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Consequential Differences: Variations in School Support for Engineering

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Introduction

One hundred and thirty-one high school sophomore girls began the FREE program in Spring 2007. At that time, all of them were high achievers in math and science (as measured by their 9th grade record in mathematics and science and their teachers' recommendations). Most were minorities, many were from working class families, and many were in the first generation of their family to attend school in the U.S. Although the girls were strong students in math and science, and lived in areas with good engineering jobs, few were considering engineering as a career possibility, and few knew an engineer personally. In these respects, the girls were similar across our sites.¹

On the other hand, they attended 7 high schools in 3 states and 6 school districts. There are some differences across these states—Colorado, Iowa, and Ohio—in educational support, policies, and requirements.² More importantly, from the beginning of the FREE project, we were struck by differences across schools in economic, social, and cultural capital to promote and support engineering. Even within school district and even when serving demographically similar students, the girls' school experiences were demonstrably unequal.

Forms of Capital

In economic terms, “capital” refers to anything that can be used in the production of other resources. Economic capital can be financial--to generate returns (profits), or physical--applied in production to increase output. Financial investments in education, for example, may generate returns in the form of knowledge or skills that increase worker productivity (Massey 2007, 16). Pierre Bourdieu (1986) extended the concept to two other forms--“social” and “cultural” capital. Social capital refers to resources that individuals can access through their personal networks for tangible (e.g., locating a job) or intangible (e.g., feeling self confident) gain. In his well-known book, *The Truly Disadvantaged* (1987), William Julius Wilson, argued that residents concentrated in high-poverty urban neighborhoods are cut off from social connections that could help them to rise out of poverty, thus limiting their social capital. Cultural capital consists of knowledge, manners, and tastes that permit individuals to be competent in elite social contexts.

¹ This summary is accurate for the CO and IA sites (83% of the girls in FREE), but not the OH site (17%). In OH, the girls were mostly white, most had much higher incomes (over \$100,000), and they attended a suburban school. However, like the girls in CO and IA, OH girls were strong students in school, and few of them knew an engineer or were considering engineering as a career when FREE began.

² [Need to add some information about this.]

The possession of cultural capital makes an individual more productive not because he or she can perform an operation better or faster, but because he or she can navigate structures of power with greater ease, feeling relaxed and comfortable in the social settings they define and thus interacting with other people of influence to get things done. (Massey 2007, 18)

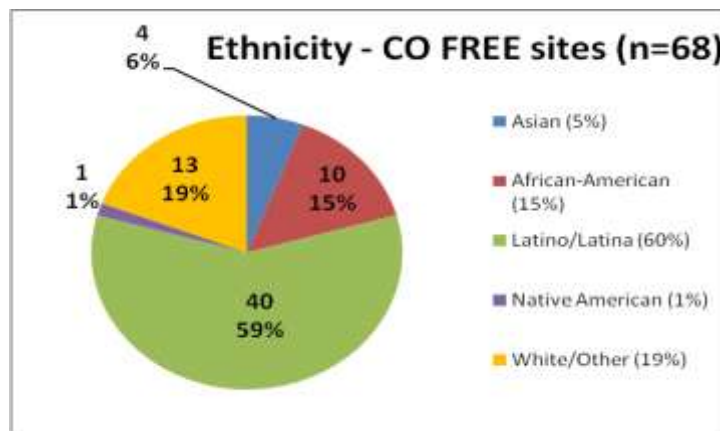
We have found that seemingly small capital differences across schools can add up to major consequences for high-achieving girls' capacity to pursue engineering, should they want to. In this paper, we will focus on the 3 Colorado high schools.

Three High Schools in Colorado

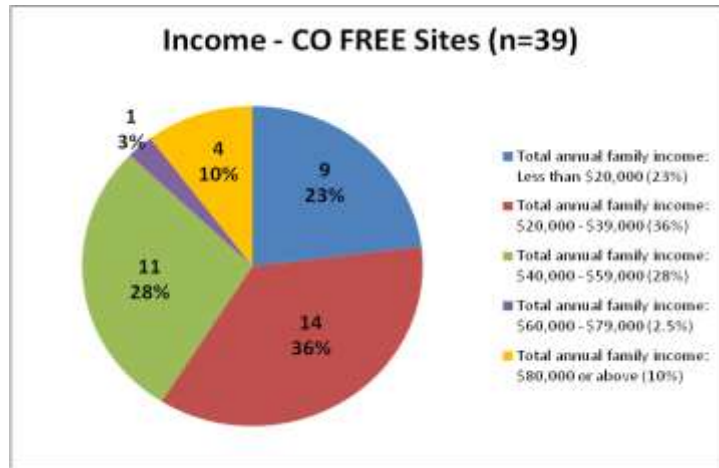
Taken together, the girls in Colorado who participated in FREE had the following general characteristics.³ They were strong students in school through the 9th grade and were recommended by their math and science teachers.

School	Average Grade 9 GPA (weighted)	Average Grade 9 GPA (unweighted)
Southside	3.721	3.374
Chavez	3.390	3.390
Aspire	4.051	3.118
Overall Average	3.721	3.294

They were approximately 60% Latina, 19% White, 15% African American, 5% Asian, and 1% Asian American. Approximately 60% lived in families with annual incomes below \$40,000. They were all urban residents and attended urban public schools.

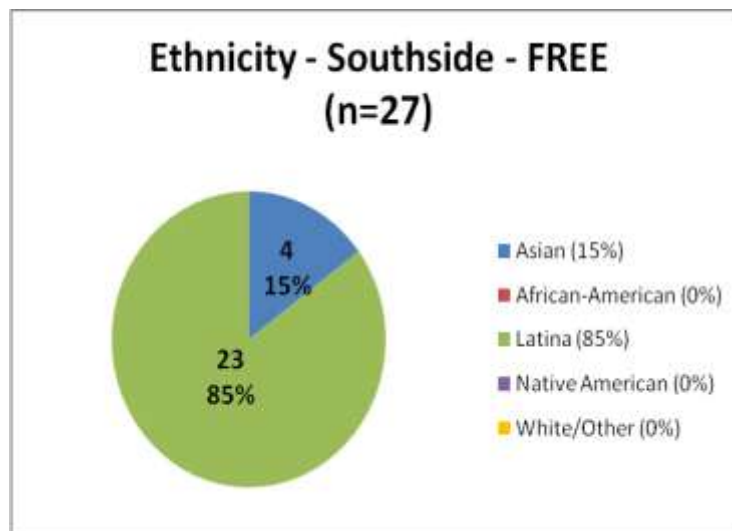
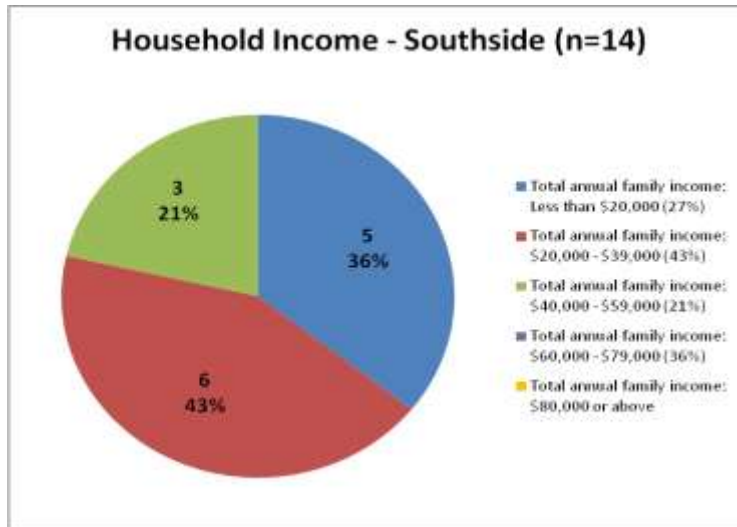


³ Need to check correspondence between pie chart and legend; some do not match.

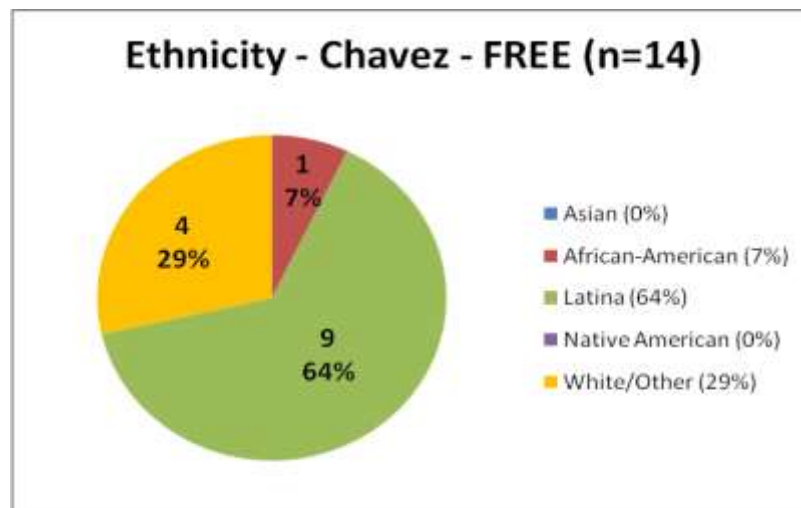
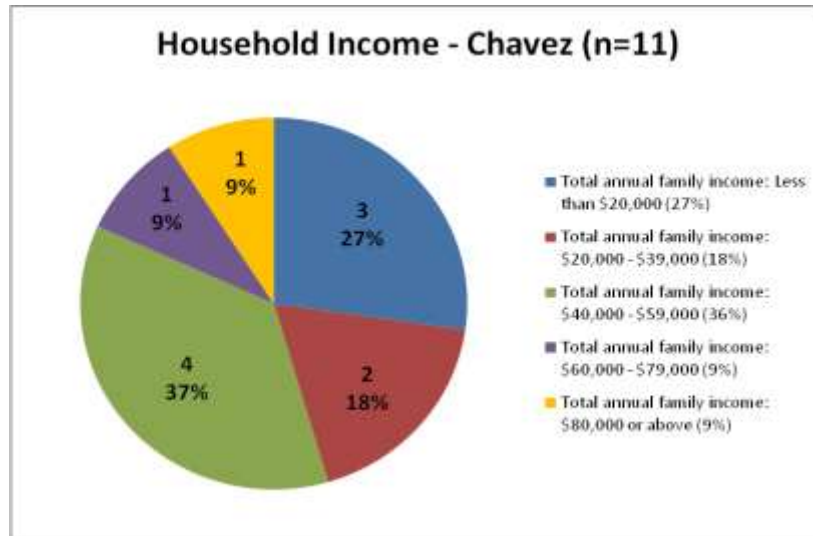


*Southside High School*⁴. Southside is a large urban public high school (2300 students) located in a Mexican-American, working-class section of a major city. On one side the school is bordered by a major urban thoroughfare with numerous fast food restaurants, small local businesses, auto repair shops, and gas stations. Small, neatly-kept residential bungalows surround the school on the other three sides. Students come primarily from the surrounding area. Among Mexican-Americans in the city, the school has a good reputation and is known for being responsive to the community. Many of the Mexican-American families who send their students to Southside have been in the U.S. a decade or less, and many of the students are in the first generation of their family to attend school in the U.S. Almost all of Southside's students are Spanish-English bilinguals, but many parents speak only Spanish. Eighty-three percent of all Southside students are Latino/Latina; 5% are Asian. Seventy-two percent of all students there qualify for free or reduced lunch. Seventy-nine percent of Southside's FREE girls lived in families with annual incomes below \$40,000; 85% of the FREE girls were Latina; 15% were Asian.

⁴ School names are pseudonyms.

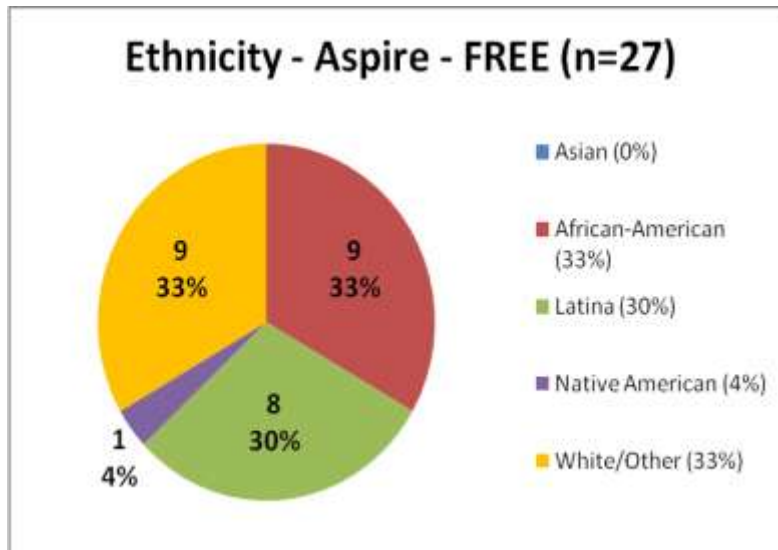
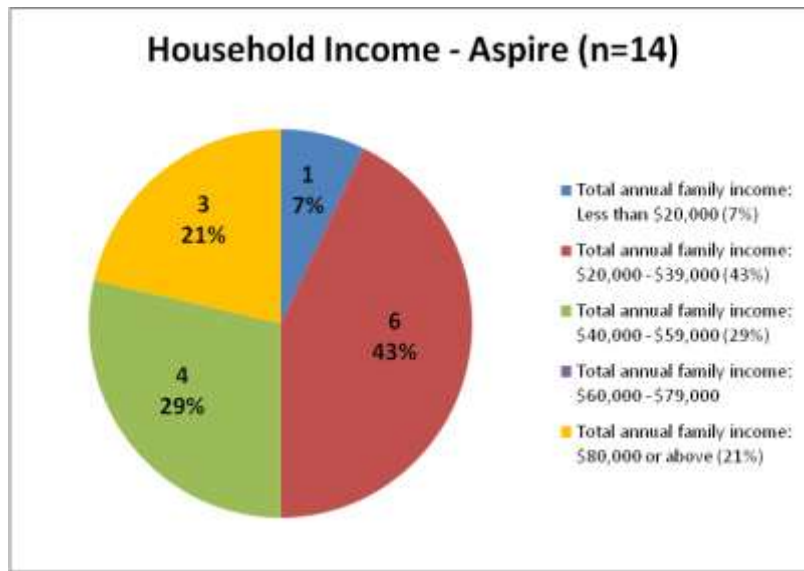


Chavez High School. Chavez High School is a public high school (1500 students) located in a small industrial section of the city; this section of town borders what was, until recently, agricultural land. The land is rapidly being converted to tract housing, but the area around the school retains the feel of a small town focused primarily on agricultural production and support. Most of the residents are solidly working class. The population is predominantly Mexican American but has larger percentages of Blacks and Whites than Southside. Most of the families who send their students to Chavez have lived in the area for generations and speak only English or are Spanish-English bilinguals. At Chavez, 63% of the student body is Latino/Latina, and 33% are White. Sixty-two percent of the students at Chavez qualify for free or reduced lunch. In FREE, 64% of participants were Latina; 29% were White; and 45% had incomes below \$40,000.



Aspire High School. Aspire is a new public charter school (n = 432) located in a section of the city center that has recently been redeveloped. Newly occupied condos, apartments, and single family houses surround the school. By charter, Aspire admits 40% low-income students and strives for an ethnically diverse student body (in 2007: 36% White, 33% African American, 25% Latino/Latina, 5% Asian, and 1% American Indian). In FREE, 50% of the girls came from families with annual incomes below \$40,000; 33% of the girls were White, 33% were African American, 20% were Latina, and 1 was American Indian.

2005 was Aspire's first year of operation, and unlike either Southside or Chavez, Aspire has a new building with soaring contemporary architecture and many up-to-date and high tech features. The students at Aspire come from across the metro area. Prospective students must apply, and if selected via a lottery, provide their own transportation. Attendance at school meetings and other events is required for parents.



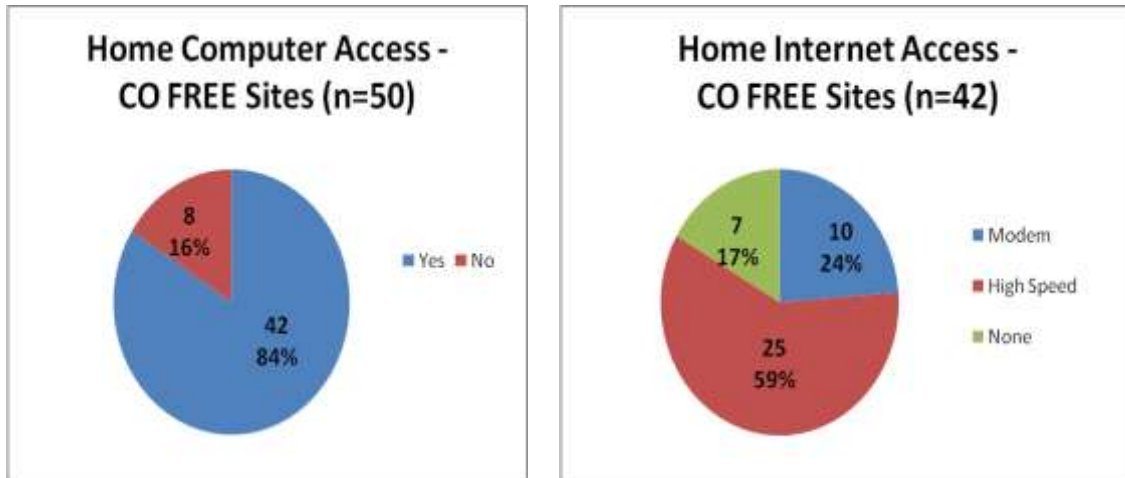
Variation Across Schools

Although many differences across these sites could be highlighted, the focus here is on three--access to technology; access to courses; and access to college counseling. All three have capital potential for girls who might want to pursue engineering.

Technology Access and Use

At the time FREE began (early 2007), all of the high schools had computers available in labs, provided some computer instruction, and allowed teachers (first priority) and then students to sign up to use the computers. At the same time, 84% of the girls in FREE reported that they had access to a computer at home, and 83% had access to the Internet

at home. These high percentages for home access were consistent across the 3 schools, but they were not reflected in the girls' use patterns at school.



School district policies govern access and use of technology at the schools. According to the district website, the following policies were in effect during our study.

[We] provide a wide-area network service that connects district facilities to each other and to the Internet at large. Access to the Internet offers vast and unique resources to both students and teachers. The district's goal in providing this service is to promote educational opportunities to schools by facilitating resource sharing, innovation, and communication. On a global network it is impossible to control all materials, and even casual users may easily discover or come across controversial material. The school district believes that the valuable information and interaction available on this worldwide network far outweighs the possibility that users may access material that is not consistent with the educational goals of the district.

[We] use internet filtering technology to meet the mandates of the Children's Internet Protection Act (CIPA) of 2000. The goal of CIPA is to protect minors from accessing content on the internet that is pornographic, obscene, or potentially harmful to minors. [We] have also chosen to block categories that show little instructional nor business value or use up significant amounts of the bandwidth of [our] connection to the internet. The intention of the additional filtering is to improve the internet performance of web sites that clearly provide instructional and business value.

A committee of District staff and educators met to evaluate how [we] are using the internet connection. Reports from the internet filter showed that an average of 10 - 15 percent of web sites visited were either entertainment or games. The decision was made to begin filtering of non-instructional, non-business and streaming media web sites in order to

increase the performance of the internet connection. The following websites and categories will be blocked:

- Games
- Internet Auctions
- Personals and Dating
- Streaming Media

If you have instructional need for web sites in these categories please refer to the link below which outlines the instructions for requesting temporary access. A principal may email the ... Hotline and request that temporary access be granted to a specified number of machines for instructional or business purposes. (District website, accessed March 2009)

The district policy, no doubt well intentioned, did not operate nearly as well as this description would suggest.

Southside. No student at Southside regularly used a computer in class. No one brought a laptop to school. The school had 3 desktop computer labs; access to each was limited. One lab, in a dedicated classroom, was used for computer instruction during the school day. Ordinarily, students not enrolled in computer classes could not use this lab. A second lab was located in the library and could only be accessed with special permission for a special assignment. A third lab was available only for students preparing college applications and scholarships. In addition, no lab computers could be used after school because there were no adults available to monitor students in the labs.

During the first meeting at Southside we planned to show the girls some exciting videos of women doing engineering with the intention of increasing their interest in the field. We reserved a laptop cart and LCD projector, but we were unable to get online and had to resort to showing the girls other, less attractive videos that we had previously burned onto discs. We later learned that the school district blocks most online videos to conserve bandwidth. The justification is that videos are for entertainment rather than educational purposes.

When we introduced the FREE website at Southside (mid-Spring 2007), some of the girls, sophomores at the time, already had email addresses and used email regularly. Others had no idea what an email address was or how email was used. All of the students needed an email address to create a user account on the FREE web site. Some created an account with little difficulty, but those who did not already have an email address needed a lot of help. These girls did not know where to go to obtain a free email address and had never heard of popular web mail services like Yahoo.com or Hotmail.com. With assistance these girls created their first-ever email account. Then, when they went to create their FREE user account, we learned that they still didn't understand that their email address must have a specific format, e.g., suzie@hotmail.com. (Two of the girls thought their email address was just the part before the @ sign.) At subsequent meetings we continued to help this group of girls with email. One couldn't remember what her email address was so she couldn't login, one couldn't remember her password, others

needed to be reminded about other functions. At the other end of the spectrum, there were two girls who immediately created their FREE user accounts and asked a researcher to take a digital photo of them to upload to their profile.

As a means of familiarizing girls with the web, we held an online “scavenger hunt” that instructed them to: 1) find answers to questions (Who invented the Frisbee? How did the idea come about?); 2) search for material of interest (Find a female engineer who created something you think is cool and describe her and her invention.); and 3) research the requirements for a college engineering program of your choice. It quickly became apparent that many of the girls did not know how to conduct online searches and were not familiar with search engines like Google or with developing search terms that would yield useful results. One of the girls made a comment during the activity that highlights her lack of familiarity and confidence with technology, “I’m just not good with technology; I just can’t do it.” Another source of confusion was terminology the girls encountered on web sites, particularly when searching for college requirements. For example, the girls were unaware that they were considered “Prospective Students,” and thus could not find the information they were seeking about entrance requirements and applications.

Of the girls who were familiar with the internet and attempted the scavenger hunt without assistance, almost all began with Ask.com. Once there, they quickly found out who invented the Frisbee, but they had more difficulty finding female engineers because Ask.com searches must be worded as a question about a specific subject, e.g., Who is _____. Once we suggested the girls use a more robust search engine like Google, they were able to find the information they needed. One of the girls struggled to find answers for the scavenger hunt even using Google, because she chose the Spanish version, which yielded different results than the English version. [Not clear why this was a problem; did we say there was only one right answer for each question?] Because we could not work one-on-one with each girl simultaneously, we realized that approximately half of the group spent time looking busy at the computer when in fact they did not seem to know what to do to complete the scavenger hunt.

Given the difficulties that half the girls exhibited, we were surprised to learn that more than 80% of the Southside girls reported having computers and Internet access at home. Unfortunately we did not ask them specifically whether (or how much) they *used* the computers at home. Our experience with the scavenger hunt exercise suggested that many were not very familiar with search tasks and did not have much experience navigating college websites.

The Blackberry data revealed other examples of Southside girls’ limited exposure to technology. Mirele is a Mexican immigrant who lives in a small apartment with her mother and her younger sister. In December 2007, Mirele and her sister begged their mother for an iPod music player, emphasizing that “everyone has one.” It was the only gift that they both wanted. However, when Christmas came and Mirele received the mp3 player she wanted so badly (it was even the latest edition with a color screen, movie compatibility, and a large memory), she couldn’t figure out how to put music on the

device. She sent a message to one of the researchers (TM) via her Blackberry asking how to use her new gift. The exchange went like this:

Mirele: “Hi TM. It's Mirele. I know this is not a BB or FREE question but I'm not sure who to ask. I got an ipod nano for Christmas and I haven't been able to put any songs on it. (Don't have internet at home and I can't download the songs on the school's or library's computers.) Do you need some sort of software to download songs? I asked one of my teachers, and she tried to help me, but she doesn't know anything about ipods. Can you give me any tips? If you can't that's ok.^-^”

TM: “Hi Mirele. What a cool gift! You need a computer with iTunes (a computer program) installed on it if your ipod is made by Apple. The computer also has to have an internet connection. Let me know if you can't find someone who has a computer with iTunes. I have it on my computer but I don't know what kind of music you listen to.

Let me know what kind of music/artists you like and I'll see what I have or will try to download them for you. Also, if you have music CDs that you want on it you can bring them to our meeting with your ipod and connector cable and I will put them on there for you.

Is your iPod made by Apple?”

Mirele: “^-^oh thank you!!!!!! I don't know anybody that has a computer with iTunes. My favorite type of music is modern rock. On the radio I listen to 93.3 FM. Also I absolutely like Chinese music, there is one Chinese song I really like it's called ““Tong Hua”” which means fairy tale. I also love J-pop (Japanese pop) and japanese anime theme songs. I also like the song ““Face Down”” by Red Jumpsuit apparatus. When we have a meeting I'll bring some other songs that I can't remember the title of right now. Thank you again^-^”

TM: “I'll make a playlist I think you might like (93.3 is my fav station too!). So at least you'll have something on it to listen to. If you bring a list of songs to the next meeting I will download them and put them on your iPod at the February meeting. Have a good night!”

Mirele: Thank you!!!!!! Good night to you too^-^”

From this point, at Mirele's request, TM began downloading extensive lists of songs to be uploaded onto Mirele's iPod and also her sister's. (At the time TM already subscribed to an online service that allowed her to download an unlimited number of songs off the internet. She explained to Mirele that it normally costs \$1 for each song downloaded.) After downloading more than 200 songs on top of the hundreds already on TM's computer that matched Mirele's musical tastes and facing repeated requests, TM had to tell Mirele that downloading the songs was time consuming and that she'd only have time to download 20 new songs before each meeting. Mirele took the news well and began emailing shorter lists of songs, lists that made exactly 20 requests. Her lists included the

exact titles of songs and the artists, which Mirele found by looking up the songs online at the library and then sending the names to TM via her Blackberry. This routine continued for the remainder of the project.

We also learned from the Blackberry data that groups of friends were using the devices to coordinate time on a computer (with internet) at someone's house. One wrote to a friend, "Are you done with your computer, so I can come over and use it for awhile?" Many of the girls depended on the Blackberries for internet access, as well as a way to contact each other. When talking to each other, the girls used the phones to talk about homework assignments, plans afterschool, and weekend outings to family functions, parties, movies and concerts.

In short, neither the students nor the teachers at Southside used computers or the Internet as a regular part of their classroom or school activities. Access to school equipment and the Internet was difficult, and students did not bring laptops from home. Even the researchers who followed school procedures to gain access and brought their laptops with them found it a challenge to use computers and the web at Southside.

Chavez. Chavez has 2 computer labs with approximately 20 computers each in the school library. These computers were reserved for teacher use, unless no teacher needed them. In order for us to use these computers for FREE meetings, we had to schedule them several months in advance. Like at Southside, students did not regularly use computers in class, and no one brought a laptop to school. As was also true at Southside and Aspire, access to most Internet sites was blocked at Chavez by district policy. The situation at Chavez was made worse by the fact that even .edu sites were blocked (inadvertently perhaps, but no one had corrected it); anyone trying to access an .edu site received a message that the site contained pornography.

According to the Chavez district policy, internet access is provided to promote sharing of educational resources, development of an innovative curriculum, and communication between faculty and students. Nonetheless, at one of our first FREE workshops at Chavez, and after submitting a special request (in advance) to gain access to the Internet and have a computer cart with LCD projector delivered to our meeting room, we were no better off than at Southside. We had not been told how to use the wireless internet on the laptop cart or that we would need another form of special permission to actually connect to the internet. The teacher in the classroom did not know how to connect to the Internet and made several unsuccessful attempts to contact the school's technology liaison. As it turned out, several different passwords were required to access the Internet, and only a few people at the school were aware of them. The technology liaison eventually arrived to help us, only to find that the sites and streaming videos we wanted were (further) blocked. Despite repeated attempts, we were never able to access the web to show videos, such as one about Engineers Without Borders (eventually burning a disc for this too).

Later in the year, we decided to show the girls the widely publicized video, "Nerd Girls." *Newsweek* had recently written an article about this all-female engineering group at Tufts University. As it turned out, the Nerd Girls website was label as pornography by the

district due to the word “girls” in the title. To watch the video we had to contact the technology person at Chavez who had to contact the district technology person and request a temporary lift from the policy restrictions. The district tech support person asked for a specific amount of time needed to lift the restriction (we requested 20 minutes) and the school tech person had to stay in the room to monitor the video and make sure it really was not pornography. We had to do the same thing at Southside to watch the short clip. At Aspire we were unable to get a tech support person to help us since the meeting was after school, but we ended up watching a similar video about the Nerd Girls on YouTube that wasn’t blocked because the word “girls” didn’t appear in the title.

As was true at Southside, some of the Chavez girls did not have a personal cell phone before receiving the Blackberry. [We need the figures on this for each school.] It became their main way of staying in touch with friends outside of school, talking to them on the phone, text messaging, or using the internet capabilities of the Blackberry to check and update their MySpace or FaceBook sites. The girls who only had Blackberries tended to carry them with them everywhere they went. Many of them also expressed how thankful their parents were that they could get in touch with the girls all the time. Stacy used the Instant Messenger function on her Blackberry to chat with her mom throughout the school day. Comparing all of the schools, the girls at Chavez used their phones the most during the school day. This was especially true for Stephe who sent hundreds of messages to her peers in the project. Whenever there were technical difficulties with the Blackberries, the girls without another cell phone would be the first to contact the researchers about the phones not working. They were always frantic. One time Iliana wanted to drive two hours round trip on a Saturday night to a researcher’s house to switch her broken phone with one that worked; she wanted to do this evn though the researcher had told her she could get a new phone on Monday. At the time Iliana didn’t have a house phone, so she depended on her Blackberry to communicate with friends, family, and her employer. According to her, it was her only way to “connect with the outside world.”⁵

Aspire. Aspire, the public charter school, had science and technology as a centerpiece of its educational mission. Its mission statement read: Aspire “is dedicated to providing a diverse student body with an outstanding liberal arts high school education with a science and technology focus.” No other school had anything like this. Every student at Aspire received a laptop computer to use at school and at home. Laptops were integrated into class work, and all homework assignments were done using them. At our first visit to Aspire, the girls immediately pulled out their laptops when we gave them a short task to complete. Email and web browsing skills that were difficult or unknown to girls at Southside and Chavez were second nature to girls at Aspire. In fact, the girls at Aspire were quick to teach the research team about “tricks” for conducting online searches, how to use html to post images on the FREE website, and how to use programs like Google

⁵ In contrast, the girls who had their own cell phones used the Blackberry to talk to other girls in the project and to access the internet because the Blackberries were more “internet friendly” than most non-smartphones. Many of the girls with personal cell phones left their Blackberries at home during the day and didn’t check them on a regular basis.

Earth and Google Sketch-Up. Although the students at Aspire were all issued laptops, the same district-wide internet policies applied, and websites like Nerd Girls were blocked. However, there was a full-time technology assistant at Aspire who helped students with their laptops and could instantly unblock sites like the .edu sites that were restricted at Chavez. In the case of the Nerd Girls video, the technology assistant happened to be gone for the day, so one of the researchers decided to search online for the video using the name of the professor that started the Nerd Girls group, rather than the name “Nerd Girls.” After a few attempts, an unblocked version of the video was found and the meeting was on its way.

Unlike the situation at Southside and Chavez, girls at Aspire had easy access to office equipment (Xerox machines, printers, paper) and even some specialized engineering equipment. For example, when the need arose to cut a thick cardboard tube, the girls marched down to the machine shop where three male students and a teacher were working. After walking in unannounced, without hesitation the girls approached one of the male students who was working at a saw with the teacher. She immediately asked him to cut the tube for her and then began joking around with him as she did with all her friends. Within five minutes of determining that the tube needed to be cut, the task was accomplished. Things like this never happened at Chavez and only once at Southside. In fact, if the researchers did not bring all the materials needed for FREE activities at Chavez and Southside, everyone would have to do without.

In sum, although surveys of the girls’ access to technology at home and its availability at school showed almost no differences across the three schools, girls’ familiarity, confidence, and pattern of regular use of computers and the Internet were much greater at Aspire than at Southside or Chavez. It appears that the schools were responsible, at least in part, for this gap. At Aspire, the public charter with a mission to promote technology, a small student body, and the wherewithal to get laptops for every student, the girls were well-practiced and proficient in technology. At Southside and Chavez, 2 “regular” public schools with large student bodies, the computer equipment was limited, its use was restricted, and many of the girls developed some proficiency only after receiving Blackberries and assistance from FREE. The girls at the three schools shared many demographic characteristics, but the schools they attended prepared them differentially and supported them differentially to take advantage of technology and the resources, connections, and capital it offers.

Course Offerings and Availability

Southside. Southside offers Advanced Placement (AP) courses which are “the equivalent of introductory college courses that provide opportunities for high-achieving students” and accelerated classes (X classes) or “advanced classes designed to challenge students intellectually, foster critical thinking skills, and prepare students to take AP level classes,” according to the Course Planning Guide obtained from the school counselor. Weighted grades take into account the “additional efforts and learning required in X and AP classes.” Some of the X courses offered are specifically for students in the English Language Acquisition (ELA) program. The ELA-X courses include Geometry,

Geography, Earth Science, and Biology. The twenty non-ELA X courses currently offered at Southside are: Introduction to Literature and Comprehension, American Literature and Comprehension, British Literature and Composition, Algebra Advanced 2X, Geometry, Pre-Calculus, Biology, Chemistry, Earth Science, Physics, Ancient History, Medieval History, Geography, Spanish Reading Comprehension, as well as Chinese, French, and Spanish 3X and 4X. Southside also offers the following ten AP courses: Studio Arts, English Literature, Calculus, Physics, Biology, U.S. Government, U.S. History, European History, Spanish Language, and Spanish Literature. Other advanced courses like Computer Science X and Trigonometry X are listed in the Course Planning Guide but weren't offered at the school during our study. Any engineering-related courses, aside from the math and science classes listed above, were offered through the Career and Technology Education (CTE) [vocational] program and included classes like Technical Applications, Computer Aided Design/Drafting Technology, and Advanced Wood Technology.

According to an academic counselor at Southside, all students take the PSAT to determine eligibility for AP courses. Counselors receive a list of students who could potentially receive a 3, 4, or 5 on the AP exam and encourage those students to take the AP course(s). Students may also enroll in AP courses with a teacher recommendation, counselor recommendation, or by parent or student request. All of the Southside girls, but one, who continued in FREE after Summer 2007 were taking AP and X courses. Most had enrolled in two or three X courses per semester since grade 9 and two or three AP courses during grades 11 and 12. The following schedule is for Lizbeth, a "typical" Southside participant in FREE. (Southside is on a semester system and all courses are usually one year long and worth 5 credits.)

Grade 9:

- AA CTE Web Design - community college credit
- Biology X
- English Seminar
- Geography X
- Geometry X
- Introduction to Literature and Comprehension
- Introduction to High School P.E.

Grade 10:

- AA CTE Accounting - community college credit
- AA CTE Technology Applications - community college credit
- AA CTE Technology Research – community college credit
- Algebra X
- American Literature and Comprehension X
- Ancient History X/Medieval History X
- Chemistry 1X
- French 1

Grade 11:

AP European History
British Literature and Comprehension X
Physics X
Spanish Reading Comprehension X
Trigonometry/Pre-Calculus X
CTE Bakery/Deli/Catering
CU Succeed/AVID
Student Leadership/Student Council
Teacher Supported Study Hall

Grade 12:

AP Literature
AP Physics
AP U.S. History
French 2
Civics
AVID
Student Leadership
Student Assistant

Do we have AP scores for FREE students at Southside?

Chavez. When we asked a guidance counselor about the AP and other advanced courses offered at Chavez, she printed out a “school profile” sheet that listed nine AP courses and said, “We don’t have a course catalog, that’s all we have.” The AP courses listed on the sheet were Calculus, Statistics, Biology, Chemistry, World History, U.S. History, Art, Literature, and U.S. Government. Scheduling for AP courses was determined by student course selections (preregistration) in April. Students could self-select to be in AP courses or they could be recommended by a teacher, counselor, or parent. The counselor also said that the school didn’t offer any accelerated courses and that the only honors courses offered were Honors English 9th, 10th, and 11th grades and Honors Science 9th and 10th grades. The high school also offered some engineering-related courses like Drafting, Engineering Explorations, and Wind Ensembles. The vocational school at Chavez offers more engineering-type courses like Introduction to Engineering, Computer Repair, Auto Repair, and Machine Shop. The following is Stephie’s schedule, a “typical” FREE participant at Chavez High School.

Grade 9:

Geometry/Algebra II
American History I
Honors Chemistry
Honors Language Arts
Honors Physics
Honors Earth Science
Honors Engineering Explorations
Civics
Computer Repair

Machine Shop I
Marching Band

Grade 10:

College Algebra/Trigonometry
Honors American Literature
Honors Biology
Honors Issues in Society
Honors Creative Writing
World Civilizations
Health
Wind Ensembles
Computer Applications
Weight Training/P.E.
Marching Band

Grade 11:

AP Calculus
AP Chemistry
Honors English
Honors World Literature
Spanish
History of Southwest and Mexico
Science Fiction Literature
Relationships
Weight Training/P.E.
CSAP Test Prep (Math, Reading, Science, Writing)
Student Council

Grade 12:

Community College – English Composition
Community College – Survey of Algebra
AP Statistics
American History I & II
Food & Nutrition I & II
Geography
Machine Shop II
Wind Ensembles I & II
Cross-Cultural Studies
ACT (Math, English, Science, Reading) Test Prep
Marching Band
Team Sports

All of the Chavez girls who remained in FREE were enrolled in honors courses during grades 9-11 and AP courses during grades 11-12. Of the 14 enrolled in AP courses during their junior year, only 8 chose to take the AP exam(s). Of those who took the test,

all received a score of 1 on all tests taken except Stacy who got a 1 on U.S. History and a 2 on U.S. Government and Aerith who got a 2 on both tests.

Other points to make about Chavez: (1) Some senior Chavez girls were taking Nutrition for the third time because it was the only elective available there; (2) A number of senior girls, including Stephanie, started to take college prep English Composition and Survey of Algebra--not offered at Chavez--at a nearby community college, but had to stop attending when the bus to transport them was cut from the budget. (3) One girl had to take Machine Shop for the second time when she could no longer attend the community college course.

Aspire. Every course—required and elective—offered at Aspire is a college prep course. Aspire requires every student to tackle “four-years of high school math through Pre-Calculus—regardless of their math level when they enter in the 9th grade—and five years of laboratory science. There is no remedial track at Aspire.” Graduation requirements at Aspire “well exceed Colorado’s higher education entrance requirements.” According to the student handbook, Aspire “has created a high-accountability culture where doing your best in your classes is expected and doing well in school is ‘cool.’” All students at Aspire complete the core curriculum, and many also complete advanced (X and AP) courses. Advanced courses include—Integrated Algebra/Geometry 1 & 2 Honors, Pre-Calculus Honors, AP Calculus, Biology X (can take AP test), American History X (can take AP test), AP Spanish, AP Chemistry, AP Computer Science, AP Physics and Engineering, and Biochemistry and Biotechnology. Students can also pick from electives like Creative Design Engineering Class, Philosophy, Newspaper, and Art. As at the other schools, students can chose to take AP classes and other advances courses or can be recommended by a teacher, counselor, or parent; however, students must have taken specific prerequisite classes in order to enroll.

The school year at Aspire is broken into trimesters, but students take the same classes for all three terms, and they receive one final grade for each class, which is an average of the trimester grades. The following is Mikey’s schedule, a typical student at Aspire.

Grade 9:

- Engineering Models
- Physics 1
- Math 1 (and Math Seminar)
- Spanish 1
- Studio Art 1
- Humanities 1
- Yoga

Grade 10:

- World Literature
- World History
- Creative Engineering
- Bioethics
- Chemistry 1

Math 2
Spanish 2
Ethics and Philosophy
Yoga

Grade 11:

Biology
Earth Science
American Literature
American History
Math 3
Spanish 3
Film
Colorado Uplift
Internship
Yoga
Independent Study

Grade 12:

Fifteen of the girls at Aspire were taking honors and AP courses, but only four opted to take the AP exam. Two girls scored a 2 on..., 1 on the biology test and 1 on the Spanish language test. Two other girls, both native Spanish speakers, also took the Spanish language test. One scored a four and one scored a five. According to the counselor, many students won't take the AP tests if they don't feel confident of a score of a three or higher.

Other points to make: (1) Aspire offers engineering-related electives like Creative Engineering and AP Physics and Engineering, although these courses are not always available; (2) Aspire hires Ph.D's from industry to teach electives for a trimester, e.g., biotechnology, nanotechnology; none of the other schools do this; (3) Aspire adopted the "physics first" philosophy which requires all 9th graders to complete a "research-based best practice," hands-on inquiry-based laboratory course. The teacher is a PhD engineer and professor at a local university. Physics is taught to 9th graders so teachers in higher grades, particularly in math and science, can integrate instruction across disciplines. This is in sharp contrast to the physics course at Chavez where the teacher relied on videos of another teacher lecturing about physics for almost every class session; (4) Aspire requires all juniors to do an after-school career internship in which school personnel help students find internships related to their career interests and students must prepare reports about their internship experiences; meanwhile students at Southside and Chavez are working after school at Taco Bell or retail outlet stores (Aspire does not "allow" students to work for pay.)

Although the girls at all three schools were strong students as measured by their grades and list of advanced courses taken, the girls at Aspire were getting a very different curriculum than those at Southside or Chavez. While all the courses at Aspire are college

prep, only some are at Southside and Chavez. While Aspire insists on course schedules that exceed those required for college admission, Southside and Chavez do not. While Aspire students are offered “advanced” courses in subjects like engineering and biotechnology taught by Ph.D.’s at the school, Chavez students get AP Physics from a video of a teacher in Hawaii and have to travel to a local community college to get basic college-prep English and math. When the district’s transportation budget is cut, they cannot attend at all. While Aspire students are learning about professional jobs matched to their career interests during after-school internships, the students at Chavez and Southside are working at low-wage, service jobs. Interestingly, girls at all three schools scored poorly (or expected to score poorly) on AP tests (except in Spanish), but the college-going curriculum emphasis at Aspire is still demonstrably strongest. As was true in the case of technology, the curriculum emphasis at Aspire gives the students there access to resources—in this case related to college admission—that the other students do not get.

Counseling and Advising

Southside. Only a few parents or older siblings (more at Aspire than at the other schools) knew much about college requirements and expectations, and even fewer were described by the girls as sources of information about college [check this from Social Network survey]. Thus girls at all 3 schools were heavily dependent on the school for this type of social and cultural capital.

At Southside counselors were assigned to students by grade level, so students had a different counselor each year. The counselor to student ratio by grade is as follows- 9th grade, 1:400; 10th grade, 1:375; 11th grade, 1:320; and 12th grade, 1:250. Mr. McMillian, the 10th grade counselor at Southside when FREE began, helped us to select the participants during their sophomore year and continued to help us with the project by reserving meeting space (classrooms and computer labs) for our monthly workshops, reserving and delivering meeting supplies like LCD projectors and speakers, sending out meeting reminders to each participant the morning of the meeting, checking in to make sure things are running smoothly, collecting and disseminating research materials like surveys, providing us with information about the participants, and even accompanying us on field trips. Mr. McMillian was a lifesaver for our work at Southside, going out of his way to accommodate us and to continue to advise our girls through their senior year, even though he had a full load of new sophomores every year. He also attended our final celebratory event where the girls showed off their projects.

Southside also offered a variety of other counseling and “college prep” opportunities. Housed within Southside is one of the district’s ten Future Centers. The goal of the center is to “enhance the college going culture in [the district’s] public high schools” by assisting students with career explorations, finding college prep programs, college application assistance, financial aid and scholarship applications, and completion of standardized test like the SAT and ACT. Each center has a full-time coordinator that can provide “expert college advising services to help students better understand their options and learn the academic requirements and programs offered by colleges across the

country.” At the start of the girls’ senior year we asked how many of them were taking advantage of this great resource. Only three girls knew it existed, and only one, Liz, the highest ranked student in the senior class, reported ever having been there. After hearing about the Future Center from us and other college prep programs operating at the school (see below), other girls started going, primarily to use the computers in the Center to complete their college applications (the only sanctioned use of these computers).

The Southside girls in FREE differed in how they took advantage of the counseling programs offered. Some, like Mirele who was shy and very quiet, seemed to rely on only a few sources: FREE, the 12th grade counselor, and Mr. McMillian. Mirele’s mother and younger sister are her only family here in the United States. Her mother attended school in Mexico and isn’t familiar with the American education system. Although Mirele’s mother can’t assist her with the college application process, she has told Mirele that she wants her to go to college. She also tells her that she doesn’t care what field she goes into as long as it makes her happy. In contrast to Mirele are girls like Teresa, Liz, and Adilene who participated in multiple “college prep” programs offered at Southside: AVID, CO Uplift, DSF, GEAR UP, Pre-Collegiate, TRIO Talent Search, Upward Bound, and others. Participants in these programs have numerous “scheduled” times set aside at school for academic advising and assistance with career exploration and college applications. For AVID, students enroll in a class described as an “in-school academic support program for grades 9-12 that prepares students for college eligibility and success.” It is designed for students with “college potential” who take “X” and “AP” courses.

When planning for our final year of FREE (AY 2008-2009 when the girls were seniors), we contacted the academic counselors at each school to inquire about how we could best assist the girls in the post-high school planning process. Mr. McMillian welcomed and expressed appreciation for any additional help we could provide with the college application and scholarship process. He said that at such a large school it is difficult for the 12th grade counselor to provide students with individual assistance and that many students don’t take advantage of the Future Center. He also put us in contact with the coordinator of the Future Center, and she agreed to help us “any way possible.” At the first meeting of the year we polled the girls to see what they wanted help with. Many reported that they had started the college application process under the direction of another program but still wanted help finding college programs, program requirements, applications, and application requirements online. They also wanted assistance with writing their college essays, getting letters of recommendation, creating a resume, filling out applications, and applying for scholarships. We helped many of the girls with a number of these things over the course of the next few months, while other girls were always one step ahead of us due to their scheduled advisory AVID class period. At the October meeting following the “how can we help you” meeting described above, three of the girls arrived with typed resumes they had created in AVID and requests for letters of recommendation from us. All of these girls continued to participate in our workshops as well as AVID and perhaps other groups until they hit the “Send” button on some of their college applications.

Some cases at Southside (and the other schools as well) required special time and attention because the girls were not legal residents of the U.S. Their status seriously limits the number and kind of schools these girls could apply to and the financial aid that they could apply for. The school district's official policy on immigration issues is "don't ask," so teachers and counselors do not provide students with the necessary information unless an individual student reveals his/her status. For obvious reasons, many students were afraid to do this and wasted valuable time on applications that would never be considered. Perhaps because we often had more time with the girls and knew them better than the school personnel (our researcher to girl ratio was approximately 1:3), we tended to hear about immigration concerns, and in most cases we were able to provide some assistance.

Chavez. The counseling situation at Chavez was similar to Southside, although Chavez did not have a Future Center. Like at Southside, the students at Chavez were assigned to a counselor by grade level and had a different counselor each year of high school. The counselor to student ratio is approximately 1:350 at Chavez, and the counselors there appeared (to us) to be more stressed and overwhelmed than those at Southside.

When we contacted the school principal at Chavez and asked about the possibility of conducting some college prep workshops with the FREE participants when they were seniors, he suggested that we talk to Ms. Smith, the senior counselor. She replied to say that the students at Chavez already had plenty of help with college applications, writing entrance essays, requesting recommendations, and applying for scholarships. She didn't think that they needed any of the services that we were suggesting and didn't offer any new ideas. As we did at Southside, we decided to ask the girls during the first meeting of the year "how can we help you with your post high school plans?" One of the top students in the school, also a participant in Talent Search (another college prep program), said that she was having trouble finding the online applications. She spent the summer with Talent Search visiting prospective schools, but apparently she never learned how to navigate college websites. Another student told us that she needed help with "everything" and didn't know where to begin. Some of the girls had an idea of the schools they want to apply to but didn't know when the applications were due or what was required to apply. In September of their senior year, none of the girls had started writing the college essay, and some were planning to apply only to schools that didn't require an essay.

[Finish Chavez, add Aspire]

Aspire. [Need the same kinds of data and topics as above, and note the following differences: (1) School schedule includes twice a week "advisory" (describe what this is) from frosh - senior years (12-15 students for 50 minutes each time)—planning and advising for college. (2) All students required to have a digital portfolio for college, started in advisory. (3) Counselor is frantic about getting ALL (100%) students into 4-year college; school holds mandatory after-school tutoring sessions during senior year to assure preparation for college work (and tests?). (4) Students write college essays in English class, prepare scholarship material in another class. (5) School requires parents

come to an evening presentation devoted to completing financial aid forms (they do this together). (1-5) are required/expected part of curriculum, done as common tasks of students, teachers, counselors, and parents. (6) When asked about FREE offering more counseling, the Aspire counselor said: “We don’t need to do that; all the resources are here already... They don’t need help with applications... they need help with the social transition to college.” In general, this was true of the Aspire girls, although some did ask us for help to rewrite a college essay (due to change in plans, desire to polish), to better understand an application, and to get more information about scholarship money. (7) Same issues re immigration status here, so those students again disadvantaged compared to others.]

In summary, the girls at Southside and Chavez did not seem to feel pressure to take college preparation seriously until their senior year, while those at Aspire were forced by the school to begin their preparations in 9th grade advisory and to continue them every year after that. Aspire had a stated goal to get 100% of its graduates into a 4-year college, and the school repeatedly emphasized that goal to students, teachers, counselors, and parents. Students who did not seem to be on track were held back a year or dismissed from the school. At Southside and Chavez, both much larger schools with much higher counselor-to-student ratios and nothing comparable to Aspire’s advisory periods, teachers, counselors and students took a less intensive approach that resulted in late moves (compared to Aspire) to implement college plans.

The early start that Aspire students got with college counseling and preparation was amplified by the more extensive use of technology and the greater availability of college-prep course offerings at the school. Along with the early start, Aspire students developed computer and Internet proficiencies that enabled them to access college websites and online applications earlier than the others. Without the Blackberries, some girls at Southside and Chavez might not yet have these skills. This could never have happened at Aspire. Also at Aspire, students could only take college-prep courses and had to take enough math and science courses to meet college admission requirements. This was not the case at Southside or Chavez, where the high school graduation requirements were lower than the admission requirements for many colleges, an important fact that some students did not realize.⁶

Conclusion

Inequality does not just happen; it is produced. In this case, it is not being produced most directly or saliently by race or income category; it is being produced by education. Many of the girls we have worked with in FREE came from similar class and family backgrounds in terms of access to capital, but the high schools they attended clearly differentiated them in important and consequential ways. The girls at Aspire became practiced in using computers and the Internet in the way of adults who are members of the college educated and professional class; the girls at Chavez and Southside did not. The girls at Aspire could take courses in specialized topics, e.g., nanotechnology and robotics, taught by Ph.D’s at their school, while the girls at Chavez and Southside had no

⁶ All 3 schools met the state high school graduation requirements.

such opportunities. When the Chavez girls took “advanced” courses at the community college, they did so to get high-school courses not offered by their school, and even then, they could not finish the courses because funding for transportation to the community college was cut. The girls at Aspire spent 50 minutes, every day for 4 years, in small advisory groups where they received guidance counseling and college- and career-related assistance from a trained professional. The girls at Chavez and Southside had one counselor for approximately 300 students, with a different counselor assigned to their class every year. In these ways (and probably others), the girls at Aspire gained considerably more economic, social and cultural capital with implications for pursuing engineering and even college, despite the same supplemental services provided by FREE at each school.

FREE worked differently and succeeded differently for the girls at Aspire compared to those at Chavez and Southside. Girls at Chavez and Southside got a boost from FREE primarily because we helped them develop computer skills and we provided guidance counseling that they probably would not have gotten otherwise. The girls at Aspire got a boost because we added a distinctive element to their preparations and resumes for college. Both types of enhancement are worthwhile, but existing conditions at Aspire amplified the effects of FREE—where the school could support, extend and help to sustain an interest in engineering through its coursework offerings and guidance activities--in ways that the other two schools could not. The girls at Chavez and Southside were left much more on their own to figure out how to pursue engineering if they “wanted to.” Even if every girl in FREE decided she wanted to pursue engineering, those at Aspire have much more capital to do so than those at Chavez and Southside.

In his 2007 book, *Categorically Unequal*, Douglas Massey quantitatively demonstrates that income inequality went from stark divisions based on gender and race in the 1950s to new foundations based on class (as measured by years of education) by 2000. He argues that the consequences of race and gender now operate *through education* in a way they did not before the end of the 20th century. The stories of Southside, Chavez, and Aspire illustrate some of the ways this form of inequality is being produced on the ground in the lives of today’s young people.

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