department of Commerce's National Telecommunications and Information Administration (NTIA), the department staked out the ground to be covered: "There is a pivotal role to be assumed in the new electronic age by the traditional providers of information access for the general public—the public schools and libraries," the report said. "These and other 'community access centers' can provide . . . a means for electronic access to all those who might not otherwise have such access."[33]

The Federal Communications Commission (FCC) agreed and pushed for changes that became part of the 1996 Telecommunications Act, which included a provision for subsidizing the cost of connectivity for schools and libraries through what is commonly referred to as the E-rate program. The program quickly saw results: while in 1994 just 35 percent of schools were connected to the Internet, 95 percent of schools were connected by 1999.[34] But many individual classrooms remained unconnected, and high-speed connectivity in the classroom was rare.

Information about high-speed connectivity in public schools is difficult to obtain—contracts with telecommunications companies have largely not been made public.[35] It was not until 2010 that the FCC, for the first time since the program's inception, released data that provided some insight into the kinds of service schools were receiving. As these data became public, researchers and advocates demanded greater investment in high-speed connectivity. In an effort to update the E-rate program, the FCC has sought to provide the consistent support needed by schools serving large numbers of low-income students to bring their connectivity into the 21st century.



Geography Description
Los Angeles Unified School District

Total Students in School District
665,123

% of Schools with Fiber Access
20.7%

% of Schools without Fiber Access
63.3%

% of Schools not reporting Fiber Access
16%

% of Schools with Fiber
Mostly Connected (> 50% Fiber)
Mostly Unconnected (< 50% Fiber)
Mostly Unknown (Not Enough Data)

Map 4 | The Federal Communications Commission (FCC) has begun to illustrate the availability of high-speed broadband in school districts throughout the country.

Source: Federal Communications Commission, "FCC E-rate Maps of Fiber Connectivity to Schools and Libraries," October 18, 2014, accessed October 20, 2014, http://www.fcc.gov/maps/E-rate-fiber-map.

In order to achieve this goal, the FCC has prioritized investment in high-speed connectivity and wireless access. The focus on capacity has led to a greater prioritization of fiber-optic technology. As New America wrote earlier this year, "because of its nearly unlimited capacity and ability to easily scale to meet future bandwidth demands, many refer to fiber infrastructure as 'future proof.'"[36] To make sure all schools and all students can take advantage of the vast resources available online, access to fiber infrastructure is critical, but it remains unclear which districts have access. The FCC recently began a data collection project "to better understand the current state of fiber connectivity."[37] It has begun to gather information from states, school districts, and individual schools to better understand the percentage of schools within each district that have access to high-quality, high-speed connections.[38]

The resulting map pulled in data both from states and localities, as well as information from the National Broadband Map, which illustrates broadband availability in neighborhoods throughout the country. This has provided a glimpse at the previously unknown state of connectivity in schools throughout the U.S.

The coloring of each school district provides a high-level view of the state of connectivity in each area, and the size of the circles indicates the number of students in each district that are affected. For example, looking at the map for Los Angeles Unified School District, it is clear that not only is a large percentage of schools without access to high-speed connectivity, but also that a substantial number of students who attend school within that district are affected. Visualizing the current state of access to high-speed connectivity is an important first step as the FCC seeks to understand the E-rate program's long-term funding needs.

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There are limitations to the data being collected: relying on self-reported information from states and school districts, and in the case of the National Broadband Map, the service providers themselves, does not present the most objective and comprehensive picture of service. Additionally, the FCC notes that "fiber access" does not necessarily represent the number of schools that have subscribed to high-speed fiber, but instead simply whether it is available in the vicinity.[39]

Still, the FCC hopes to spur additional state and local engagement to improve information on current school connectivity, and to better understand and meet the needs of individual school districts and communities. As those original NTIA reports emphasized, public schools and libraries play a critical role in helping communities access the Internet. As such, they need to be strong hubs of connectivity.

Higher Education

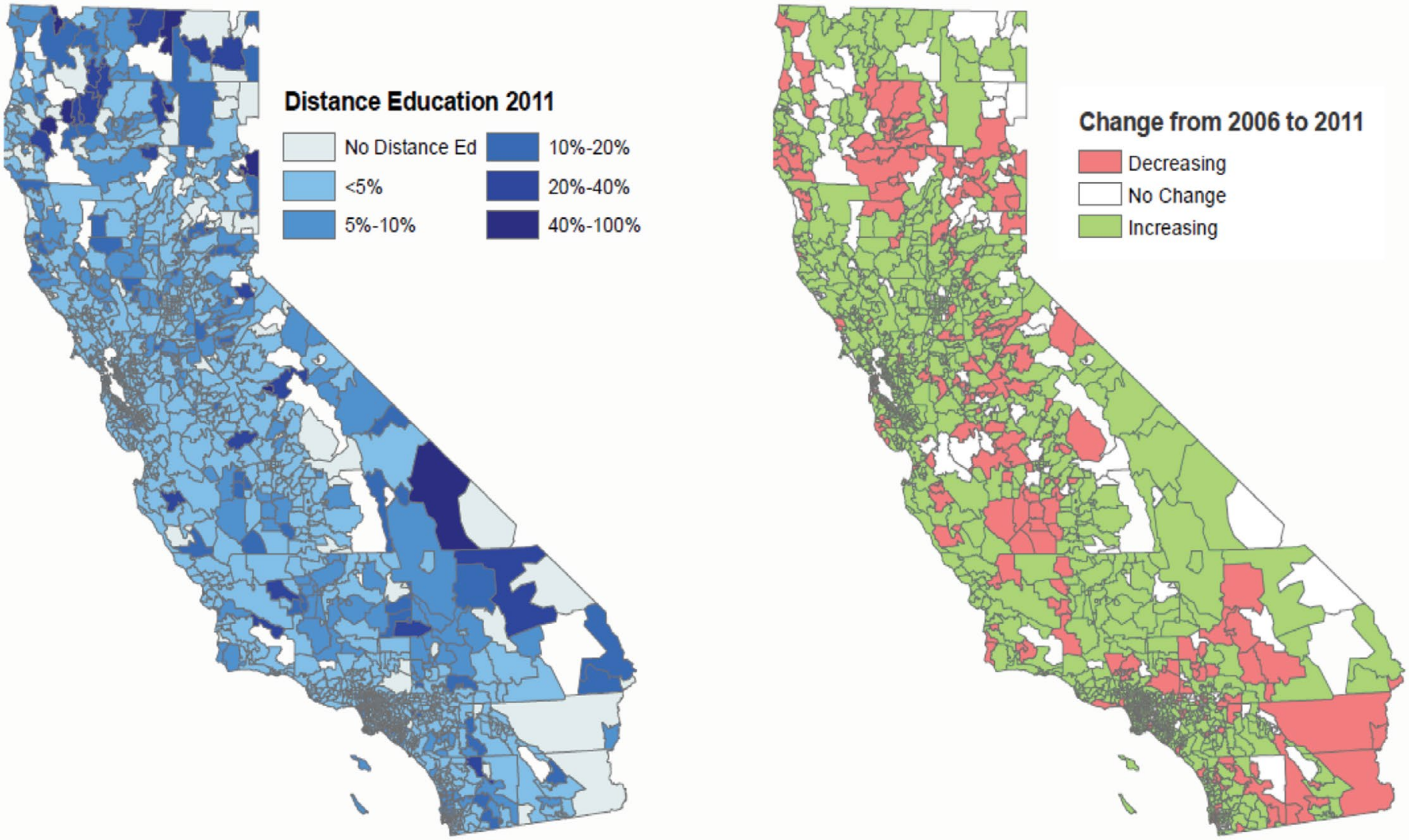
Over the past several decades, access to higher education has become increasingly important for success in the workforce. The difference in well-being between people with and without a college credential has never been greater. According to recent Pew Research Center work, "on virtually every measure of economic well-being and career attainment—from personal earnings to job satisfaction to the share employed full time—young college graduates are outperforming their peers with less education."[40]

Unlike for elementary and secondary education, the U.S. does not provide universal access to higher education. Postsecondary opportunities do not exist in every community. In California, for example, more than 1,000 schools serve the state's almost 2 million high school students. Conversely, about 150 public colleges and universities in the University of California, California State University, and California Community College systems serve approximately 2.8 million students, a relatively small portion of the adult population in the state. The vast majority of those students are enrolled in the community college system. Only about 400,000 are enrolled in a four-year institution.[41]

In part to meet growing demand, colleges and universities like those in California are serving larger numbers of students through distance education courses and programs, the majority of which are now offered online. In a 2013 New America report, *State U Online*, Rachel Fishman noted that more than 21 million individuals were enrolled in at least one online course in the fall of 2010.[42] Research from the California Community College Chancellor's Office (CCCCO) has demonstrated that a large number of its students have begun taking advantage of distance learning, with 27 percent enrolled in at least one course—a fifteen percent increase from 2006.[43]

As the data from CCCCO demonstrated, distance learning enrollment was increasing, but it was less clear who had gained access and where they were located. The CCCCO's annual reports looked at enrollment changes by age, race, ethnicity, and gender, and each of those variables seemed to remain constant. As recently as 2011, the analysis had not looked at regional changes in enrollment within the state.[44] It was uncertain to what extent distance education was expanding access to higher education throughout the state.

In 2012, working with the California Community College Geographic Information Systems (CCCGIS) Initiative, the CCCCO was able for the first time to map growth in distance education enrollment to spot regional patterns and changes. Through this visualization, the CCCCO compared present data to those collected in 2006 and found that the vast majority of jurisdictions throughout the state experienced increasing enrollment during that time. Looking at enrollment in 2012, the organization was also able to see which jurisdictions in the state had the greatest number of students enrolled. Some areas had well over 40 percent.



Map 5 | The California Community College Chancellor's Office mapped enrollment growth in online distance education programs to spot regional patterns and changes.

Source: California Community Colleges Chancellor's Office, "Distance Education Report," August 2013, accessed October 16, 2014, http://californiacommunitycolleges.cccco.edu/Portals/0/reportsTB/REPORT_DistanceEducation2013_090313.pdf.

Moving forward, policymakers could take advantage of numerous additional opportunities for analyzing access to higher education through distance learning. One important factor in looking at access is the connectivity on college campuses themselves. This is especially pressing for students on campus enrolled in some online coursework. Community colleges overall are less likely to have robust connectivity; according to the 2010 National Broadband Plan, "only 16% of these public community college campuses currently have high-speed broadband connections comparable to those of American research universities."[45] Students may struggle to take advantage of some aspects of online learning opportunities without access to robust connectivity.

An additional consideration is the availability of high-speed broadband in households. More than one fourth of all California residents lacked home broadband access in 2011, according to the National Telecommunications Information Association (NTIA).[46] The interaction between higher education opportunity through distance education and availability of high-speed connectivity for households is an important one, especially for students enrolled exclusively in distance learning. As online programs grow, proximity to institutions may become less critical, but community connectivity will become increasingly necessary.

New technologies provide many new opportunities for higher learning, but without clear planning they may increase inequities as well. Considering all of these assets necessary for a community to access higher learning—whether that is on campus or online—can help ensure that at the least gaps in access do not increase. In the best case, it can begin to highlight new avenues for access.

Informal Learning Environments

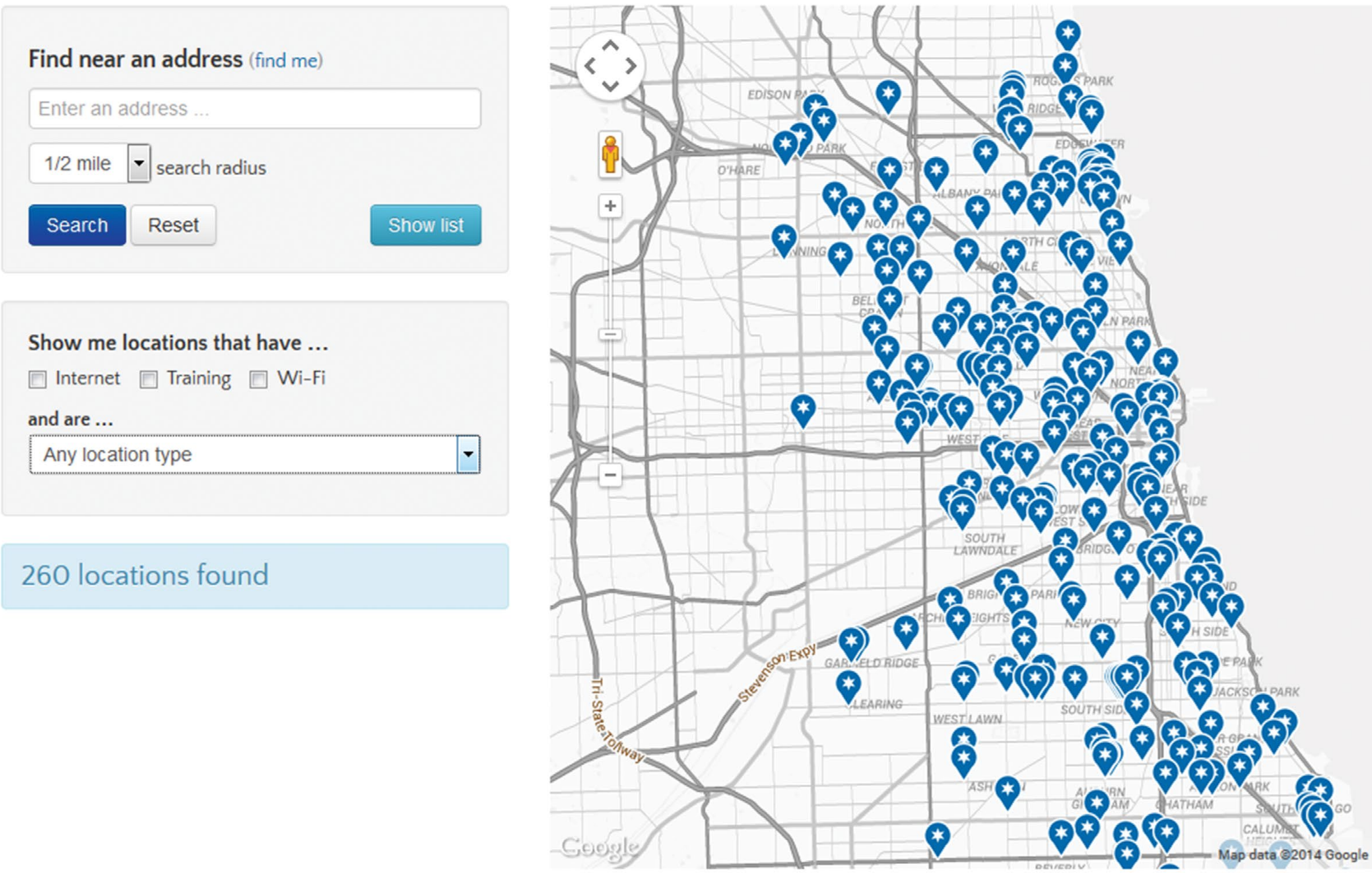
There are many other public institutions that act as informal learning environments within communities. The most prevalent of these are public libraries, which provide a wealth of services and learning opportunities. There are also an increasing number of recreation facilities, community centers, museums, parks, and other organizations that provide important programming and access to resources.[47]

One relatively new resource is community technology centers. In 2000, the Department of Education funded the Community Technology Centers Program (through the Elementary and Secondary Education Act reauthorization), which in part led to the expansion of these resources in urban and rural economically distressed communities. While the federal program has since ended, investment in these important community assets has continued in many areas at the state and municipal levels.

Recognizing that many other public institutions, in addition to community technology centers, provide access to computing technologies and wireless connectivity, the city of Chicago began the project Connect Chicago. The project was designed to help residents throughout the city identify spaces where they could go to access information online. As Chicago's Office of Innovation and Technology explains, "Connect Chicago brings all these resources to one virtual place, allowing residents and visitors—including those with limited digital skills—to easily find convenient and publicly-accessible technology resources and services."[48]

To easily find these resources and services, Connect Chicago mapped their locations, along with pertinent information such as operating hours. Residents of the city can search on smartphones by address—or by physical maps posted throughout Chicago's public transit system—to locate the closest places where they can access computers to go online. The map includes community technology centers along with other informal learning environments that have online access, including public libraries and schools, city college campuses, senior centers, workforce centers, youth career development centers, and even Chicago Housing Authority locations that provide wireless Internet access.

While this particular project is geared more specifically toward information sharing, as opposed to information analysis, it illustrates yet another way mapping can be used to better understand the network of learning opportunities available within communities. This information also presents a chance for further analysis regarding access to computing resources, and demonstrates how communities can leverage existing assets to expand access.



Map 6 | To help residents easily find technology resources and services, Connect Chicago mapped their locations, along with important information such as operating hours.

Source: Department of Innovation and Technology, "Technology Resources and Services in Chicago," City of Chicago, accessed October 15, 2014, http://www.cityofchicago.org/city/en/depts/doit/provdrs/dei/svcs/techlocator.html.

RECOMMENDATIONS

In an increasingly networked world, access to learning opportunities, in formal and informal environments and across the age spectrum, will be critical to students' successes in school and careers. Access must be grounded in an understanding of where students live and what resources are within their reach. Learning opportunities need to be considered holistically, instead of in discrete conversations that miss critical connections between early learning, elementary and secondary schools, higher education, libraries, and other informal learning institutions—as well as the state of broadband connectivity within and outside each institution.

Advancements in computing technologies have paved the way for visualizing these complex networks, providing for more detailed data and imaging. These tools have already been leveraged in fields as diverse as urban planning, engineering, transportation, infrastructure planning, and public health. To some extent, these advances have been used for planning in education, but often in a limited capacity, and often to look at just one component of these extensive networks. Today, policymakers have the opportunity to employ these tools to make more informed decisions about equitable access to learning across their jurisdictions.

To advance the holistic use of these tools across the education spectrum, New America offers three main policy recommendations:

Collect and Share Comparable and Comprehensive Data

More data are available than ever before, but there are still limits on the availability, comparability, and comprehensiveness of information. While each example

highlighted within this report used data made available by various public institutions at the federal, state, and local levels, there are clear limitations to existing information.

Availability

The movement toward open data continues to build momentum, but much municipal data collection has continued in non-digital formats. Further, certain types of information—broadband pricing, for example—are not publicly available at all. Policymakers should continue to work toward opening data, especially regarding public spending, to allow for greater analysis.

Comparability

Given that a wide range of public organizations collect data, comparability continues to be a challenge. Especially for spatial analysis, the scale, or level of aggregation—whether the data are available by state, county, neighborhood, school district, census tract, and so on—is fundamental for comparing information. Policymakers at all levels must begin to work together to better standardize data collection to allow for better comparability.

Comprehensiveness

A major limitation for analysis is the completeness of each dataset. Every example presented within this report was affected—some to a greater extent than others—by incomplete data. Moving forward, policymakers should pursue new strategies for ensuring comprehensive data collection.

Understand the Local Network of Learning Opportunities

The majority of examples explored in this report center on one particular area of learning opportunity—whether it is distance learning in higher education or the availability of community technology centers. There are far fewer examples that seek to understand the whole network of learning opportunities available within a neighborhood or community. But it is through looking at the whole ecosystem that major deficits become clear.

Prioritize Community Needs

As policymakers gather and map data that provide community-level views of learning opportunities, these images will begin to highlight the different needs within each area. For local policymakers, prioritizing these needs is much more straightforward; for state and federal leaders, providing flexibility for these disparate priorities often presents a greater challenge. Balancing national priorities—like the current Administration's focus on expanding pre-K enrollment—with the main concerns of individual communities is critical.

CONCLUSION

There is a pressing need to understand the networks of learning opportunities within low-income communities. The examples included here illustrate how mapping can begin to highlight the learning assets—and deficits—within them. Mapping the resources available will help guide planning and investment in order to close the gaps in learning. If children are already behind before they ever come into contact with the education system and if income continues to drive academic outcomes, education will not be a springboard of opportunity for all.

Robust, connected networks of learning opportunities should be available for all. Using mapping to portray the assets a community already has access to—as well as those which are missing—and how those assets are connected to one another can help build communities of educational opportunity. It represents a first step toward strengthening communities to support life-long, networked learning, from early education through higher education and beyond.

Notes

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