Uptown Upgrade

Building a Technological Infrastructure in East Harlem Schools (CSD 4)

Robert J. Rodriguez
New York State Assembly, 68th District
East Harlem/El Barrio and the Upper East Side

Acknowledgements

I would like to acknowledge and express my deep admiration for the leadership of Superintendent Alejandra Estrella, UFT Representative Servia Silva, Manhattan Borough President Gale Brewer, Pedro Pedraza, my Education Advisory Committee, and my impassioned constituents. Above all, I want to commend District Four's hard working teachers and administrators who wake up every day to do what is best for students. I would like to extend a special thank you to my staff: Adam Davis, Gabriel Hernandez, Anne Kadamani, Jason Cruz, Jordan Salinger, and Wilmer Cabral.

East Harlem schools have been helping my family to learn and grow for three generations. Yet, for that entire duration, our schools have not received the funding they are entitled to. After sixteen years into the new millennium, schools in East Harlem do not have the technological capacity recommended in 1997. The New York City Department of Education must allocate $18 million dollars from the Smart Schools Bond Act to bring our schools into the 21st Century. This report is meant to kickstart the planning phase by assessing conditions and offering community perspectives with the goal of equipping East Harlem schools with the services it both requires and deserves.

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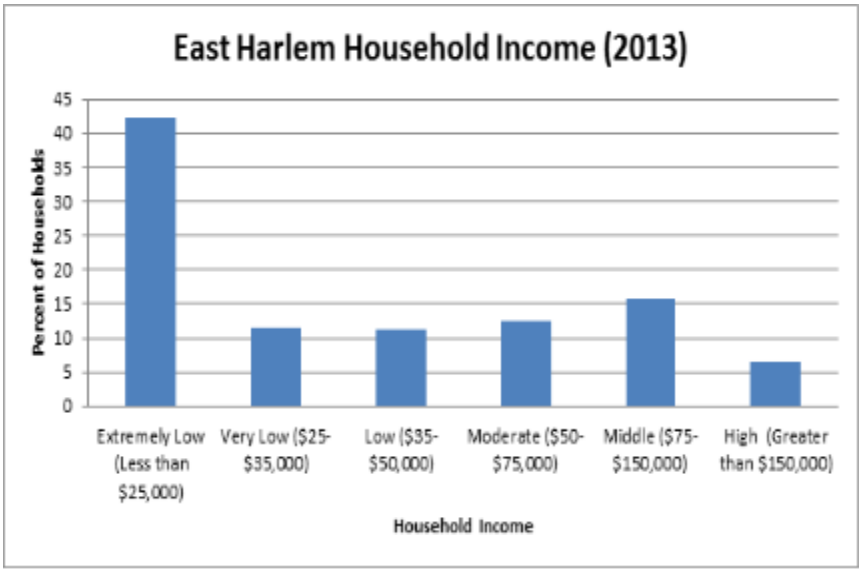
EXECUTIVE SUMMARY

Technology has become incorporated into every facet of work, education, and life. Jobs and activities that never required the use of technology have become transformed as they become an integral part of work performance. New occupations are continually being created that depend upon the facile use of technology. Everyday activities like paying bills, balancing one's checkbook, and finding bus and train schedules either require or are made easier by the use of technology. Students are asked to research and report information that would be difficult to obtain without access to technology. An individual who lacks the training in modern technology will soon find themselves severely disadvantaged at school, locked out of the job market, and unable to easily manage the everyday tasks of life. These disadvantages become magnified in minority communities because of the synergistic effects of discrimination and the prioritization of funding into more affluent areas.

Technology also presents the possibility of making individuals' lives more secure. It provides the ability to observe activities that can threaten public safety and prevent unwanted individuals or items from entering protected spaces. In populations with higher crime rates, whether in schools or on the streets, outdated or nonexistent technology can be a further impediment to crime prevention.

More than other places, schools can benefit most from the infusion of and training in the use of technology. It is where we have one of our most vulnerable and precious populations and where we hope to infuse them with the skills and abilities to be able to pursue their dreams. Learning hardware, broadband, and modern security systems combine to create the technological infrastructure that is a pillar of an effective 21st century learning environment. Technology integrates within daily instruction to prepare our students for success in college and in future careers.

There is no place in which the infusion of security technology, computers, and the training in their use will bring more benefits than in the schools of East Harlem. Only sixty percent of East Harlem residents have earned a high school degree. The deficit in life skills has drastic consequences on human lives. In 2014, the unemployment rate for East Harlem was a staggering 11.3 percent[1]. Those who are employed generally work in low paying and low skill jobs. The current median household income for East Harlem was approximately $33,500, about $20,000 less than the rest of New York City[2]. Thirty one percent of residents in East Harlem live below the poverty level[3]. Investment in this community will pay off as East Harlem citizens gain the technological skills to enable them to access higher paying and skilled jobs. East Harlem also has a demonstrated need for better and more security systems. In 2013, while most of New York City was celebrating record low crime rates, East Harlem residents experienced a seventeen percent increase in crime, with increased numbers of rapes, robbery, and assaults[4]. Thirty seven percent of youth surveyed in East Harlem responded that they avoid areas in their community because of gang activity and twenty two percent of youth said they carry a weapon[5]. In the 2013-14 school year police responded to 192 incidents in District Four schools. Sixteen of these incidents were classified as major crimes, averaging one major crime per two schools[6]. Every day that we do not address these dismal truths is another day that the schoolchildren of East Harlem needlessly suffer.



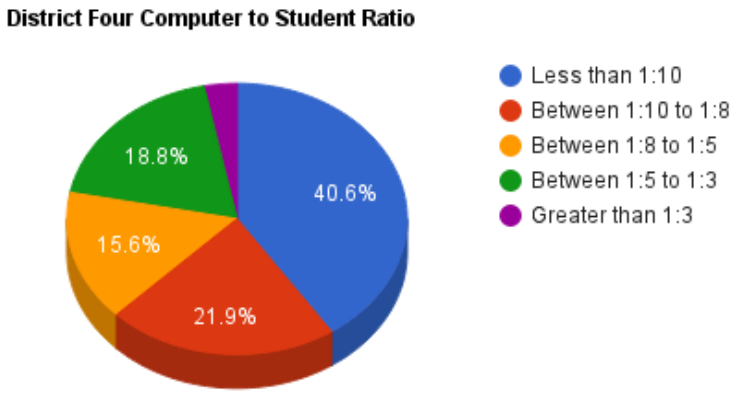
The graphic above shows the distribution of household income in East Harlem according to the US Census Bureau. The median household income for was 2013 was $31,888. Investing in the neighborhood's schools would provide residents opportunities for economic mobility.

[1] "EMPLOYMENT STATUS 2014 American Community Survey 5-Year Estimates." *American FactFinder*; (2014).
[2] Solis, G. "El Barrio Could Get a Lot More Crowded Under Rezoning Proposal"; (New York 2016).
[3] King L, et al. *Community Health Profiles 2015, Manhattan Community District 11: East Harlem*, 6.
[4] Bellafante, G. "Violent Crime Fell? Tell It to East Harlem."; (New York 2013).
[5] Washington, M. "Community District ll Statement of District needs Fiscal Year 2014"; (New York 2014).
[6] City of New York. *School Safety Report*. NYC OpenData; (New York 2015).

Fortunately, there is a path forward that will help in the solution to these problems. In 2014, New York voters in approved the Smart Schools Bond Act (SSBA) which authorized $2 billion to improve the technological infrastructure in the state's schools. Of these funds, New York City received and allocation of $783,141,339[7]. This decision provides the opportunity to both update and put in place technological capabilities in East Harlem that will help prepare its students for life in the 21st century. Districts can use the money in four areas: installing high-speed internet in schools and communities, acquiring learning technology, constructing facilities for kindergarten and replacing classroom trailers, and installing high tech security systems on school campuses.

It is now up to the NYCDOE to decide where and how to spend this money. The funds made available through this act should be given to communities that are already underfunded through current state funding policies. East Harlem and the schools in its Community School District Four are areas where a significant investment can make the largest difference in the lives of children and their families. Supplemented by additional funding, **the NYCDOE must allocate $18 million of the Smart Schools Bond Act budget to support the short-term and long-term goals of schools in this community.** This report aggregates survey data from District Four school administrators and the Superintendent's office to identify the needs and areas of required investment including estimated costs based on previous requisitions.

In the survey completed by all of District Four's thirty two schools (Appendix A), administrators outlined their technology needs that the SSBA can address. First, the results compellingly show that East Harlem hardware is outdated and insufficient. A



This chart shows the computer to student ratio of District Four schools. Over eighty percent of schools have fewer than one computer per five students recommended in 1997.

[7] "Smart Schools Allocation." *NYS Smart Schools Search*. New York State, 2014. Web. 20 Jan. 2016.

commision President Clinton convened in 1997 recommended that schools have a minimum computer to student ratio of 1:5, East Harlem, however, is nowhere close to this level[8]. **Seventy eight percent of schools have a computer to student ratio worse than 1:5 and forty one percent have worse than 1:10[9].** East Harlem does not have the number of computers needed to support our students that was recommended almost twenty years ago. Second, District Four is also lacking in internet bandwidth. In 2013, education technology experts recommended that all schools have a minimum bandwidth equivalent to 100 kbps per student and predicted that schools would need ten times the amount by 2018[10]. **Yet, in East Harlem only thirty one percent of schools have the recommended 100 kbps per student bandwidth.** Students, many of whom cannot access the internet at home, must rely on internet speeds that inhibit learning. These students also deserve a safe place to pursue their learning, however, **one third of administrators do not believe they have a security system that adequately keeps students safe.** These schools would like to use SSBA money to upgrade their security to protect their children and staff. The District Four Superintendent's office estimates that it will cost between $18-22 million to bring their school technology to the minimum expert-recommended levels[11].

A combination of SSBA money and other funds would begin building a technological infrastructure that provides ample access to computers, the internet, and security systems. While a majority of the funding to update East Harlem's schools should come from SSBA monies, additional federal, state, municipal, and private capital can supplement these funds. SSBA also presents an opportunity for matching grants from entities that support building education and technology equity in East Harlem. This investment would not only provide East Harlem children with the skills to access everyday uses of technology and prepare them for the rapidly evolving job market, but also allow them to do so in a safer environment.

[8] "Report to the President on the Use of Technology to Strengthen K-12 Education in the United States." President's Committee of Advisors on Science and Technology; (Washington, D.C. 1997).
[9] Davis, A. "District Four Technology Needs Survey." Survey. (New York 2015).
[10] Shellabarger, E. "Calculating Your School District's Bandwidth Need: Network Essentials for Superintendents"; (2015).
[11] Valdez, E. "Community District Four Smart Schools Plan"; (New York 2015).

These two maps display the number of students in the Class of 2011 that graduated college-ready in the Upper East Side and East Harlem (Chalkbeat). Despite the fact that these two Manhattan neighborhoods are adjacent, a wide disparity remains between the achievements of their children. Introducing more technology in East Harlem schools can help close the achievement gap between these neighboring communities.

According to language in the SSBA, it is the responsibility the New York City Department of Education to seek out feedback from constituents to determine how the funds should be distributed. As of the release of this paper, there has been minimal effort from the NYCDOE to hear from East Harlem. **This report is meant to kickstart the planning phase by assessing conditions and offering community perspectives with the goal of equipping East Harlem schools with the services it both requires and deserves.** The report highlights the technology, STEM, and security needs within East Harlem's District Four public schools and sets out policy recommendations to address these needs. We look forward to our continued work with the superintendent's office, policymakers, and the community to ensure our schools are preparing our students for college, leadership, and life.

COMMUNITY SCHOOL DISTRICT FOUR TECHNOLOGY SUMMARY

Summary of CSD 4 Technology Cost Estimates

Category	Price Per Unit	Number of Schools	Total Cost
Retrofit Buildings	$500,000	20	$10,000,000
Broadband Improvement	$100,000	22	$2,200,000
Laptop Carts	$50,000	25	$3,750,000
Smart Boards	$6,000	7	$840,000
Security System Improvements	$50,000	10	$500,000
Auditorium and General Improvements	$50,000	21	$1,050,000
		Total	**$18,340,000**

This table shows conservative estimates for the amount District Four needs to bring their schools into the 21st century.

Based off of survey data, interviews, and bandwidth measurements, District Four needs a minimum of $18 million to provide students the modern education they are entitled to. The numbers detailed in the charts above are conservative estimates of what the district requires to provide its students with the educational tools recommended in 1997. However, in all likelihood District Four schools need a far larger investment. The prices for each item came from the District Four Superintendent's Office and are based on previous purchases. The number of schools needing each item came primarily from our independant survey, interviews, and school visits.

The Superintendent's office estimates that twenty school buildings must be improved. Modernizing District Four's buildings will require great amounts of capital because many are in disrepair and cannot support a significant increase in technology use. Many administrators have voiced concerns that their buildings do not support the small amounts of equipment they already

have. **One principal said that whenever a class plugs in their computers the room loses power.** Many others explained that they do not have the outlets and electrical infrastructure to support computer carts. In addition, much of the technology in auditoriums are out of date, broken, or nonexistent. The Superintendent's office estimates this will cost a minimum of $11,050,000.

Twenty two schools cited in the survey that they did not have adequate broadband to support their students. The Superintendent estimates that it will cost $100,000 to bring each school up to speed for a total of $2.2 million. However chances are this problem is more widespread. Servia Silva, the District Four United Federation of Teachers representative, collected the internet speeds of the district's elementary and middle schools (Appendix B). All twenty five schools tested, had well below the recommended one hundred kbps per student[12]. This will only worsen as more students use computers and the internet, necessitating further funding.

The twenty five schools that had a computer to student ratio worse than 1:5 would receive two to four laptop carts, each containing thirty laptops. Since thirteen of these schools have worse than a 1:10 computer to student ratio, the district assumes the average school would need three laptop carts, costing a total of $3,750,000. Although we do not argue for a "one size fits all" method of technology purchases, this would bring all schools to the 1:5 ratio. This asking price could change depending on the types of devices each school requires, the number of devices each school needs to execute their technology plan, and the amount of funding the schools can secure through other avenues.

In our survey, seven schools requested that NYCDOE install smart boards in their classrooms. If each school received twenty smart boards and had them installed, the total price tag would be $840,000. Similar to the laptops, this number could change based on each school's technology vision and plan. However interviews suggest that District Four administrators and teachers require a far greater amount of smart boards. The Superintendent has received informal requests

[12] Silva, Servia I. "District Four Internet Speeds." Personal interview. (New York 2015).

for smart boards from far more than these seven schools. In addition, a group of elementary students wrote our office asking for each class to be equipped with smart boards. One student explained that "teachers can explain [topics] better with a smart board because we can work out the problem to understand it better.[13]" The district will require further SSBA monies to satisfy its stakeholders' actual demand for this product.

Ten of the schools surveyed responded that they do not have an adequate security system. The Superintendent's office estimates that each school would require $50,000 to update their system. However it is likely that more than ten schools need this service. Twenty two schools in the district wrote their schools need more security cameras in the survey. Of these, twelve schools said they needed more than seven cameras. Because these requests for cameras were not included in the calculations above, the $500,000 estimate is most likely lower than the actual need.

The survey data also shows that any investment in District Four would be money well spent. **One hundred percent of administrators agree that students would benefit from increased technology in the classroom. Seventy two percent of administrators predict that teachers would use these additional computers daily.** Not only is there a desperate need for this funding, but stakeholders are eager to use the technology to make a difference in the classroom.

[13] "William Paca's Needs." Letter to Robert Rodriguez. (New York 2016).

HISTORY OF EDUCATION TECHNOLOGY AND STEM

For the last 50 years experts have been identifying the benefits of technology as a learning tool, but despite this, the United States has been sluggish to take action. In the early 1960s, Seymour Papert conducted one of the first studies that described the potential of computers to transform learning. He realized the intersection of entertainment with tasks necessitating critical thinking facilitated student motivation and mastery of certain mathematical skills. More recently, a report from SRI International identified four ways in which technology improves student learning when paired with curricula. These are through increased engagement, participation in groups, interaction and feedback, and connection to the real world. Although previous students could have greatly benefitted from assistance in these areas, it was not until the mid-1990s that serious discussion of the widespread integration of technology in schools began.

As the United States entered the new millennium and the digital age, a consensus emerged that a 21st century education required the integration of technology into the classroom**. Yet despite this overwhelming agreement, most of the schools within East Harlem's District Four still have not achieved the minimum technological standards recommended by federal experts nineteen years ago.** Improvements in the district are long overdue, and well-directed funding can rectify the neglect that these schools have suffered over the past two decades.

President's Council of Advisors on Science and Technology (1997)

George H. W. Bush's administration founded the President's Council of Advisors on Science and Technology (PCAST) to advise the President on the effects of science and technology on domestic and international affairs. In March of 1997, under the Clinton administration, PCAST released a groundbreaking report submitting a number of recommendations on how to best improve technology within public schools and standardize the appropriate levels of accessibility.

Unfortunately, East Harlem schools have not begun to be able to reach the nineteen year-old standards set out by the council. PCAST advised schools to have a minimum of one computer for every five students. **More than three quarters of the schools in East Harlem are lacking the recommended number of computers available to their students.** As early as 1997, the council also addressed the issue of equitable technological access. PCAST explained that socioeconomic status, race, ethnicity, gender, geographical factors, and special needs should not be an impediment in providing technological learning opportunities. Sadly, despite this warning, thousands of schools serving minorities and low-income families do not have the means to offer ample, high-quality STEM learning experiences to their students. Finally, the council unequivocally highlighted that education had to shift from teaching students *about* technology and instead implement curricula that *use* technology. Investing in East Harlem schools' technology would give teachers the tools to teach New York State and current state standards while simultaneously building computer literacy.

"Every child in America deserves a chance to participate in the Information Revolution," Clinton said[14]. In order to reach this common sense goal, resources need to be focused on inner city technology deserts such as East Harlem.

Since 1997, PCAST has made a number of recommendations, most recently updated under the Obama administration.

President's Committee of Advisors on Science and Technology (2010)

In its 2010 executive report, PCAST articulated its concern that U.S. schools continue to lag behind other advanced nations in STEM education due to insufficient and misdirected funds. They explained that one of the largest barriers to maintaining pace with other nations is the United States' dearth of STEM related resources in schools that prepare the next generation of experts. Specifically, schools need more resources to focus on underserved communities and particularly young girls who are on the wrong side of the technical achievement gap. PCAST

[14] McEachern, W. "Teaching Machines"; (2000).

President Obama met with PCAST to discuss the underrepresentation of minorities and women in STEM.

submitted a number of recommendations that highlighted the importance of focusing resources on women, minority, and underrepresented communities.

In part, PCAST addressed this pressing need for equity by suggesting the construction of targeted STEM schools. The authors of the report stated that "STEM-focused schools represent a unique national resource, both through their direct impact on students and as laboratories for experimenting with innovative approaches… The federal government should promote the creation of at least 200 new STEM-focused high schools and 800 STEM-focused elementary and middle schools over the next decade, including many serving minority and high-poverty communities[15]." Fortunately, East Harlem children have some access to STEM-focused schools that are working to prepare and inspire students for technology based careers. Two of these schools are the Manhattan Center for Arts and Sciences and the Young Women's Leadership School. Unfortunately these schools suffer from a lack of funding that prevents them from properly providing for their student body. Both schools expressed that they require more funding to properly implement a technology based STEM program. Young Women's Leadership School does not come close to the suggested bandwidth for its students.

PCAST continued by addressing the homogenous STEM workforce, a problem that can harm innovation in the field. On students, PCAST stated:

> "Opportunities to learn STEM outside of school are especially important for members of groups underrepresented in science and engineering, including girls, African-Americans, and Hispanics. As early as elementary school and middle school, many students from these groups begin to think that they will not or

[15] "Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future." President's Council of Advisors on Science and Technology. (Washington, D.C. 2010).

> cannot excel at STEM. These messages sap the natural interest and lower the performance of groups underrepresented in STEM fields… This underscores the importance of giving children exciting opportunities in STEM early in life, and shows that the effects of such experiences can be long lasting."

By directing the funds to schools in communities like East Harlem, the state can finally provide these "exciting opportunities" for all children in the district.

Policymakers should follow the recommendations of PCAST, especially in addressing the digital disparities between East Harlem and wealthier communities. Students must have ample STEM learning opportunities both inside and outside of school. We wholeheartedly agree, and see the SSBA funds as the chance to allow technology to drive STEM education and programming in East Harlem. Additionally, with expectations that job growth will primarily take place in STEM related fields, it becomes increasingly important to ensure that policymakers reduce the underrepresentation of minorities and women in the STEM field. As a result, we must ensure that schools have the resources and capabilities required to make these objectives a reality.

Common Core State Standards (2009)

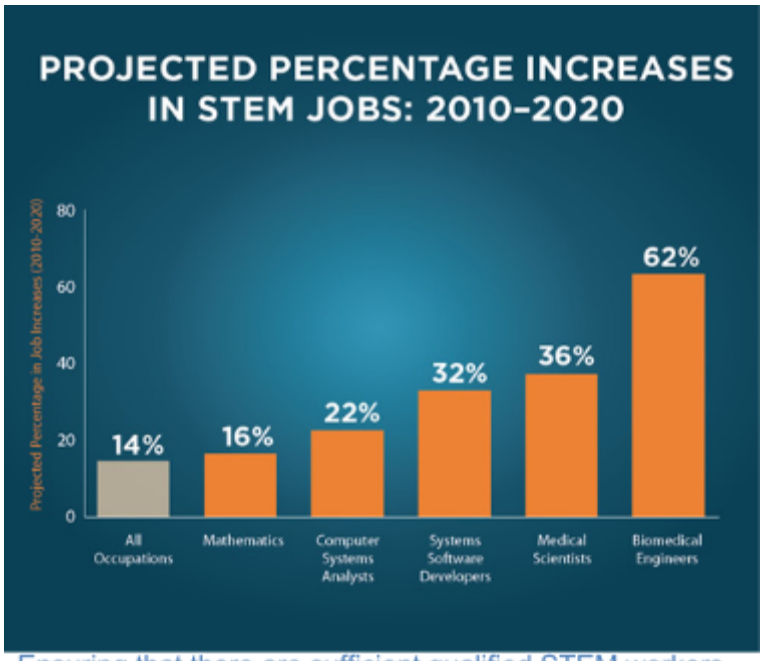
In 2009, States began developing the Common Core State Standards (CCSS): new learning targets that incorporate skills and knowledge necessary for life in the 21st century. These learning goals largely updated the arcane and inconsistent state standards that teachers used to inform their practice. An important aspect of these standards was the incorporation of technological and critical thinking skills that come from the STEM disciplines.

In our era of high-stakes testing, students who have these skills perform better on State and Federal assessments. Unlike former state standards that had lower expectations for student achievement, states designed the Common Core to develop problem solving and analytical skills to ensure students are successful after high school. This mode of thinking is especially fostered by the types of learning tasks students must solve in properly taught STEM classrooms, which often require technology. In addition, students take CCSS assessments entirely on the computer,

which heavily favors students who have had ample practice working on computers. East Harlem students, who have little experience with computers at school or at home, approach the test at a disadvantage. The students must undertake tasks requiring high-level thinking while using foreign tools such as keyboards, mouses, audio equipment, and other in-test tools. Results on these tests have drastic consequences for students' future class placement, school funding, and possibly future teacher pay. Regardless of the future of Common Core or the high-stakes testing model, for the sake of giving students the skills to earn an accurate score or the needed skills that affect the rest of their lives and the community, lawmakers have no choice but to support technology and STEM initiatives.

THE STEM GAP

Exposure to and instruction in technology are crucial for the economic well-being and social mobility of the residents of East Harlem. The U.S. Bureau of Labor Statistics projects that employment in science, technology, engineering, and mathematics (STEM) fields will grow by one million jobs by 2022[16]. In order for United States children to have access to high-paying job opportunities and to meet the new demands of our changing economy, schools need to teach students the skills to compete in the STEM fields. As one of the world's major technology hubs, New York City will have even more profound growth in technology jobs. According to *Business Insider*[17],

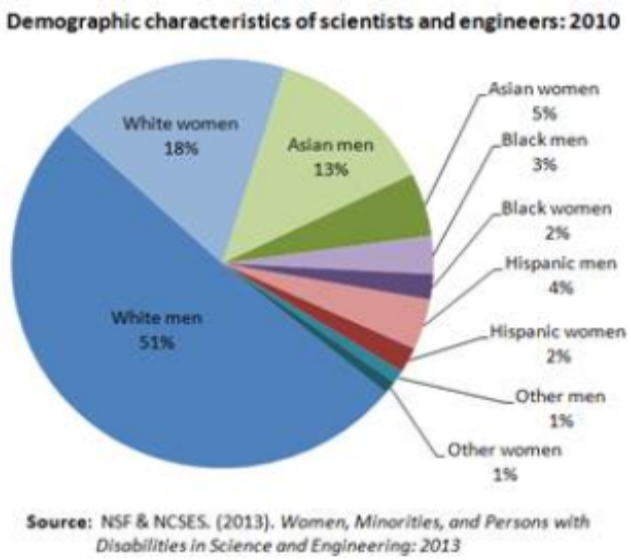


Ensuring that there are sufficient qualified STEM workers is essential for economic and national security. (Image: http://www.ed.gov/stem)

[16] Vilorio, D. "STEM 101: Intro to Tomorrow's Jobs"; (2014).
[17] Turkel, D. "New York City's Mayor Will Require All of the City's Public Schools to Teach Computer Science"; (2015).

between 2007 and 2014 the city's technology sector grew by fifty seven percent and it will continue to follow this upward trajectory into the future. New York City's children will need significant exposure to technology and STEM education in order to succeed in the world directly around them.

Further, minorities and females are currently underrepresented within the STEM field. By investing in East Harlem New York State can help close this gap. This disparity is clearly highlighted in recent statistics from the Census Bureau. Despite the fact that the United States workforce is eleven percent Black and fifteen percent Hispanic, the STEM workforce is only six percent Black and seven percent Hispanic. In addition, there are twice as many men as women in STEM occupations[18]. Properly targeted funding would close this race and gender gap and foster a more diverse STEM industry. The primarily Black and Hispanic neighborhoods of East Harlem are particularly disadvantaged as they have a student body that is fifty one percent female and ninety six percent nonwhite[19]. District Four schools must receive allocation of STEM and technology focused resources comparable to their greater need in order to purchase technology necessary to prepare the next generation for the demands of the economy and close the underrepresentation of minorities and females within the STEM industries.



There is a drastic underrepresentation of women and minorities in the STEM fields.

[18] Landivar, L. "Disparities in STEM Employment by Sex, Race, and Hispanic Origin"; (2013).
[19] "Demographic Snapshot." District Four. New York City Department of Education; (New York 2015).

SUMMARY OF EXISTING CONDITIONS AND TECHNOLOGY NEEDS IN EAST HARLEM

East Harlem Hardware

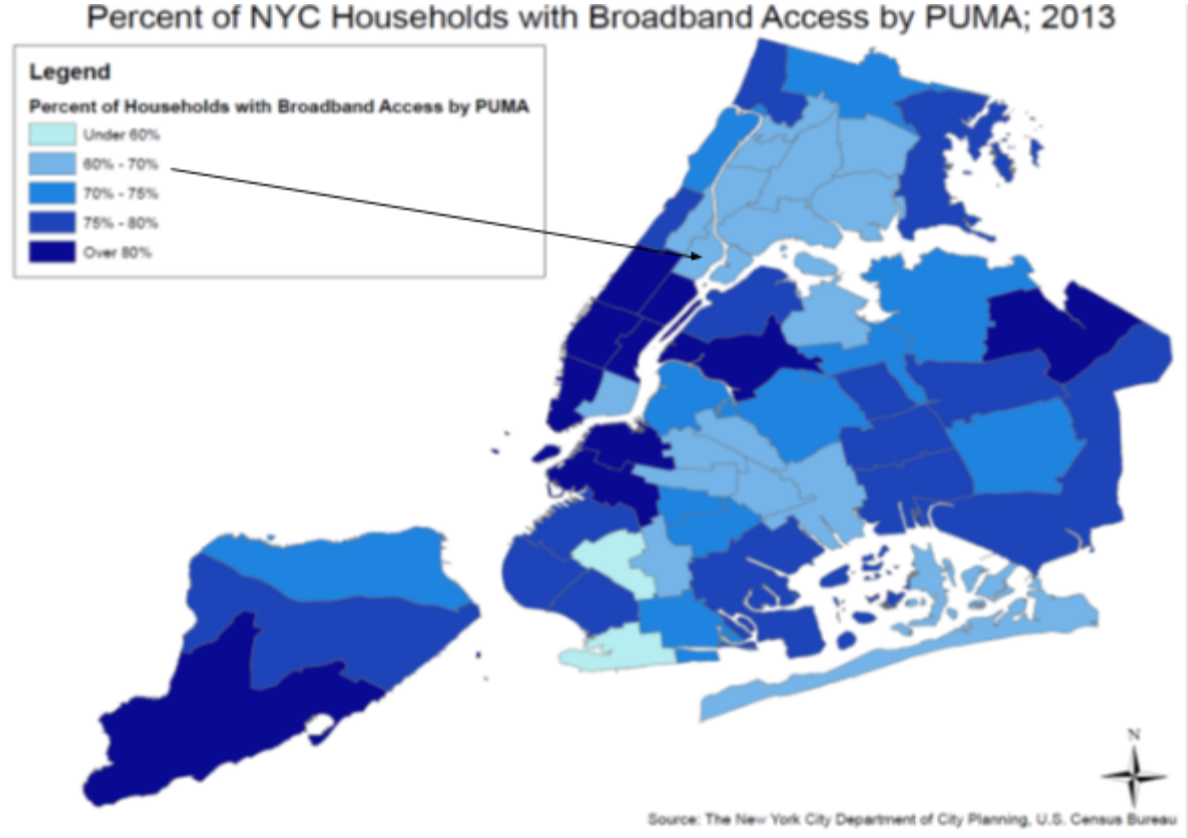
New York City has put forth some effort to incorporate technology and security in schools. However East Harlem residents are still in desperate need of assistance. In collaboration with the Superintendent from District Four, the office of Assemblymember Rodriguez conducted a survey of the principals in District Four. All thirty two schools in the district responded to the survey. Their responses painted a desperate picture that demands a swift solution. **Seventy eight percent of schools in East Harlem have less than the 1:5 computer to student ratio recommended in 1997. Forty one percent of schools had a computer to student ratio of less than 1:10.** Of the few computers that these schools have, teachers report that the hardware is outdated and has broken or missing parts. Supporting the need for building retrofitting, some teachers even find that when they plug in their laptops, they lose power in their section of the building. Despite the mandate from the President's office two decades ago, most East Harlem students attend schools that do not even have the outdated acceptable number of computers. Principals also stated that they lack the appropriate technology to take care of their current needs. **When asked if they had adequate technology for teachers and students, sixty nine percent of administrators said they did not.** Many schools do not even have enough support to maintain the little technology they do have. Less than half of principals responded that they have adequate access to technical support. One principal succinctly described what an average District Four school needs:

> "We need 30 computers in each classroom so every teacher can integrate online learning into every lesson. We need a smart board in each classroom so teachers and students can share their work. We need a tech specialist to troubleshoot and upgrade hardware and software in a timely manner so learning can be seamless."
>
> - *Principal Jacqueline Price Harvey, Samuel Stern*

Policymakers must direct funding from the SSBA and other resources to enrich these often ignored schools.

East Harlem Broadband

The lack of technological resources in East Harlem extends to broadband as well. Low-income citizens of New York have access to broadband at half the rate of middle- and high-income residents. Further data shows that internet connectivity is correlated with affluence, and that students attending poor schools are more likely to have slower internet connections. In East Harlem, where ninety one percent of students live below the poverty line, well-equipped schools could be the only opportunity for students to practice utilizing the internet. Schools currently do not have the recommended bandwidth to support their students' learning. **Only thirty one percent of principals agreed that they had sufficient bandwidth for their school.** Schools depend on substantial public funding to overhaul their connectivity plans to allow any significant changes to accommodate the technology and STEM lessons that the community and government are pushing for.



This map demonstrates the distribution of households with broadband Internet in New York City. East Harlem is one of the three Manhattan communities where 30-40 percent of households do not have access to broadband. A majority of the neighborhoods in Manhattan have fewer than 20 percent of their households without broadband access.

East Harlem STEM

American students overall do not understand the value of STEM fields, spurring the dismal projected participation in STEM occupations. Despite the wishes of its school administrators, District Four is struggling to explore STEM subjects with its students. **Eighty one percent of schools wrote that they did not currently use a technology-based STEM curriculum, but ninety four percent wrote that they would if the funding was available.** Investing in technology would finally allow District Four to properly address one of our nation's most pressing educational issues. Technology-based STEM curriculum can make a huge difference in students' perception of the subjects. In a recent student survey on this type of curricula, seventy five percent of students said they developed independent learning skills and ninety percent said their course made real-world connections. Technology would help to expose District Four students to the vast set of opportunities outside of East Harlem.

East Harlem Schools Support Technology

Principals are overwhelmingly supportive of increasing the presence of technology in their schools. **One hundred percent of the principals agree that more technology in the classroom is required**. Administrators recognize the importance of integrating technology and would actively lead to the modernization of their schools. Most principals have already planned for this push. Ninety percent of principals have a long-term technology plan based on input from all stakeholders. One hundred percent state that they have the space to store large technology purchases. Legislators must provide the funds to realize these plans. Teachers are similarly eager to implement technology in their lessons. Twenty three of the thirty two principals wrote that if every student had a computer then teachers would use the technology every day. Another nine said their teachers would employ the computers 2-3 times a week. Schools are ready, lawmakers must support them.

New York City Proposes Computer Classes

Mayor Bill de Blasio has put forth some initiatives to address New York City schools' technology and security needs, but they are not enough. Recognizing the city's rapidly growing technology sector, de Blasio announced that New York schools will offer computer science to all

students within the next decade. In order for the mayor to meet this goal, East Harlem needs significant investment to address the scarcity of computers, broadband, and qualified educators available to the school district. East Harlem's allocation of the total $81 million the Mayor dedicated to this initiative should be in proportion to the district's need. This infusion of aid would help rectify the city's racial disparity in computer science opportunities. Of the New York City students who took the computer science AP Exam in 2014, only nineteen percent were Black or Hispanic despite the fact that the NYC public school population is 68.2 percent Black or Hispanic. The student body of District Four is 26.2 percent Black and 61.4 percent Hispanic. East Harlem, as one of the communities with the greatest proportion of Black and Hispanic students, would be a worthy place to concentrate funding to combat this disparity. In order to most efficiently and equitably target funding for computer science, the city should invest in a technological infrastructure to assist the students who need it most.

East Harlem School Security

East Harlem school leaders also voiced that the state of school security within District Four is unacceptable. Despite Mayor de Blasio recent efforts to install security alarms in schools, East Harlem principals still report inadequate security systems to protect their children. According to our survey data, **thirty one percent** of principals in District Four feel that they do not have a security system that ensures the safety of their students. **Seventy** percent responded that they need more security cameras to supplement their existing system, with a majority asking for more than seven. East Harlem requires substantially more investment in security systems from the SSBA funds in order to safeguard the lives of thousands of students.

FUNDING SOURCES

Smart Schools Bond Act

The main source for funding the above proposals should come from the money made available through the Smart Schools Bond Act. While New York has an obligation to spend their SSBA funds throughout the city, East Harlem has the one of the highest needs for modernizing schools, and cannot begin the process without $18 million from the fund to District Four schools.

Even before New York City can begin spending the funding in wealthier communities, by law the city must update the technological infrastructure in communities like East Harlem. In order to free the funds the state allocated to New York City, school administrators must fulfill the requirements of a "Smart Schools Investment Plan" outlined in the "Smart Schools Bond Act Implementation Guidance"[20]. Some of the requirements set minimum standards that East Harlem schools would need to meet before the state could legally spend the money in other areas. The SSBA requires that districts must "increase the number of school buildings that meet or exceed the … minimum speed standard of 100 Mbps per 1,000 students. **Achieving this standard is a precondition for the purchase of devices**..." The DOE has not yet met this need and cannot purchase further equipment for the district. According to our district's survey data, sixty nine percent of schools do not have this minimum strength of broadband. The NYCDOE is obliged to allocate the resources to upgrade District Four's broadband before it can use money in other ways. Therefore we recommend that the DOE fund improvements to the following schools to ensure compliance with the act: **The Bilingual Bicultural School, Jacques Cartier School, William Paca, Jose Celso Barbosa School (PS 206), Jose Celso Barbosa School (PS 112), Patrick Henry, Mosaic Preparatory Academy, TAG Young Scholars, Isaac Newton MS for Math and Science, Manhattan East School for Arts and Academics, Joseph Lanzetta, Coalition School for Social Change, Luis Munoz Rivera, Renaissance School of the Arts, Central Park East I, Central Park East II, Global Neighborhood Secondary School, James**

[20] Smart Schools Investment Plan. "Smart Schools Invest Plan Overview"; (New York 2014).

Weldon Leadership Academy, River East Elementary, The Young Women's Leadership School, Park East High School, and Roberto Clemente.

The Smart Schools Bond Act Implementation guidance also includes suggestions of how to supplement New York State funds in the language of the bill. These include E-Rate Category One funds and assistance from the New York State Broadband Program Office. Below are additional possible sources of funding East Harlem schools can combine with SSBA money to best support their students' access to technology.

Federal

The United States established the Broadband Technology Opportunities Program (BTOP) to provide capital to spread internet and technology use throughout the country. Through this program, New York State was apportioned tens of millions of dollars, much of which is intended to go to low-income communities in New York City, such as East Harlem. For example, about $14 million was made available to Harlem and the South Bronx in the NYC Connected Communities program. This program is meant to expand computer centers in libraries, senior centers, public housing facilities, and similar institutions. The government could spend this money to improve any computer infrastructure that supports after school programs or adult education, which many District Four schools do. This is only one of the BTOP programs that District Four could take advantage of. Thirteen additional BTOP programs that operate around the nation and New York State could have funds available to modernize District Four's broadband[21]. But much of this money has already been spent. Not only should the federal government renew the money for these effective programs, but it should also allow schools to take advantage of more funds. Schools are essential community hubs, and investment in their technological infrastructure can support the program's mission to connect citizens to high speed internet and technology.

[21] "Grants Awarded New York." National Telecommunications and Information Administration.

East Harlem could also seek assistance from the Enhancing Education through Technology State Program, whose goal is to improve student achievement by increasing technology in schools. This is a very underutilized resource. **Only seventeen percent of schools which began 1:1 computer to student technology initiatives reported using EETT funds to support their transformation despite its widespread availability.** While districts have already apportioned funds to their projects, the federal government should continue to renew this program in 2016 and beyond to support East Harlem and similar schools.

Additional State Funding

New York has many programs that specifically fund technology in schools. According to the New York State Ed Tech site, public school districts can claim $14.98 per student per year to purchase instructional computer software under the "Aid for Computer Software Purchases." Similar programs are the "Instructional Computer Hardware and Technology Equipment Aid," "Professional Development Instructional Technology," and others. Under the discretion of the Commissioner, schools can apply for aid to cover the cost of installing hardware and expanding internet capabilities. For Fiscal Year 2015, District Four schools received $494,391 in funding for textbooks, libraries, software, and hardware based on a per-capita basis. Schools should take these funds into account as they create their technology plans.

Municipal

Funding can also come from Mayor de Blasio's allocation of $81 million over the next ten years for access to computer science classes. As the data above demonstrates, the program's success in East Harlem is contingent on a major influx of money to support more technology and trained professionals to teach computer science and STEM courses.

The city also offers Resolution "A" funding to finance one time capital improvements for schools. These grants can cover projects that upgrade labs, auditoriums, playgrounds, and technology. Last year Manhattan Borough President Gale Brewer awarded more than $2.1 million of this to schools in and around District Four to upgrade their technology infrastructure.

Schools within District Four should apply for money from this program to support their unique technology plans along with SSBA money.

Non-Profit and Private Investment

There are many organizations whose mission is to provide technology to schools that could partner with District Four to facilitate East Harlem schools' transition to the 21st century. Many of these organizations are already active in New York City. They include PowerMyLearning, Google, Verizon, Intel Education, Time Warner Cable, Cablevision, Teaching Matters, MOUSE, Common Sense Media, AUSSIE Digital School Solutions, the One-to-One Institute, and many others. Some of the mission statements of these nonprofits also include starting or enhancing STEM initiatives in schools. Past partnerships have been extremely successful, in particular NYCDOE's partnership with IBM through the creation of the Pathways in Technology Early College High School (P-TECH). In conjunction with CUNY, these groups created a highly successful STEM focused school that provides all graduates with an Associate's Degree and a job at IBM[22]. The institution was even praised by President Obama in a State of the Union address. This successful model has now proliferated to the Bronx and Queens with new partnerships from private entities such as ConEdison[23]. The City should continue to use its connections to reach out to these organizations to form partnerships dedicated to furnishing the students of East Harlem with technology and STEM curricula.

Companies that rely on technology have a vested interest in providing training to East Harlem students to meet their future employment needs. According to researchers from Georgia Tech, there are far more projected computer science jobs than there are people studying computer science. Leaders in technology industries mostly agree that this personnel problem originates in childhood, and would be willing to invest in solutions that target a young demographic. In addition, technology companies have been rebuked for their small numbers of female and minority employees.

[22] "Welcome to P-TECH!" *Pathways in Technology Early College High School*. Pathways in Technology Early College High School.
[23] Chapman, Ben. "P-TECH Will Be Duplicated in Bronx, Queens." *NY Daily News*. 4 Mar. 2013.

There is also precedence for companies contributing to initiatives to provide technology education to students. When Chicago and San Francisco announced their commitment to provide computer science to all students companies including Google, Microsoft, and Facebook contributed to the districts. Since Mayor de Blasio's similar announcement, AOL and venture capitalist Fred Wilson provided contributions towards the initiative. New York City policymakers must reach out to these companies not only to ask their expertise in providing technology to East Harlem, but also for their cooperation and assistance in the project.

School Budgets

Schools can make changes to their budgets to provide funding for technology. Once students are equipped with computers, schools no longer need to buy as many supplies. For example, schools would no longer need as many textbooks, paper, printer ink, assessment material, and other items because students can use paperless computer programs. East Harlem schools could incorporate such changes into their budgets as well as long-term technology plans when applying for funds to bring computers to their schools. Policies should also help connect schools to funding sources to help realize their technology plans. Despite the wide range of organizations that provide funding for educational technology, schools that purchased technology only sited an average of 2.1 sources of funding[24]. If East Harlem schools had access to a database of funders, then they could pursue more resources to incorporate into their budgets. The combination of the above funding resources and budget changes could be sustainable. In one national study, many schools noted that despite using grants to purchase technology, they were able to continue to fund their technology needs through their normal operating budget. Providing District Four with an initial sizable investment would give many of the schools the support they need to utilize technology in the classroom in a sustainable way. These changes would also free money to support the STEM initiatives that schools wish to get underway.

[24] Greaves, T. *Revolutionizing Education through Technology: The Project RED Roadmap for Transformation*; (Oregon 2012).

Schools can make further operational changes that are almost free. Schools could also make use of the technology that families and students already possess, such as laptops and cellphones. Texas's Plano Independent School District does this with some success, allowing students to connect their devices to the schools' internet. Although personal laptops are somewhat of a rarity in East Harlem, teachers could incorporate students' cellphones into their lessons accompanied with appropriate classroom expectations. Students could also employ these devices when exploring STEM subjects.

CASE STUDIES OF TECHNOLOGY IN SCHOOLS

The following section describes a number of case studies in which technology was brought into the schools. The conclusions we can draw from them are:

1. When properly implemented, the introduction of technology into schools can result in enormous improvements in academic performance and satisfaction.
2. Proper implementation of technology plans for schools should be incremental with participation by all stakeholders, continuing assessment, and planned revision as necessary.
3. Planning technology implementation requires a bottom-up approach that gives schools and teachers autonomy.
4. In addition to improving academic performance and preparing students for the work world of the future, new technology plans can result in cost savings and greater efficiency. This is particularly true for new security systems.
5. New technology in the schools has an outsize positive effect on minority and underprivileged students.
6. There should be a 1:1 ratio of computers to students.
7. Extensive teacher professional development and leveraging teacher leaders is essential to successfully integrate technology in the classroom.
8. Partnerships with the private sector can be critical in the implementation of new technology plans.

Global Technology Preparatory

Global Technology Preparatory, an East Harlem middle school, claims a small space amongst a swarm of activity. The entire campus includes two schools, sports complex, a learning garden, and the district office. But despite the chaotic setting, GTP inspires a feeling of order and purpose that springs from the students' academic pursuits. In one class half of the students

practiced on their personal piano keyboard while the other half learned about music theory from their teacher. Another classroom was full of 8th graders independently researching neighborhood high schools to apply to that year. Another teacher had her 6th graders start the day with typing exercises. Students tapped away alongside awards shouting out the fastest typers in the class.

Eighth grade students researching which high school would best fit their needs. Technology allows Global Technology Preparatory students to participate in meaningful activities that impact their future.

East Harlem has many examples of the transformation that sufficient access to technology can have on students' educational experience, but Global Technology Preparatory (GTP) is one of the most instructive. GTP has taken a forward thinking approach to educating East Harlem youth through using technology to drive their everyday classroom instruction. GTP, a middle school serving 178 students, maintains in a 1:1 student to computer ratio to "effectively prepare students for the 21st century." The school, which is ninety four percent Black and Hispanic and thirty five percent students with special needs, is emblematic of the kind of changes PCAST calls for and the success that a well-executed technology program can have.

Through correctly utilizing technology, GTP has made meaningful academic gains for their students. In the 2014 quality review, the school was noted for significantly increasing its

students' achievement levels. On its improvement in the State English and math tests, GTP earned "excellent" and "good" ratings, respectfully. In addition, a 2014 survey of parents, teachers, leaders, and students of Global Technology Preparatory, the school scored higher than the city average in all six categories (instruction, environment, collaborative teachers, school leadership, community ties, and trust). School leaders, parents, and students credit some of these inspiring results to the proper use of technology in the classroom.

Students are practicing their typing skills at Global Technology Preparatory. These computers and their maintenance have to rely significantly on private funding. SSBA funding could sustain the school's program for years to come.

GTP's principal David Baiz explained that this success was not simply because of the 1:1 computer to student ratio, but also effective school operation. Baiz has trust in his staff and supports them as they use technology and research based learning strategies to drive teaching their content. "We do things that work for us. We try new things and see what works." This adaptive strategy has led to great success, especially in science where students participate in a "blended learning" approach to the subject. In this strategy, where students learn independently with technology and in small groups guided by the teacher, students explore science content through an investigative lens. This accomplishment was possible because of a school culture built by administration and a staff that fosters a collaborative and trusting environment. Teachers are encouraged to take risks and learn by doing. Although the funding for technology

came from outside the school, Baiz and the leaders before him had the freedom to work with his staff and families to figure out the best ways to use technology in their particular classrooms.

Having a well-planned vision created and shared by stakeholders led to developing best practices and community buy in. Both families and students support the direction of the school, and have a voice in that direction. When one parent was discussing the coding class that her son elected to take, she explained that technology enabled students "to learn so many things that they would not have known. And the kids love it." Students likewise consider technology as an essential tool to extend their learning. A student taking a break from reading her novel said "technology helps me learn in ELA and music. It helps answer the questions I have." Technology works in conjunction with effective instruction and other school supports to provide a quality education in a neighborhood that is plagued by low student achievement.

GTP also demonstrates that with well thought-out school technology and culture plans, the fear that students will damage computers is unfounded. There have been almost no instances of accident, theft, or vandalism of the expensive equipment.

To provide the best opportunities for students and to cover the cost of hardware and maintenance, GTP relies on partnerships with private donors. Principals at GTP actively reach out to organizations that share the vision of providing a 21st century education to all students. Currently the school works with Google, Cornell Tech, Citizen Schools, and other organizations to ensure that students receive the best education possible. Not only does this collaboration educate GTP's children, but it fosters relationships between students, businesses, and community members. However these programs can be costly to both the outside organizations and the school itself. The founding principal found that fundraising became an essential part of her job, in which she had to constantly pursue corporate donors and grants. Currently GTP is pursuing funding to create a digital learning library to share with the school next door. **A mere three percent of the nearly $800 million available to the city could sustain GTP and programs around the neighborhood for decades.**

This is only one example of the successful integration of technology in schools in New York City. One need only look to Stuyvesant High School, Software Engineering Pilot, Academy for Software Engineering, and the Laboratory School of Finance and Technology to see the changes that technology programs can have on how students learn. Common to these institutions is the vision that technology is fundamental to driving instruction and preparing students for life.

1:1 Computer Student Ratios in Schools

One of the most comprehensive studies of the effects of a 1:1 computer to student ratio found that proper implementation of computer programs has a wide range of benefits. This study, called Project RED, gathered information from 997 U.S. schools. Project RED researchers identified five main areas by which the community benefited. First, correct implementation of 1:1 programs can actually save money. Respondents reported that the technology contributed to improvements in productivity as well as revenue gains at the federal, state, and local levels. Initial investments in East Harlem could potentially pay for themselves not only in qualitative benefits to students' wellbeing but also in concrete economic gains.

Second, 1:1 schools that appropriately use technology outperform all other schools both academically and in future earnings. This discovery is further supported by Global Technology Preparatory outperforming other East Harlem schools. SSBA funding can provide schools with the technological tools to raise student achievement in a historically underperforming district.

Third, 1:1 technology proved to be the most influential cause contributing to improved test scores, dropout rate reduction, improved discipline, and course completion among vulnerable populations. The groups where technology most helped were English Language Learners, Title 1 (a federal program for schools serving students in poverty) students, special education classes, and reading intervention classes. District Four schools have high proportions of these populations: 22.3 percent are learning disabled, 10.5 percent are English Language Learners, and 90.5 percent live below the poverty line[25]. Targeting SSBA funds to East Harlem schools to

[25] "Demographic Snapshot." District Four. New York City Department of Education; (New York 2015).

purchase technology for 1:1 intervention programs would provide a return on investment though large academic improvements.

Fourth, allowing students to go online increases student engagement and productivity. These factors have long been regarded as important to improving student achievement and success in college. In 2011, only a meager thirteen percent of students graduated "college ready" from East Harlem schools[26]. By providing technology to these often neglected students from an early age, they will be able to work more efficiently and learn the skills that will get them to and through college.

Students in history class at District Four's Park East High School. A student commented that "if we had the advantage of more technology, we could complete our lessons with a lot fewer problems."

Fifth, the study found that the daily use of technology presents the best return on investment for schools. Incorporating technology into daily lessons was found to be one of the top five indicators for better discipline, daily attendance, and future college attendance. Currently most District Four schools do not have close to the necessary technological infrastructure to provide this immersive experience for students.

Clearly this study shows that well implemented technology programs raise student achievement and engagement in a number of ways, necessitating the need for policies that can bring these same opportunities to East Harlem. When combined with new STEM initiatives, the gains that 1:1 programs create would also amplify benefits to students. In a study of afterschool STEM programs in which students were able to use computers, researchers found benefits in three areas: STEM skills and knowledge, excitement about STEM careers, and a higher likelihood of graduation and the pursuit of STEM occupations. If lawmakers equipped East Harlem schools

[26] Cramer, P. "Interactive Map Offers Illustration of College-readiness Disparities"; (New York 2012).

with sufficient technology, new STEM programs would have an even more positive effect on the lives of students.

Lessons from Technology Rollouts

When modernizing a school's technology, individual schools must create a plan based on their needs, execute the plan, evaluate the execution, and adjust their plan based on what they find. Properly carrying out these steps can create systemic and meaningful change in the way we educate our students. The case studies below illustrate lessons learned in the recent Maine and Los Angeles technology rollouts.

Maine Learning Technology Initiative

Over a decade ago Maine policymakers created the Maine Learning Technology Initiative (MLTI) with the goal of achieving a 1:1 student computer ratio in all public schools. Maine introduced the technology to great success by following a plan that had stakeholder buy-in and informed by data. Fifteen months after the start of MLTI, seventy percent of both students and teachers responded that the laptops had improved the educational experience. Among the most cited advantages were that laptops provided more educational resources, access to information, opportunities for research, better organization of schoolwork, and improved student writing skills. Not only was MLTI the first statewide K-12 1:1 program, but the over eighty thousand participants make it the country's largest[27]. Its success is predicated on its bottom-up approach that allowed individual schools to select the devices, software, and training that was right for them.

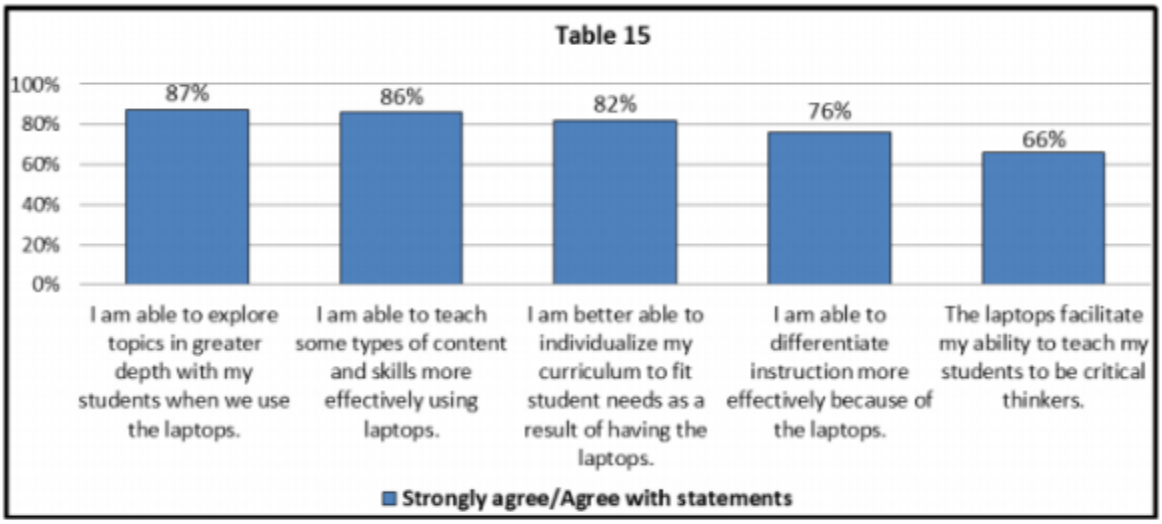
Maine phased in their 1:1 program by targeting a segment of their school population with comprehensive resources. The initial costs over the first two years included approximately $15 million for devices, $1 million for professional development, and $3 million to establish networks and technical support[28]. This incremental strategy allowed the government time to evaluate and adapt MLTI. Rather than spreading their limited resources around the state, Maine

[27] "About MLTI." *MLTI*. Maine Department of Education, n.d.

[28] McCarthy, Phillip D., and Yellow Light Breen. "Teaching and Learning for Tomorrow: A Learning Technology Plan for Maine's Future." Jan. 2001.

exclusively provided seventh and eighth grade students and teachers with computers, technical assistance, and teacher professional development. Instead of arranging a far-reaching but depthless technological program, Maine was able to assess and reap the benefits of a comprehensive 1:1 program, even if it only affected the learning for some students. New York City should also progressively introduce the technology accompanied by robust support systems to grant teachers the necessary time to adapt.

After middle schools had time to experience MLTI, Maine collected and analyzed data to improve the plan. Timely stakeholder feedback showed that teachers required more technical support and professional development. Maine worked with educators and private partners to address these issues. As New York spends its SSBA funds, they must also be proactive in soliciting feedback from stakeholders and solving any problems that emerge.



Maine teachers overwhelmingly found that MLTI helped improve learning in their classroom.

Once sufficient data demonstrated programmatic success, the Governor allocated additional money to expand MLTI into high schools. The gradual rollout process paired with comprehensive teacher support provided the opportunity to fine-tune MLTI and gave teachers the equipment, training, and time to adjust their curricula. Maine continues to collect data and hold conferences with stakeholders to discuss technology updates and recommendations. New

York should emulate Maine's community and data-informed program as it decides how to use hundreds of millions of dollars.

Los Angeles Unified School District iPad Program

Los Angeles Unified School District (LAUSD) began their 1:1 program in 2012. Los Angeles's top-down approach to their planning excluded stakeholders throughout the process and led to the waste of millions of dollars in taxpayer money.

Because the district purchased technology without proper research and feedback from the community, students received hardware that did not meet their needs. With minimal discussion between school board members and the community, LAUSD contracted Apple and Pearson to provide and outfit the iPads for their schools. Although teachers were initially grateful for the new technology, the computers began to hinder the learning process. Students quickly learned how to hack their iPads to access sites that the school district had blocked, distracting them from their studies. In addition, the computers had faulty software. Programs would crash when classes attempted to use their personal logins on software that was not equipped for so many users. Curriculum software installed on the devices would periodically malfunction, rendering that day's lessons inaccessible. These technical difficulties led to a massive loss of effective instructional hours in the classroom. On top of the technological issues, teachers also complained that they received almost no training and consequently did not know how to integrate iPads into their instruction. Superintendent Deasy had no choice but to suspend the enterprise in August of 2014.

Los Angeles did not have a community informed vision and plan when introducing technology. Because LAUSD did not fully understand what they wanted the technology to accomplish, they did not select the proper vendors for hardware and software. Former LAUSD Superintendent John Deasy even faced an FBI investigation for selecting Apple and Pearson to provide the technology for his schools without examining offers from competitors or hearing from stakeholders. In contrast, because Maine had a clear vision for its students, their department of

education solicited proposals from different vendors and purchased equipment and curricula that best met the needs of their students. Through research and soliciting stakeholder feedback, New York needs to determine in what ways they want to use technology to better students' lives and then select technology that accomplishes their goals. District Four schools petitioning for funds similarly need to create plans informed by the public to appropriately integrate technology.

Advice from stakeholders in individual schools will ensure that monies for technology will avoid obsolescence. As illustrated by LAUSD, if teachers and students are handed technology without a plan they support, chances are they will not use the technology in a productive way. Although teachers and students overwhelmingly supported providing more technology to students, teachers quickly became disinvested in LAUSD's plan. Only thirty six percent of teachers who received iPads strongly supported continuing the iPad rollout. Many teachers voiced that they needed more training before using the computers. LAUSD did not heed these voices until it was too late. New York City should not make the same mistake. One teacher responsible for her school's iPad rollout described teachers' ambivalent feelings towards the 1:1 program.

Laura Schafenacker, a science teacher responsible for her school's iPad rollout, explained how it was the bungled rollout rather than the technology that was a disservice to students. Teachers were originally excited to receive iPads for their school, but worried about their minimal training which covered how the iPad functioned instead of proper pedagogy. Because the district did not set up teachers to succeed, many of her school's educators rarely used the readily available computers. However a few pioneering teachers successfully used their technology to improve their practice on a near daily basis. The 1:1 ratio allowed teachers to accommodate their students with disabilities, communicate better with students and families, solidify their classroom management, prepare for state assessments, improve literacy skills, and providing otherwise unavailable experiences such as simulating experiments and touring museums. Even though Schafenacker credited iPads for much of her students' improved assessment scores, LAUSD collected the hardware and is currently keeping them in storage. Teachers were disappointed

with the rollout, not the technology. The publicity of Los Angeles's failure should not deter a 1:1 program in New York City.

Although many pundits labeled the iPad rollout a failure after its first year, the intention behind the program was sound. After assessing lessons learned from their first attempt, LAUSD intends to continue providing technology to students on a massive scale. In order to set up students for success in our technology dependent world, policymakers have to direct funding in ways that close the technology gap. If implemented properly there are real possibilities that a computer per student program can begin to close the both the digital divide and the achievement gap.

Avonte's Law and School Security

In a fall day in 2013, Avonte Oquendo ran out of his public school in Queens and never came back. Although his mother had warned the school that her autistic son "likes to run," Avonte disappeared from his class and ran out the school's side door and into the city. After many months of searching, his remains were found in the East River.

Although this tragedy came from one school, many schools are not equipped to keep their students safe. In response to Avonte's preventable death, NBC news launched an investigation into the efficacy of New York City school security. The news team attempted to enter schools without permission to see how security systems would respond. Out of ten attempts, NBC effortlessly gained entry into seven, including Avonte's school. In these seven schools the news team accessed multiple floors, classrooms, and cafeterias without being stopped or questioned. NBC attributed this lax response to inadequately monitored access points as well as lack of action by security guards. This issue of lax security jeopardizes the safety our entire city's children, and students deserve immediate security system reform.

New York City has begun to strengthen school security and the newly available SSBA money allows the city to make schools safe. **In 2014, New York City passed "Avonte's Law" which funded the installation of 21,000 audible door alarms by the end of 2015. But as the end of**

the year approaches, most schools in East Harlem need further security technology to keep their students safe.

East Harlem school administrators are already doing their best with the available resources to keep kids safe, but are still in need of financial support. District Four has existing procedures to monitor and respond to school security systems. Now that schools have the proper procedural structures in place, they need the technology to best implement the structures. Investments toward security technologies coupled with clear school security procedures would keep the more than 14,000 District Four students safer. Monies from the SSBA are one of the few options left for our schools to improve the infrastructure that is meant to keep our students safe.

POLICY RECOMMENDATIONS

Below are policy recommendations that will give East Harlem children the educational opportunities that they deserve. These recommendations detail how to use SSBA money and additional policies that would ensure its most effective use. The lessons learned from the case studies and research on the conditions in East Harlem informed the recommendations that address technology in schools, STEM improvements, and updating security systems. These recommendations also apply to other districts implementing technology plans.

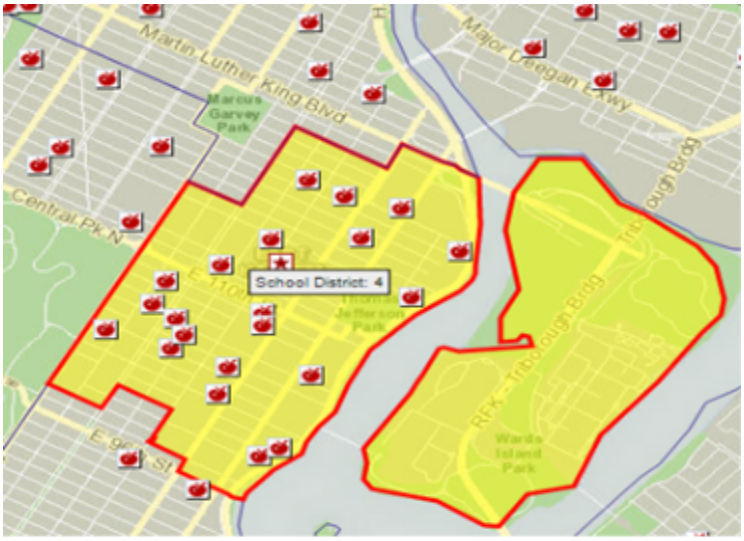
Providing Technology to Schools

1. District schools submit their individual technology plans to the NYCDOE

The ultimate success of any initiative follows a basic cycle: plan, implement, evaluate, adjust, and repeat. To create a well-crafted plan one must take into consideration the existing conditions and input from affected and participating stakeholders. Rather than executing a top-down citywide plan, the NYCDOE should allow individual schools to address their specific needs. Administrators, teachers, students, families, and other relevant community members should all be offered the chance to contribute their opinions about what their school needs. Administrators should use this information to write a technology plan which they then submit to District Four for funding. Schools can best accomplish the collection of stakeholder opinions by sending surveys to and holding forums with the groups above and analyzing the collected data as they develop their technology vision and plan. The Department of Education should oversee school and district plans to ensure that districts collect data to evaluate the efficacy of their programs and make any necessary changes based on those findings.

While every school technology plan should ultimately be formed by the school community, there are some matters that the NYCDOE should be responsible for. **Currently, the NYCDOE is responsible for large portions of teacher professional development. It is imperative that the**

district create a comprehensive professional development plan that supports teacher implementation of technology, allows for school flexibility, and leverages teacher leaders. This should supplement individual school's professional developments tailored to their specific visions. First, the district should create a series of differentiated professional developments to guarantee that teachers have the pedagogical knowledge to use technology in class. One of the main reasons for the iPad failure in Los Angeles was that teachers did not know how to effectively teach with technology because they did not have the proper training. Any buildup of technology must be paired with periodic training that allows teachers to master strategies. Our survey data suggests that many schools still need assistance with training their teachers to effectively use technology in the classroom. Only nineteen of the thirty two District Four schools agreed their school had the means to provide effective professional development on integrating technology in the classroom. The NYCDOE can provide a foundation of professional developments that schools can tailor to their needs. Second, schools and teachers must have the flexibility to participate in training that is specific to their needs. This can be accomplished by allowing school leaders to deliver and edit professional developments, provide differentiation for teachers, and incorporate student and teacher data. These strategies build relevance to teachers' practice and maximize the benefits of trainings. Third, both schools and districts need to utilize teacher leaders to spread best practices of using education technology. Teachers who are especially skilled with using technology in the classroom should



This map shows the location of traditional public schools in School District Four, each one represented by an apple. Although District Four has 32 traditional public schools, many schools share their campuses due to lack of space and resources. However this dynamic could facilitate the sharing of technology and IT experts.

lead trainings and collaborate with their colleagues to support all teachers with this massive transition.

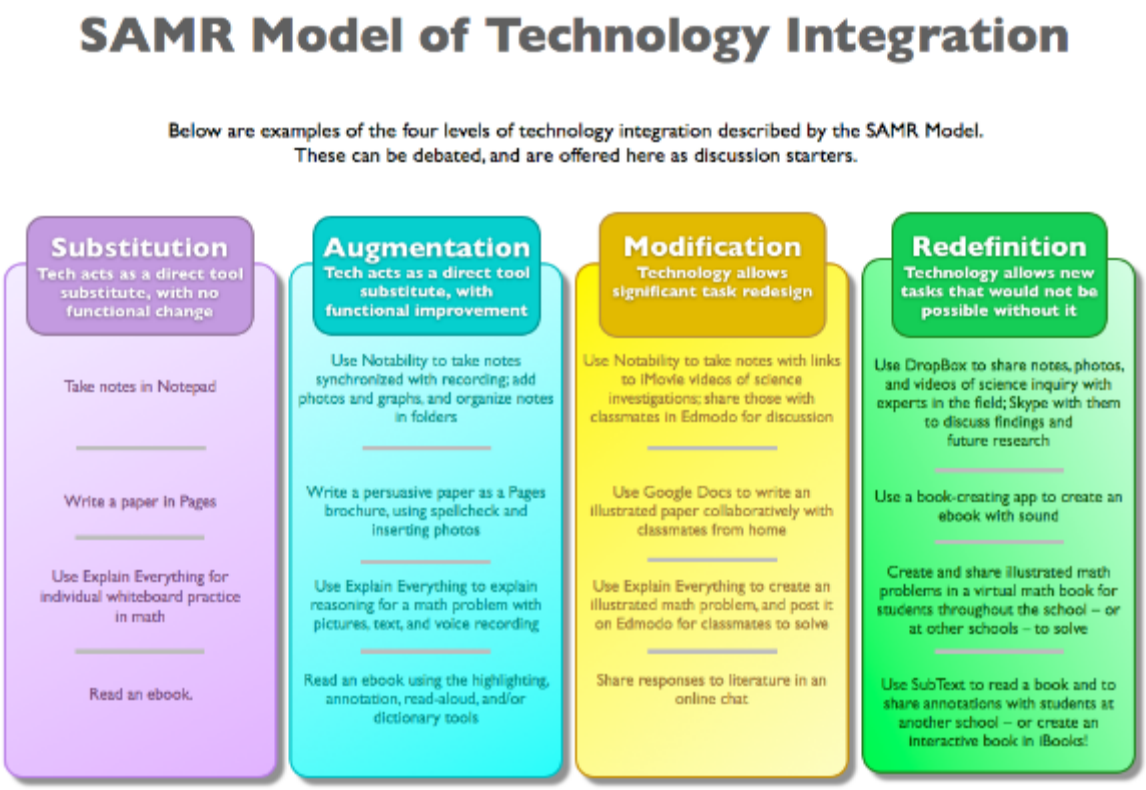
In addition, each community school district should be responsible for the maintenance of technology. First, as technology falls into disrepair or becomes outdated, the district should have a plan to allocate money to replace the faulty technology. Second, NYCDOE should dedicate IT personnel to small clusters of schools. More technology means more technology malfunctions. It is important for a school to have a technology expert readily available to solve any issues to minimize loss of instructional time. Since many schools share a building or are located in close proximity to each other, one IT person could be responsible for a few schools. It is up to the district to determine the most cost-effective way to staff IT professionals to support schools' use of technology.

Investing hundreds of millions of dollars into school technology is a considerable task, and government should allocate money to hire experts to help school districts through the daunting process. The One-to-One Institute is a nonprofit that specializes in developing "sustainable and successful 1:1 computer programs" for schools. They take a systems wide approach that tackles many of the issues above, including collecting stakeholder input, integrating technology into curriculum, providing professional development, and evaluating the efficacy of the program. They work with organizations from the school-wide to country-wide levels.

2. Use the SAMR model to support teacher implementation

In order to transition technology into the classroom, principals should employ the Substitution Augmentation Modification Redefinition Model (SAMR). SAMR helps ease teachers into modifying their curriculum to include technology through incremental steps. In the first two phases, teachers keep their original tasks but substitute or augment the original media students used with technology. For example, students read the same article on a computer instead of a textbook. The next two steps teachers use technology to create new tasks that transform and enhance students' learning experiences. For example, instead of an article, students would

conduct independent research. This gradual process allows teachers to adapt their practice to the possibilities that new technology makes available.



The diagram above shows the process and examples of the SAMR model. This strategy is a useful tool to incorporate in the professional development of teachers as they learn to incorporate technology in the classroom.

3. Adopt internet safety strategies

As East Harlem incorporates computing into its school environments, policymakers need to consider the safety of their students. As students and teachers become more connected, they become at risk of cyberbullying, losing their privacy, and interacting with malicious strangers. We support anti-cyberbullying legislation to help protect our youth as they spend more of their time online.

The main preventative measure against these negative consequences of increased internet use should be student education of proper internet etiquette as well as supporting writing skills. As

school districts solidify their plans to support internet safety, they should take into account the following research based best practices. First, internet safety education should begin in early grade school. Research found that twenty percent of eight to ten year olds used social networking sites daily in 2010, and it is most likely that this number has only grown in the time since. The start of internet safety education should begin in tandem with the start of internet use to prevent any negative consequences before the dangers emerge.

Second, parents should be the principal internet safety educators for their children and schools supplement what parents teach. A recent survey showed that a majority of teachers believe the onus of internet education should be on the parents, and *all* of the parents surveyed stated that they teach their children internet safety. Schools, public health officials, and other agencies should equip parents with resources and guidance to set up our parents and students for success.

Third, in-school internet education should incorporate proven educational strategies and programmatic evaluation. Currently, most internet education relies on imparting knowledge rather than building skills. internet education should include activities that allow students to practice handling problems similar to what they will encounter in the real world. For example, students should practice in situational role-plays with their peers rather than simply repeat back what they learned to the teacher. Only practice can lead to lasting behavior change.

To supplement the primary strategy of student education, schools should require students and parents to sign acceptable internet Use Agreements and block unwanted sites from schools' broadband.

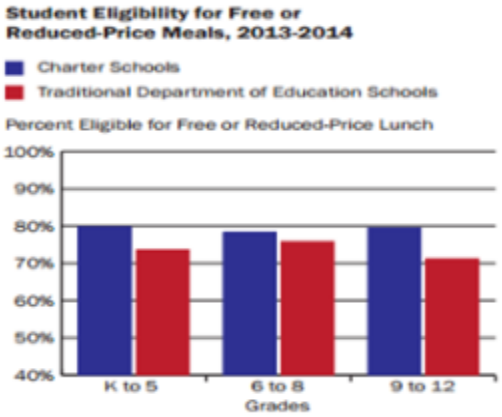
4. Provide funding for technology sustainability

Despite the fact that most school districts must work within strong budget constraints, any wide-scale technology program necessitates money to replace hardware as time goes on. It is illegal for schools to use SSBA funds for the recurring costs that technology creates. Project RED data shows that "computers in all schools are aging at an alarming rate, and funding for

replacements is dwindling just as fast." To protect any investment in East Harlem education, policymakers need to set aside money to maintain, if not expand, their new technology. SSBA will address the technology gap, but additional money is needed in the future to continue to maintain technology levels and address obsolescence. In order to service the immediate and long-term technological maintenance, New York City should expand the Division of Instructional and Information Technology which currently provides that amenity.

5. Fund technology initiatives in charter schools

District Four charter schools, which primarily serve low-income Black and Hispanic children, cannot receive funding from the SSBA. New York State should fund technology programs that serve the many of the students who would benefit the most. While much of the public views charter schools as private schools that receive public funds, this is blatantly untrue. Even though charters serve all children, New York City charters often serve populations with higher rates of poverty. Unfortunately these public charter schools must serve these high needs populations with fewer public funds than traditional public schools. Charter schools' per-pupil funding is less than that of traditional schools (as seen below). Additionally, charter schools are often times denied basic funding that traditional schools receive. SSBA eligibility or additional money should be made available to support these institutions which serve our city's neediest students with smaller budgets.



Charter schools must support high need students, oftentimes with fewer public dollars. Charter schools are entitled to the same funding for technology that their traditional school counterparts receive.

Investment in STEM

1. Fund STEM curricula

As our nation's STEM sectors rapidly expand, our schools need to educate students so that they are able to fulfill worker demand. Currently, the STEM sector has a startling underrepresentation of women, Black and Hispanics, and persons from low-income backgrounds; descriptors of many of the students of East Harlem. Yet principals in the district reported that they have few STEM opportunities for students. East Harlem schools must implement technology-based STEM curricula to prepare students for the workforce and open their eyes to careers they have never imagined. District Four can use money from the SSBA to purchase hardware software that support technology-based STEM curricula.

2. Adopt Next Generation State Standards

To further support STEM, New York State should adopt the Next Generation State Standards (NGSS), research based standards that incorporate STEM skills and content. New York has been considering adopting these standards to replace outdated and less rigorous state science standards that are currently in place. Because the government has been slow-moving on this issue, schools and teachers have been left in the lurch, unsure if they should modify their lessons after NGSS or the current standards. States across the country should vote to begin transitioning to NGSS for the 2016-17 school year with full implementation by fall 2019.

3. Provide financial incentives for effective STEM teachers

The government should provide financial incentives for STEM teachers who are rated highly effective on a research-based rubric of teaching best practices. PCAST recommends a minimum of five percent of teachers' salaries added to their income. This further pay would motivate trained STEM professionals to continue teaching in East Harlem rather than work in a different district or a higher paying occupation. This practice could even save money through retaining teachers. Urban school districts lose on average $70,000 a year in teacher transfers and an

additional $8,750 for every teacher that leaves the district[29]. The small increase to teachers' salaries would decrease these costs.

4. Invest in afterschool STEM programs

If policymakers are unwilling or unable to establish STEM curricula in schools, they should consider the adoption of the above policy recommendations for after school programs. Students spend fewer than twenty percent of their waking hours in school, leaving unexploited opportunities for students to explore STEM. All levels of government should support the creation of after school programs staffed by qualified professionals who practice data-driven instruction and evaluation to give the schools in East Harlem further access to STEM education. These programs would provide high-need students with constructive after school activities while supplementing the learning that schools provide during the day.

Improve School's Security Systems

1. District schools submit security plans to NYCDOE

Along with their technology plans, administrators should submit school security procedures to the NYCDOE in order to ensure that principals will have the systems in place to properly use the new technology. Avonte's death was attributable to both the lack of oversight and the lack of a security system. Schools need to demonstrate that they have a functional procedure in place to operate and respond to any of the security systems installed in schools.

2. Install security cameras

Investing with a focus on security cameras specifically addresses a wide range of behavioral concerns in East Harlem schools. According to the United States Department of Justice, security cameras would meet most District Four's needs. Security cameras are most helpful for deterring fights, unwanted outsiders, theft, and many other dangerous behaviors.

[29] Amos, J. "What Keeps Good Teachers in the Classroom? Understanding and Reducing Teacher Turnover"; (2008).

Although security cameras can be expensive, choosing the correct type of camera for a school's needs can be cost-effective. Purchasing school cameras can also reduce the time needed to monitor students. For large zones that need surveillance, such as gyms, lunch areas, and parking lots, cameras can observe an area that would otherwise necessitate multiple people. This would provide school staff with more free time to serve their students.

Furthermore, cameras help improve school culture providing hard to dispute evidence on tape. This can be a vital tool for administrators. Many administrators report that students will admit to rules they broke when shown a video recording of their actions. The same evidence assists schools in settling liability claims or discussing student behavior with parents. This combination of creating a sense of safety and a fair disciplinary tool will help keep students in the classroom and focused on their academics.

3. Provide funding for security sustainability

In order to best use allotted funding, New York must invest in security systems in a sustainable way. New York State and City must allocate money to District Four to maintain the systems that they are installing with funding from Avonte's Law and the SSBA.

Assemblymember Robert Rodriguez (middle) at Harlem Link Charter School.

CONCLUDING VISION

Inaccessibility to technology and effective STEM curricula in low-income communities is driving the gross underrepresentation of minorities in STEM fields. This cannot remain the status quo. **The disparity in our city's schools and technological access is a threat to our city's economic competitiveness and the civil rights of East Harlem citizens.** Policymakers can close the digital divide detailed above through the correct allocation of funds to properly planned, executed, and evaluated school programs.

Providing students with access to computers can have a life-changing impact. Adequate funding from the Smart Schools Bond Act and other sources can educate and inspire East Harlem students. An East Harlem sixth-grader who received a computer (home learning center) thanks to the group Connected Learning explained that "the home learning center I received in April 2011 has made a huge difference. The science section helps me better understand physics, logic, and has taught me more about space. This has helped me think that I may want to work at NASA." Access to a personal computer not only helped her succeed in class, but also opened her eyes to a future she had not imagined before. Lawmakers have the opportunity to provide this same essential and transformative experience to all students within District Four.

Learning best takes place in safe environments. All the money in the world spent on new technology for schools can be for naught if students are not protected or made to feel safe. As this report notes, this can be accomplished relatively easily through cost-effective means.

Although this report focuses on East Harlem, it has far-reaching implications. East Harlem is a microcosm of the technology deserts that many of our nation's low-income communities are. This report's assessment of conditions and concomitant recommendations can apply to areas suffering similar conditions around the country. Technology is woven into every aspect of our lives, and education should be no exception.

APPENDICES

Appendix A Survey Results

Below are select responses from our offices independent survey of District Four schools. If you wish to see all questions and responses, please visit http://district4survey.weebly.com and download the file.

What is the name of your school?	Approximately what is your computer to student ratio?	Does your school have an adequate security system?	My school has sufficient technology hardware for teachers and students. E.g. computers, printers, projectors, etc.	My school has sufficient internet bandwidth for teachers and students (recommended 100 kbps per student).	My school currently uses a technology-based STEM curriculum.	If all students had access to a computer, how often would teachers use them in a classroom.	How many more cameras would your school need to ensure student safety?
PS182 BBMS	Between 1:8 to 1:5	No	Disagree	Neither Agree nor Disagree	No	Daily	3-4
04M146	Between 1:5 to 1:3	Yes	Disagree	Agree	No	Daily	7+
PS 102 - Jacques Cartier School	Less than 1:10	Yes	Strongly Disagree	Neither Agree nor Disagree	No	2-3 Times a Week	I do not need more cameras
04M007 Samuel Stern	Less than 1:10	Yes	Strongly Disagree	Strongly Agree	No	Daily	1-2
PS/MS108	Less than 1:10	No	Disagree	Strongly Agree	No	Daily	7+
PS 155	Less than 1:10	No	Strongly Disagree	Strongly Disagree	No	Daily	I do not need more cameras

4M372, Esperanza Preparatory Academy	Between 1:10 to 1:8	Yes	Strongly Disagree	Agree	No	Daily	I do not need more cameras
PS/MS 206 - Jose Celso Barbosa	Between 1:8 to 1:5	No	Strongly Disagree	Strongly Disagree	No	Daily	7+
PS 171	Less than 1:10	Yes	Agree	Neither Agree nor Disagree	No	Daily	1-2
Mosaic Preparatory Academy 04M375	Between 1:10 to 1:8	Yes	Agree	Disagree	No	Daily	7+
TAG Young Scholars	Between 1:5 to 1:3	No	Agree	Strongly Disagree	No	Daily	7+
04M825	Between 1:10 to 1:8	No	Neither Agree nor Disagree	Neither Agree nor Disagree	No	Daily	I do not need more cameras
04m072	Less than 1:10	No	Disagree	Agree	No	Daily	7+
Manhattan East School For Arts and Academics	Between 1:5 to 1:3	Yes	Disagree	Disagree	No	2-3 Times a Week	5-6
Global Technology Preparatory	Greater than 1:3	Yes	Agree	Agree	Yes	Daily	3-4
PS 96 Joseph Lanzetta (04M096)	Less than 1:10	No	Strongly Disagree	Strongly Disagree	No	Daily	7+
Coalition School for Social Change	Between 1:10 to 1:8	Yes	Agree	Disagree	No	2-3 Times a Week	I do not need more cameras
04M083	Less than 1:10	Yes	Strongly Disagree	Disagree	No	Weekly	I do not need more

							cameras
04M377 (Renaissance)	Between 1:8 to 1:5	Yes	Strongly Disagree	Disagree	Yes	2-3 Times a Week	7+
Central Park East II	Less than 1:10	Yes	Strongly Disagree	Disagree	No	Daily	I do not need more cameras
M381	Between 1:5 to 1:3	Yes	Disagree	Strongly Disagree	Yes	Daily	7+
James Weldon Leadership Academy PS\MS 57	Less than 1:10	No	Disagree	Disagree	No	Daily	7+
River East	Between 1:10 to 1:8	Yes	Strongly Disagree	Disagree	Yes	Daily	I do not need more cameras
The Young Women's Leadership School of East Harlem	Between 1:5 to 1:3	Yes	Neither Agree nor Disagree	Strongly Disagree	No	2-3 Times a Week	
Central Park East 1	Less than 1:10	Yes	Strongly Disagree	Neither Agree nor Disagree	No	Daily	7+
Vito Marcantonio	Less than 1:10	Yes	Strongly Disagree	Agree	Yes	Daily	5-6
Park East High School	Less than 1:10	Yes	Strongly Disagree	Strongly Disagree	No	Daily	1-2
central park east hs	Between 1:8 to 1:5	No	Strongly Disagree	Strongly Agree	No	2-3 Times a Week	5-6
PS 112 Jose Celso Barbosa School	Between 1:10 to 1:8	Yes	Agree	Neither Agree nor Disagree	No	Daily	5-6
P.S. 38 Roberto Clemente	Between 1:10 to 1:8	Yes	Strongly Disagree	Strongly Disagree	Yes	Daily	7+

The Heritage School	Between 1:8 to 1:5	Yes	Strongly Disagree	Agree	No	2-3 Times a Week	3-4
Manhattan Center for Science and Math	Between 1:5 to 1:3	Yes	Agree	Agree	No	2-3 Times a Week	I do not need more cameras

Appendix B District Four Hardware and Internet Speed

This table shows the internet speeds in twenty five of District Four's elementary and middle schools[30]. The internet speeds in all schools are well below the recommended 100 kbps/student ratio. A majority of the schools share a building which allows for the possibility of sharing of resources.

DBN	Students	Teachers	Occupancy	Circuit	Speed (kbps)
04M007	384	29	Co-Located	EVPL (Fiber)	40
04M012	541	25	Co-Located	EVPL (Fiber)	40
04M037	220	19	Co-Located	EVPL (Fiber)	10
04M038	278	26	Single Occupancy	EVPL (Fiber)	20
04M050	335	27	Single Occupancy	EVPL (Fiber)	40
04M057	869	65	Single Occupancy	EVPL (Fiber)	10

[30] Silva, Servia I. "District Four Internet Speeds." Personal interview. 18 Nov. 2015.

04M072	568	43	Single Occupancy	EVPL (Fiber)	10
04M083	451	31	Co-Located	EVPL (Fiber)	10
04M096	461	35	Single Occupancy	EVPL (Fiber)	50
04M102	312	34	Single Occupancy	EVPL (Fiber)	10
04M108	633	45	Single Occupancy	EVPL (Fiber)	40
04M146	405	41	Single Occupancy	EVPL (Fiber)	10
04M155	372	31	Co-Located	EVPL (Fiber)	20
04M171	719	48	Co-Located	EVPL (Fiber)	10
04M182	357	26	Co-Located	EVPL (Fiber)	10
04M206	468	66	Co-Located	EVPL (Fiber)	10
04M224	164	17	Single Occupancy	EVPL (Fiber)	10
04M372	519	67	Co-Located	EVPL (Fiber)	40
04M375	345	30	Single Occupancy	EVPL (Fiber)	10
04M377	166	15	Co-Located	EVPL (Fiber)	20

04M381	149	18	Co-Located	EVPL (Fiber)	40
04M406	172	15	Co-Located	EVPL (Fiber)	40
04M497	190	17	Co-Located	EVPL (Fiber)	40
04M825	267	21	Co-Located	EVPL (Fiber)	40
04M964	280	24	Co-Located	EVPL (Fiber)	10

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