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Early Introduction of Computer Science Education in Minority Youth: A New Representation of Tomorrow's Engineers?

Jordan E. Arnold
University of San Francisco, jearnold328@gmail.com

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Jordan Arnold
MPH Candidate 2017
University of San Francisco

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Abstract

Computer Science (CS) has a large underrepresentation of females and racial minority (Hispanic and African American) populations in today's education intuitions and workforce. Public health workers and companies have reviewed the consequences of this underrepresentation. Although a promise to incorporate more STEM education in schools the large gap is still prevalent. The Google Code Corps (GCC) is a partnership between The Boys & Girls Clubs of America (BGCA), AmeriCorps, and Google with a symbiotic goal to impact minorities and low-socioeconomic (SES) communities through education, mentoring, and capacity building. GCC project aims to empower BGC members by developing a successful and sustainable CS program. The completion of GCC year-one findings resulted in more ethnic minorities partaking CS classes and an overall increase in CS concepts. In summary, 44% of BGCSV participants were female and 70% were ethnic minorities. Students who partook in classes felt they could have a career in computer science. Furthermore, staff demonstrated a feeling that CS First was an easy and well-structured program. Multiple internal and external factors including allostatic load and a leaky pipeline contribute to a large underrepresentation of minorities in CS. Implementing CS education early and through multiple layers of the Social Ecological Model (SEM) shows promise for an increased interest. Programs like the GCC can create long-term improvements and set up student success through capacity building activities. However, proper mentorship and continuing assessments and motivating are necessary for overall program success and creating a sustainable impact on both minorities and the CS workforce.

I. Introduction

Computer Science (CS) has a large underrepresentation of females and racial minority populations in today's education intuitions and workforce. In the past decade there has been a promise from technology companies and organizations to narrow this gap (Hodari, Ong, Ko, & Smith, 2016). However, research shows that this is not constantly true, especially with computer science careers. CS minorities are defined as women, African Americans, Hispanic or Latino, or mixed race. According to Beyer, CS is the only STEM career where the participation from females is decreasing (2014). The article *Learning and Individual Differences, Learning and Individual Differences,* stated only 23% of all STEM workers are female and only 12% are Hispanic (Han, Capraro, & Capraro, 2016). Furthermore, only 4% of CS students are African American, with only 2% of the engineer workforce, showing a greater problem (Mone, 2017). Computer Science and STEM (science, technology, engineering and math) discrepancies are related to social, economical, cultural and institutional frameworks; often referred to as a systematic or pipeline problem (Mone, 2017). Segregation, as a consequence of racism, has created unequal access to education, employment opportunities, and SES indicators. Although racism alone is not a conquest of health, research shows an association through a causal pathway (Williams, 1999). While, high income has been associated with better health outcomes, children, who live in poverty in the United States, are mostly African American's, American Indians and Hispanics. Children with parents from who have lower educational attainment are more likely to not have health insurance, creating poorer health outcomes and detection (University of Minnesota [Minnesota], 2013). Lifespan is also affected by socioeconomic status. According to Williams, health and lifespan are different among white and African American men as well as income (1999). Black men of a high income live 7.4 years longer than those in poverty, blank women are 3.8 years apart, but both have lower socioeconomic status (SES) and life expectancy

than white counterparts (1999). Pure races, in terms of genetically homogeneous population, do not exist, but we still capture differences; there is more genetic variation within racial groups than between them. In the US, races more differentiate between power, status, and resources (1999). Racism and stereotyping are other factors that effect minority health and those of a low SES. African American and other minority families are more associated with poor neighborhoods and schools, creating limited education opportunities. Lastly, people who tend to experience racism are more likely to have psychological problems such as distress, stress, and substance abuse (Minnesota, 2013).

As summarized, low socio-economic status (SES) is associated with increased mortality and morbidity rates, but the mechanism of this connection is less understood. SES includes factors related to income, education, the lived environment and other factors (Dowd, Simanek, & Aiello, 2009). The leaky pipeline-stem theory provides one explanation of why minorities who may enter the CS field do not sustain for long. This can begin at an individual, intuitional and community level of the ecological model. Discrepancies include an unsupportive work environment and social micro-aggressions (Hodari, Ong, Ko, & Smith, 2016). Negative self-image and perceived poor efficacy from minorities often arise from predetermined issues (Beyer, 2014). From an institutional level, poor academic achievement of minorities in schools often stem from individual and social factors (Han, Capraro, & Capraro, 2016). Furthermore, English as a second language, communication skills, and low-economic status can affect academic achievement (2016). Lastly, a lack of opportunity to implement CS at a young age, or schools which do not view CS as part of a core curriculum, attribute to the lack of minorities and females in CS programs (Lee, 2015). Changes need to be made on a systemic level between schools, boards, teachers and parents (2016); this is part of a nationwide problem

where the US is overall low in math and science scores (Mardner, 2012).

An economic disadvantage already exists between racial minorities. According to Williams, urbanization and industrialization along with race play a role in lob loss, wages, and skill variations (1999). Industrial jobs and plants also create low-wage and high-risk jobs for low SES and minority communities, creating another economic disadvantage. Computer science careers can lessen the wage gap and create new opportunities for traditionally disadvantaged communities (1999). Code.org (as cited in *Google*, 2016) identifies CS and one of the highest paying career opportunities, including the second highest paid college degree. Also, there is a large gap between the demand of CS and programmer jobs and the percentage of CS specific STEM degrees; 530,000 open CS jobs, 71% new jobs are STEM and 3.5 times a demand in California specifically. Besides for financial implications careers in engineering will help with communication, environmental, and communication (Mardner, 2012). Many successful programs with CS and students have seen increased vocabulary, problem solving, teamwork and higher self-efficacy (Mouza, Marzocchi, Pan, & Pollock, 2016). As previously mentioned, there is a large gender gap in engineering fields, CS education from a younger age help elevate this gap (Tsan, Boyer, & Lynch, 2016).

Background

Computer Science (CS) or programming has a large underrepresentation of females and racial minority populations in today's education intuitions and workforce. According to Code.org (as cited in *Google*, 2016), only 3% of the CS job market is made up of minorities (Appendix E). Public health workers and companies have reviewed the short term and long term consequences of this underrepresentation since the technology boom. A lack of variety for CS workers take part in all layers of the ecological model, and therefore solutions should encompass multiple levels as well. Although a promise to incorporate more STEM education in schools to target minorities and support to prevent a leaky pipeline are promised. Narrowing the demographic gap in CS and STEM careers has been a major objection of many companies, but the promise of growth for woman of color had not been represented (Hodari, Ong, Ko, & Smith, 2016). Narrowing the CS gap is crucial for success of upcoming industries and generations. Code.org (as cited in *Google*, 2016) predicts that by 2020, over 1 million computing jobs will be available and only 400,000 CS students are projected. Overall, CS careers are both high paying and high demand; creating a $500 billion opportunity (Appendix G).

Individual:

Stereotypes, interests, and values can impact self-efficacy with computer science skills, impacting the STEM pipeline and female CS dropout rates (Beyer, 2014). Woman in the technology workforce are portrayed as communal, emotional and caring about others, which affects their acceptability in STEM and explains why many women do not consider engineering careers. (Mardner, 2012). Furthermore, English as second language effects academic achievement, as well as problem solving and communication skills (Han, Capraro, & Capraro, 2016). Racial minorities may have to work full time and can be exhausted, minimizing their

extracurricular activates and impacting their resume (Mone, 2017). The combination of a hard workload, demanding classes and constant stress can impact a students or workers progression. Furthermore, the concept of an allostatic load helps identify stressors on minority's health. Researchers use a weathering hypothesis to conceptualize the physiological burden from long term stressors of being a minority or female over time. Individuals with a high allostatic load have greater negative health consequences, including high blood pressure, cholesterol levels, and poorer mental health (Geronimus et al., 2006).

Interpersonal:

CS culture is often looked at as intelligent men of a white or Indian background, introverted and techy. This too is a stereotype that limits both individuals and companies for potentially new innovations and jobs. Interpersonal orientations begin with students and are often based off gender, male dominance and overall impacts social justice of the CS career gap (Beyer, 2014). However, community settings have created programs the change the social injustices and stereotypes of the programming community. Many after school community based programs use role models to create social opportunities and build capacity for female STEM students (Koch, & Gorges, 2016). Isolation, discrimination and gender differences tend to keep woman away from CS careers (Mardner, 2012). Moreover, in the workplace, women who excel in engineering may be criticized by peers or made feel in superior. Support groups and programs such as Women Who Code or STEM Cheerleaders help empower female computer scientists both at the workplace and in schools (2012). However, some argue that this can furthermore heighten the view of women programmers as weak and needed special or different treatment than their male counterparts (2012.)

Organizational:

Educational institutions and businesses need to appraise, implement and evaluate current tactics that aim to include underrepresented groups into engineer programs. Economic imbalances and social justice issues heighten the CS gap, and women are affected more. Furthermore, exams, instructors and current educational programs do not set up all students for success (Beyer, 2014). Currently, less than half of the states count CS classes towards high school graduation, underlining an intuitional and education board's need to view engineering as a serious educational program (Code.org, 2017). Furthermore, less than 3,000 of the 1.6 million A.P. Exams are taken by minorities taken (Appendix I). Workplace environment should help improve women of color and collogues quality by offering support, diminishing sexism, and preventing micro-aggressions or victim blaming (Hodari, Ong, Ko, & Smith, 2016) However, some strides have been made to connect more varying populations to programming. Currently, Google offers a social encouragement, self-perception, and academic exposure career perception to build capacity through multiple platforms (Koch, & Gorges, 2016). Furthermore, Berkley, Stanford, and other universities revamped CS coursed to be more appealing to females (Mardner, 2012). Implementing pedagogical practices with STEM lessons can create positive CS skill development, creating a positive attitude and diminishing the gender gap with CS (Mouza, Marzocchi, Pan, & Pollock, 2016).

Community:

According to code.org, 91% of parents want their children to learn CS in school or after school programs (Code.org, 2017). Technology companies such as Google and Apple aim to increase CS education and computer literacy in youth as well (Lee, 2015). Specific communities already implement CS education as a standard; however branching out to other, underserved

communities is the goal. Hispanic ethnic groups have the largest growing high school drop out rates. They are also heavily underrepresented in CS and minority students are more likely to attend an impoverish school than their white counterparts (Han, Capraro, & Capraro, 2016). Luckily, minority participation in CS is increasing due to supporting programs and universities, but still, racial minorities exist because there is a systemic issue that begins within community norms. Urbanization and industrialization, along with race, play a role in lob loss, wages, and skill variations. Industrial jobs and plants also create low-wage and high-risk jobs for low SES and minority communities, creating another economic disadvantage, compared to engineering careers that are low-risk and high pay. Overall, racial differences and discrepancies are a reflection of policies and a system that sustains inequality (Williams, 1999). Programs to mentor youth and students to stay with CS, creating digital support an example being Code 20140 for African American students (Mone, 2017).

Policy:

In one study, a project-based learning format, with STEM education, created higher testing scores and possible less student dropout (Han, Capraro, & Capraro, 2016). Other findings showed, CS courses in high school were as effective as math and science to influence STEM careers for students (Lee, 2015). Current HS curriculum is contemporary and chose by policy makers, teachers and principals (2015). For most education intuitions, CS is an elective and non-core class in schools (2015). Gender discrepancies can begin before the age of 10; implementing CS between K-5th grades can increase usability and minimize misconceptions about engineering (Tsan, Boyer, & Lynch, 2016). Throughout history, minorities and women have been summarized as inferior. Although systematically improving, there are still regulations that maintain this discrimination (Williams, 1999). Furthermore, a lack of standardization of "at risk" student

definition can create difficulty quantifying what policed need to be met (Tsan, Boyer, & Lynch, 2016). Historic examples of discrimination include the Three-fifth Act, slavery, Immigration Laws and Indian Reservations. Racism in the US can be summarized as an inferiority ideology that often leads whites at the top and can justify unfair treatment, leading to negative beliefs and prejudices, many of which still exist today (2016). The system of proprietary social factors and racism affects the health of minorities through specific physiological mechanisms or allostatic load.

Although the underrepresentation of minorities and women in CS has been addressed on all levels of the ecological model, and issues and strategies have been identified, a greater intervention is still needed. I would like to further research individual and policy factors that effect CS and engineering fluency. Furthermore, incorporating my own data and personal experience working with the Boys & Girls Clubs of Silicon Valley could be an asset to better understand the tech pipeline issue with females and the allostatic load of minorities. The reviewed article has mixed reviews on what strategies were successful to decrease the minority gap in CS careers. However, there is a fairly strong consensus that academic, systemic, workplace and interpersonal approaches must be implemented. These will help create self-efficacy for youth and decrease stereotypes about coding. Furthermore engineering education should be implemented at a young age. Some strategies have shown success in increasing capacity, increasing or maintaining interest with computer science programs. While others find interest in CS is equal between gender and races when implemented at a young age. Due to the interdisciplinary forces that effect CS and STEM education and acceptability I think more research needs to be done; there is not one effective method. I would also like to look into other

successful projects, non-relating to CS and STEM education to use as a possible guide for decreasing the gap.

Google Code Corps and the computer-coding platform CS First offer a free versatile curriculum that can target youth anywhere. This program has been utilized by thousands of clubs; for the Silicon Valley we have provided over 2000 hours of coding to 500 youth. More so, CS First aims to increase confidence, instill courage, grow perseverance, provide a sense of belonging and overall create a positive impact (*Google,* 2016). This program allows for anyone to flexible CS education in schools, after school programs, or at home. Although the program may be simple, education needs to be entertaining and capture attention of the pupils. My project aims to sustain CS education by collaborating with Google and other companies directly. Code.org, Scratch, and local companies all help ensure that students have fun while learning to code. We also recruit and train volunteers to motive and inspire students Code Corps currently has an 80% retention rate with community and tech volunteers (Appendix H). In summary, a need to involve minorities, females, and youth with CS and engineering is a must, but for sustainability the leaky pipeline must be addressed. Programs like CS Fist connect with multiple levels of the social ecological model in a fun and sustainable way.

II. Scope of the Project

The Google Code Corps Volunteer Specialist (GCC) role is a partnership between The Boys & Girls Clubs of America (BGCA), AmeriCorps VISTA, and Google, each with specific missions and philanthropic goals. However the overarching theme is to positively impact minorities and low-socioeconomic communities through education, capacity building, and sustainability. The Boys & Girls Clubs of Silicon Valley (BGCSV) offers services to the San Jose and surrounding low-income families by providing outstanding childcare and other services. BGCSV was founded in 1944, and offers innovative, effective, and compassionate after school and summer enrichment programs for low income, high-risk youth. Furthermore they provide families services including healthcare, scholarships, and events. The mission of BGCSV is to inspire and empower all young people, especially those who need us most, to realize their full potential as productive, responsible, and caring adults.

BGCSV has fifteen full-time employees including admin staff and unit directors and has fourteen board members to allocate donations, network and promote the clubs. They also employ numerous students and community members to provide direct service. Furthermore, BGCSV aims to incorporate pedagogical practices and structured curriculum to provide the highest quality of services to members. The core programs offered by BCGSV include arts, lifestyle, education, sports and technology. Other services that cultivate capacity building and absence of security for members including health services, mentoring, academic support, field trips and more. My role as a Google Code Corps Volunteer Specialist was mostly a combination of administrative work,

computer education and building sustainable partnerships. However, the daily pedagogical practices motivate future capacitates through events, fieldtrips, connecting tech mentors and other sustainability activities.

Google Gives or Google.org is the charitable part of Google and aims to fund technology, data, and user-centered design to make a better world, faster. The main goal of Google Gives' is to support nonprofits in their effort to tackle society's greatest challenges, making our community stronger. Google.org was founded in 2005 and provides grants to technology, health, community, and education: totaling over 100M dollars in grants, 200,000 hours and $1 Billion in products. A majority of Google's services are free for the public with the aim to crate a lasting global impact. Their education platforms include, Made With Code, Google Science Journals, CS4HS, CS First and many others. Google Code Corps utilized many of these services, but the primary tool for capacity building is CS First, a computer science curriculum designed for after school education. This platform allows for educators, teachers, parents, and volunteers to lead students through fun and self paced coding education lessons. Google and MIT provide the classes, materials and lesson plans.

AmeriCorps VISTA (Volunteers in Service to America) was founded in 1965 and is a government-funded service that aims to fight poverty in America. The overarching mission of VISTA is to building the organizational, administrative, and financial capacity of organizations that fight illiteracy, improve health services, foster economic development, and otherwise assist low-income communities. Around 8000 Americans annual work as full-time volunteers in underserved communities on various tasks to support this mission. BGCSV connects with VISTA with the overlapping objective to

help ensure that participating youth receive support academically, emotionally and socially to break the cycle of poverty. The Code Corps VISTA project is responsible for building the capacity of BGC members by developing a manageable and sustainable Computer Science program. GCC connects with BGC directors and staff to develop sustainable coding education and cultivate tech partnerships. More specific program goals include:

a. Ensure participating youth receive support they need to help break the cycle of poverty through building computer science capacity at the Boys & Girls Clubs of Silicon Valley.
b. Implementation of a professional plan including resource and program development, monitoring, evaluation and reassessment.
c. Successfully allocate resources and funds for the sustainability of the Code Corps program at Boys & Girls Clubs of Silicon Valley.
d. Advocate for social change or services for underserved communities in San Jose, specifically those affecting youth.
e. Communicate the BGCSV grant writer (Michelle), on BGCSV policies on fundraising, gift-in-kind benefits and budget; research grant writing tools through websites and webinars.
f. Successfully assist with the submission of a grant for BGCSV Outcomes and completion of the BCC goals will be measured thorough specific, deliverables. Deliverables are organized quarterly through the VAD or VISTA Assignment Description and through USF learning objectives (Appendix A).

a. *Q1:* Participate in VISTA, Google and BGCSV trainings. Evaluate/develop existing volunteer strategy that include all tools, guidelines and processes currently being used including assessing current technology needs of Clubs. Launch a 2-week long coding summer camp to target 240 youth with CS education. Collaboration with the Club, perform outreach to local media, schools, organizations and community leaders to promote the program, particularly with Google and the community. Identify and begin training volunteers and staff.

b. *Q2*: Support Code Corps programming throughout recruitment and coordination of volunteers; create recruitment and promotional materials. Target 80 youth for fall for CS First programming. Work with BGCSV tech staff, admin and directors to garner support and begin mandated reporting. Coordinate two additional activities (Fieldtrips, Career Days, Hour of Code) for BGCSV members. Begin planning a Hackathon to target 50 youth and further tech partnerships. Create a sustainability guide to document processes used for Code Corps activities and outreach.

c. *Q3:* Continuation of Code Corps Support Activities from previous quarter, updating materials and process guides and training new volunteers as necessary. Continue timely reporting and documentation of best practices used for sustainability guide started in previous quarter. Participate in a MLK Day of Service activity. Continue recruitment efforts of volunteers. Target 80 youth for winter for CS First programming. Continue event planning with supporting volunteers/staff.

d. *Q4*: Build sustainability and track successes, challenges, and opportunities. Coordinate Hackathons and other supplemental events. Recognize volunteers. Ensure all processes are well documented for future use by VISTAs or Club staff. Continue

recruitment efforts of volunteers. Target 80 youth for spring for CS First programming. Execute Hackathon event with supporting volunteers/staff. All processes well documented for sustainability of activities.

Lastly, through collaboration with multiple organizations, communities, staff and members, the Google Code Corps and my role as a Volunteer Specialist built capacity and sustainability with many levels of the Social Ecological Model (SEM). A brief overview of this interconnectedness includes:

Individual: Capacity building, CS education, presentation skills, critical thinking, and professional plan.

Interpersonal: team work, volunteer recruitment, family news letters, and connecting co workers, volunteer feedback, staff feedback.

Organizational: community outreach, fundraising, training, corporate partnerships, staff training and services.

Community: media outreach, communication with city council, fund/ resource allocation, BGCA partnership, Tech trainings, and grants.

To reiterate, my role as a Google Code Corps Volunteer Specialist was a collaboration with an overarching theme to positively impact minorities and low-socioeconomic (SES) communities through education, capacity building, and sustainability.

III. Public/Population Health Impact: Findings and Significance

The CS First program findings included a significantly greater amount of ethnic minorities, Hispanics and African Americans, who took CS classes than their counterparts of Asian and white students (Table 1 & 2). Furthermore, 38% of national student participants were female and 44% of BGCSV participants were female (Table 2). Using chi square test, we determined a significant number of targeted students involvement (female, African American, or Hispanic) with CS programs compared to non-minority students (p value < 0.001). CS First surveys demonstrated that students gained knowledge on basic CS concepts and terminology with at least 50% of students who started a coding project finished it; a significant of students coding capacity as showed from the start of the CS First course (activity 1) towards the end (activity 7) throughout the 24 classes, with a very strong p value < 0.001. Students who partook in Google Code Corps (GCC) classes felt they overall could have a career in some sort of computer science. Overall, demonstrating students having an overall greater interest in CS and STEM concepts from week 1 to week 7 (Appendix I). Staff and volunteer feedback surveys also found that CS First was an easy and well-structured program. They [volunteers] generally felt the students enjoyed the program. Overall, using multiple media including projects, events, and activities increases students' access to CS education.

Reflecting on my experience with the CS First coding classes as part of a technology core curriculum I felt that implementing a new program at a non-profit (BGC) requires individualized scheduling. Furthermore, non-profits rely on grants that are connected to specific instructions and reporting; Non-compliance can result in a loss

of funding. Policies, both county and state, that require coding as part of a core curriculum can create greater access and early exposure for minorities. The next steps for the Code Corps project (year two) is to increase exposure, expand and increase sustainability. We aim to expose youth to CS at young age from 7-13 and increase the number of participants each year. We also aim to further expand CS programs to minority populations and females; preventing future pipeline issues, overall increasing cultural competence. Sustainability will be met through recording student success and measure CS program acceptance while connecting with politicians and community leaders for policies and support of STEM programs.

As a non-profit BGCSV, requires grants, fellowships, donations and gifts-in-kind to function. Google Code Corps is a nationally funded program through NCSS and Google, which requires reporting for both organizations. The sustainably of the program has been continued for another year with the new VISTAs being on boarded May 1st, 2017. The data collected throughout my service directly reflects the involvement of organizations and individual to increase CS capacity for underserved youth. Media and partnerships guarantee funding, and grant writing is a necessity for BGCSV as a non-profit and GCC success and sustainability. All grant writing must follow BGCSV compliance and deliverables. The Symantec grant funded the two VISTAs specifically and was completed submitted November 2016 and again April 2017.

Based off my own experience and personal research, there is still a large lag in qualitative and quantitative data needed to successfully narrow the minority gap and pipeline in computer science fields. Data research should include projected number of schools that offer CS First or other coding education, demographics of districts and

counties that offer these classes. Furthermore, education of parents and teachers on importance of CS education should be established and further researched. Overall, determining what age that the pipeline begins, when minority students stop sustaining STEM classes can help future programs target the status quo and create more impact. Early exposure creates interest and curiosity, therefore establishing a sense of competency and capacity (Women Who Choose Computer Science [as cited in *Google*, 2016]).

IV. Conclusion

Computer Science (CS) has a large underrepresentation of females and racial minority populations in today's education institutions and workforce. Overall, there is a substantial minority gap in both engineering education programs and careers. Over the past decade there has been a promise from technology companies and organization to narrow this gap. A few main factors are more widely present with the circular process of CS and minorities including: underrepresentation, stereotypes and influences. The short term and long term consequences of this underrepresentation has been reviewed by public health workers and companies since the technology boom (Beyer. 2014). A lack of variety for CS workers takes part in all layers of the ecological model, and therefore solutions should encompass multiple levels as well. Stereotypes or what a programmer looks like also poorly influences diversity with CS careers.

CS culture is often looked at as intelligent men of a white or Indian background, introverted and techy. This too is a stereotype that limits both individuals and companies for potentially new technologies and jobs. Furthermore, excel in engineering may be criticized by peers or made feel in superior (Mardner, 2012). Also, economic imbalances and social justice issues heighten the CS gap. Lastly, influences from both a structural and social standpoint including exams, instructors and current educational programs do not set up all students for success (Beyer, 2014). Hispanic ethnic groups have the largest growing high school drop out rates; they are also heavily underrepresented along with females and other minorities (Han, Capraro, & Capraro, 2016). Allostatic load or the system of proprietary social factors and racism affects the health of minorities through specific physiological mechanisms and the CS pipeline.

The project objectives of the Boys & Girls Clubs of Silicon Valley include to offer innovative, effective, and compassionate after school and summer enrichment programs for low income, high-risk youth. The overarching mission of VISTA is to building the organizational, administrative, and financial capacity of organizations that fight illiteracy, improve health services, foster economic development, and otherwise assist low-income communities. My role as a Google Code Corps Volunteer Specialist was CS Education, capacity building and sustainability. This role required a partnership with Google, The Boys & Girls Clubs of America (BGCA), and AmeriCorps Each partner has some variety of specific goals for their organization. My project aims to sustain CS education by collaborating with Google and other companies directly. Google Code Corps and the platform CS First offer's a free and versatile curriculum that can target youth anywhere. This platform has been utilized by thousands of clubs; for the Silicon Valley we have provided over 2000 hours of coding to 500 youth. More so, CS First aims to increase confidence, instill courage, grow perseverance, provide a sense of belonging and overall create a positive experience. Students receive support academically, emotionally and socially to break the cycle of poverty.

The Google Code Corps program goals include ensuring participating youth receive support they need to help break the cycle of poverty through building computer science capacity at the Boys & Girls Clubs of Silicon Valley. While also advocating for social change or services for underserved communities in San Jose, specifically those affecting youth and communicating with the BGCSV grant writer on BGCSV policies on fundraising, gift-in-kind benefits and budget; research grant writing tools through websites and webinars. Overall action steps should follow the BGCSV and GCC

missions and values while focusing on exposure, expansion and sustainability of the program to truly narrow the CS gap and create self-efficacy with minority students in computer science classes and careers.

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V. Tables

Table 1: GCC Demographics (BGCSV)

GCC Gender	Data (BGCSV)
Male	231
Female	210

GCC Ethnicity	Data (BGCSV)
AA	9
Asian	111
Hispanic	260
Other	19
White	38
Unknown	4

Table 2: GCC Demographics (National)

GCC Gender	Data (BGCSV)
Male	458
Female	330

GCC Ethnicity	Data (BGCSV)
AA	193
Asian	80
Hispanic	247
Other	87
White	148
Unknown	4

Table 3: Calculated P values of CS First (BGCSV)

Category	Observed	Expected	P Value
CS and STEM Comfort/ Interest			
Greater Interest	272	149.5	
No Greater Interest	27	149.5	1.43093E-45
			< 0.001
CS Targeted Populations			
Minority Youth Participants	389	220.5	
White or Asian Male	52	220.5	5.93994E-58
			< 0.001
CS Targeted Ethnicities Only			
White	38	87.4	
Asian	111	87.4	
Hispanic	260	87.4	
African American	9	87.4	
Other	19	87.4	1.0986E-106
			< 0.001

VI: Figures

Figure 1: CS First Ethnicity Participation Summary (BGCSV)

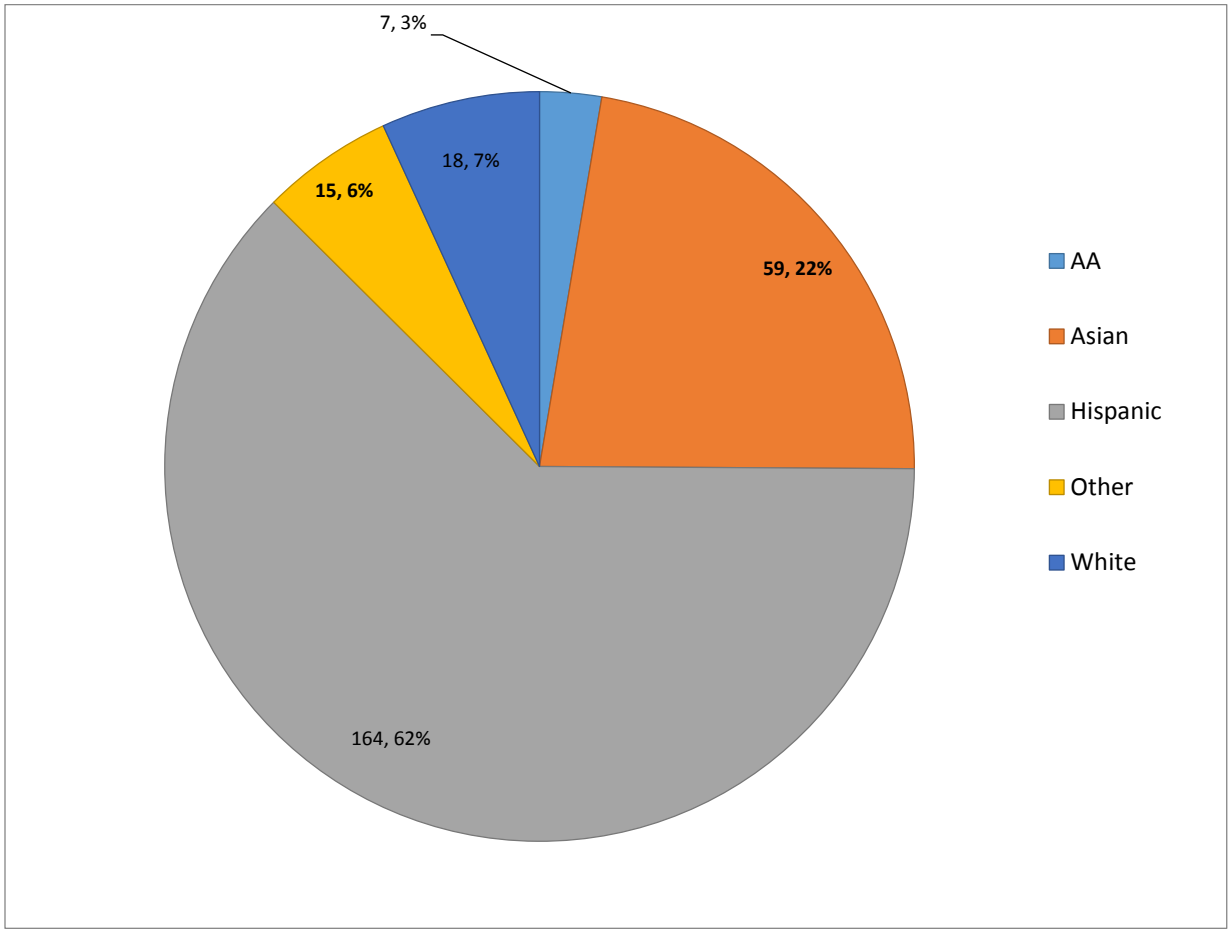
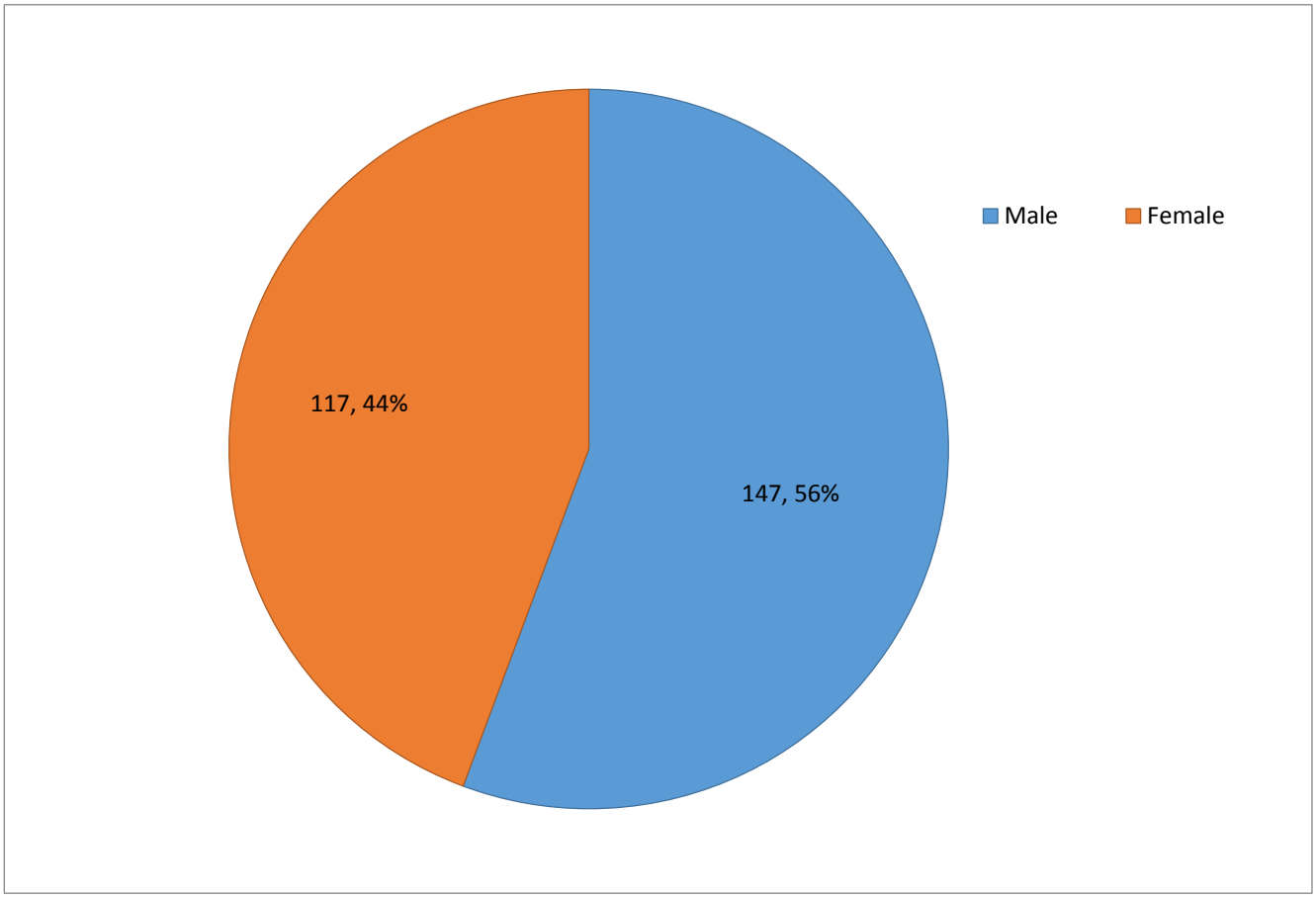


Figure 2: CS First Ethnicity Participation Summary (BGCSV)



VI. Appendices

Appendix A: Reflection

When I began my service as an AmeriCorps VISTA with the Google Code Corps I was mostly asked the two same questions: why did you dedicate a year of service? Do you have any experience with computer science or coding? In general, an opportunity to volunteer and focus on social inequities is ideal for many public health majors, but the VISTA program offers so much more than those opportunities listed. I knew I would be able to serve my community while gaining uncanny professional skills and receive a once in a lifetime opportunity. I often felt that people, myself included, can easily get comfortable in careers, relationships, and with material possessions; receiving next to nothing pay and immersing myself with a new community created just the right about of discomfort to allow for a substantial experience.

I was originally surprised when I applied, that my position required no prior CS experience; as I had absolutely none. I was only introduced to the concept of coding when I moved to San Jose for college and had friends who were CS majors. Instantly I was confused by the concepts and did not see myself anywhere near that majors (as some of my students probably felt). As I began to learn basic programming concepts and research the importance of STEM careers, my view on the traditional "programmer" changed. I felt privileged to take part in such an amazing and groundbreaking program. I am excited to see the expansion of the BGCSV community and growth of coding education as the program continues. CS First was a fist step to motivate students to tackle new challenges and use creativity while introducing coding concepts; the entire experience created a new perception for the students of BGCSV and myself.

Appendix B: Final Learning Objective

Supervised Field Training in Public Health Student Learning Contract

Goal 1: Ensure participating youth receive support they need to help break the cycle of poverty through building computer science capacity at the Boys & Girls Clubs of Silicon Valley.				
Objectives (S)	Activities	Start/End Date	Who is Responsible	Tracking Measures
Implement CS First Curriculum at BGCSV Clubs targeting 240 youth annually	-Review curriculum and create ed material -Create training material and DRIVE -Organize club participation by quarter and target number of students	05/2/16- TBD	Jordan, Wendy	VISION student tracking
Organize three events to increase CS Capacity for students	-Review BGCSV tech events -schedule 2 hackathons, field trip, tech event -Plan, coordinate and host tech events	07/10/16-02/03/17	Jordan, Wendy, Alethia	BGCSV Calendar
Recruit and train volunteers and BGCSV Tech directors on the importance of CS education and CS First program implementation	-use multiple mediums to recruit potential volunteers -setup and plan for volunteer interviews -follow BGC protocol for volunteer screening - Host staff trainings and offer support	06/02/16- TBD	Jordan, Wendy, Tech Staff	Calendar, surveys

Goal 2: Implementation of a professional plan including resource and program development, monitoring, evaluation and reassessment				
Objectives (S)	Activities	Start/End Date	Who is Responsible	Tracking Measures
Manage participation and demographics through quarterly reports	-create a report file on dive, connect with BGCA - monitor student completion of CS First surveys and data fro reports (age, gender, ethnicity)	08/31/16, 11/30/16, 01/31/17, 04/31	Jordan, Wendy	VISION, Silicon Valley Report
Distribute quarterly surveys to volunteers and directors to receive program feedback.	-Create a google survey to distribute to volunteers, obtain volunteers retained -communicate with all site staff on program acceptance, pros & cons	11/15/16- TBD	Jordan	Google Sheets and Drive
Allocate bi-monthly meeting with fieldwork supervisor to reevaluate goals and needs.	-document meetings through meeting minutes -schedule meeting using shared calendar -communicate openly about program (SWOT)	07/10/16- TBD	Jordan, Wendy, Alethia	Google Calendar, Meeting Minutes

Goal 3: Successfully allocate resources and funds for the sustainability of the CodeCorps program at Boys & Girls Clubs of Silicon Valley.				
Objectives (S)	Activities	Start/End Date	Who Responsible	Tracking Measures
Communicate with Michelle, the BGCSV grant writer, on BGCSV policies on fundraising, gift-in-kind benefits and budget	- set up monthly meetings/ follow ups to review the process - review BGCSV policies for allocating funds, GIK, grants, etc	9/27/16	Jordan, Michelle	Fieldwork log, calendar, BGCSV Drive
Successfully assist with the submission of the Symantec CodeCorps grant	- review Symantec grant qualification with Michelle - data input for grant and submit	9/28/16-10/13/16	Jordan, Michelle	Symantec submission form
Fundraise over $1000 cash or GIK resources to use for program sustainability	- create fundraise medium (Go Fund Me) - create holiday donation letter - transfer funds to BGCSV VISTA account	11/10/16-01/28/17	Jordan, Wendy	BGCSV Budget
Completion and submission of a supplementary grant or fellowship request	- research and choose appropriate grant - write grant request using BGCSV systems	10/13/16- TBD	Jordan, Michelle	BGCSV Budget,

Goal 4: Advocate for social change or services for underserved communities in San Jose, specifically those affecting youth				
Objectives (S)	Activities	Start/End Date	Who Responsible	Tracking Measures
Create a partnership between local professional companies and organizations	- reach out to local tech companies through e mail and connections - continuation of partnership through contact list and newsletter	ongoing	Jordan, Wendy	Google reports
Participate in BGCSV promotional events	- attend BGCSV volunteer Gala, Golf fundraiser, College week	04/25/16, 11/4/16, 10/16	Jordan, Aelthia	BGCSV Calendar, Google Reports
Use social media, community boards, schools and local businesses to raise awareness of CS First and the lack of diversity.	- Find flyer-making program - assist with tech information for BGCSV newsletter -partnership w/ SJSU CS department	ongoing 09/21/16	Jordan, Wendy	Google Drive

Appendix C: Master of Public Health Program FIELDWORK TIME LOG

SAN FRANCISCO | School of Nursing and Health Professions

Master of Public Health Program

FIELDWORK TIMELOG

Student Information	
Student's Name: Jordan Arnold	Campus ID #: 20376237
Student's Phone: 530 318 8126	Student's Email: jearnold328@gmail.com
Preceptor Information	
Preceptor's Name: Alethia Ruiz/ Jessica Vaughn	Preceptor's Title: Volunteer Coordinator/ VISTA Leader
Preceptor's Phone: (408) 250- 7917/ (404) 487-5783	Preceptor's Email: alethia.ruiz@bgclub.org, jvaughn@bgclub.org
Organization: Boys & Girls Clubs of Silicon Valley/ Boys & Girls Clubs of America	
Student's Start Date: 04/28/2016	Student's End Date: Hours/week: 04/28/2017

Time Log for (Check One):

X Spring 2017 **____ Summer 2017**

____Fall 2017 **____Spring 2018**

Week	Total # of Hours	Preceptor Initials
05/01/2016- 05/12/2016	76	JDV
05/15/2016- 05/28/2016	80	JDV
05/29/2016- 06/11/2016	78	JDV
06/12/2016- 06/25/2016	80	JDV
06/26/2016- 07/09/2016	78	JDV
07/10/2016- 07/23/2016	78	JDV
07/24/2016- 08/06/2016	76	JDV
08/07/2016- 08/20/2016	80	JDV
08/21/2016- 09/03/2016	74	JDV
09/04/2016- 09/17/2016	78	JDV
09/18/2016- 10/01/2016	72	JDV
10/02/2016- 10/15/2016	84	JDV
10/16/2016- 10/29/2016	80	JDV
10/30/2016- 11/12/2016	76	JDV

11/13/2016- 11/26/2016	75	JDV
11/27/2016- 12/10/2016	80	JDV
12/11/2016- 12/24/2016	82	JDV
12/25/2016- 01/07/2017	78	JDV
01/08/2017- 01/21/2017	80	JDV
01/22/2017- 02/04/2017	80	JDV
02/05/2017- 02/18/2017	80	JDV
02/19/2017- 03/04/2017	76	JDV
03/05/2017- 03/18/2017	78	JDV
03/19/2017- 04/01/2017	76	JDV
04/02/2017- 04/15/2017	80	JDV
04/16/2017- 04/29/2017	82	JDV

Grant Writing/ Research Hours (40 total)

09/27/2016	3	JDV
09/28/2016	2	JDV
09/29/2016	4	JDV
10/12/2016	4	JDV
10/13/2016	4	JDV
11/17/2016	6	JDV
11/30/2017	2	JDV
02/21/2017	4	JDV
02/22/2017	4	JDV
04/27/2017	4	JDV
04/29/2017	3	JDV

Appendix D: Student Evaluation of Field Experience

Student Information	
Student's Name: Jordan Arnold	Campus ID # 20376237
Student's Phone: 530 318 8126	Student's Email: jearnold328@gmail.com
Preceptor Information	
Preceptor's Name: Alethia Ruiz	Preceptor's Title: Volunteer Specialist
Preceptor's Phone: 408 890 2916	Preceptor's Email: Alethia@bgclub.org
Organization:	The Boys & Girls Clubs of Silicon Valley
Student's Start Date: 05/13/2016	Student's End Date: Hours/week: 05/01/2017

Please use the following key to respond to the statements listed below.

SA = Strongly Agree A = Agree D = Disagree SD = Strongly Disagree N/A = Not Applicable					
My Field Experience…					
Contributed to the development of my specific career interests	SA	A	D	SD	N/A
Provided me with the opportunity to carry out my field learning objective activities	SA	A	D	SD	N/A
Provided the opportunity to use skills obtained in MPH classes	SA	A	D	SD	N/A
Required skills I did not have Please list: There were new challenges including grant writing, purchase requisition and data collection. But I was able to learn these new skills during my fieldwork.	SA	A	D	SD	N/A
Required skills I have but did not gain in the MPH program Please list: My job required using multiple tools including Google calendar, sheets, PowerPoint and excel which I had some experience with. Overall, I needed to combine and collaborate	SA	A	D	SD	N/A
Added new information and/or skills to my graduate education Please list: Almost all my classes connected to my fieldwork. Specifically my non-profit administration elective, CBPR, Policy and Stats.	SA	A	D	SD	N/A
Challenged me to work at my highest level	SA	A	D	SD	N/A
Served as a valuable learning experience in public health practice	SA	A	D	SD	N/A
I would recommend this agency to others for future field experiences.	Yes			NO	
My preceptor…					
Was valuable in enabling me to achieve my field learning objectives	SA	A	D	SD	N/A
Was accessible to me	SA	A	D	SD	N/A
Initiated communication relevant to my special assignment that he/she considered of interest to me	SA	A	D	SD	N/A

Initiated communication with me relevant to general functions of the agency	SA	A	D	SD	N/A

2. Would you recommend this preceptor for future field experiences? Please explain.

_____Yes _____No _X__Unsure

I truly enjoyed my fieldwork and felt that I was able to have a unique experience. I also enjoyed my organization, team, and overall experience. The only reason this sight may be in issue is due to the location (San Jose) and the ling-term scope of the work.

3. Please provide additional comments explaining any of your responses.

Connecting CS to public health has required both research and a new concept of what determines health. However, I feel by project was able to connect technology, social inequalities, culture, income and other issues. Living in Silicon Valley, theses issues are even more so predominant. Overall this project was challenging, eye opening and truly a phenomenal experience.

4. **Summary Report**: All students are required to prepare a written summary of the fieldwork to be submitted with this evaluation form.

Quarterly reports based on data collected throughout my fieldwork were submitted to CSCS describing our experience, highlights, challenges and raw data, in detail. A summary of my work included the following: Over 800 BGCSV members participated in CS education, over 3500 hours of coding completed, 24 volunteers recruited, all BGCSV technology staff trained, two Hackathons, one technology fieldtrip, over $10,000 in donations and services acquired, and community partnerships created with Google, Microsoft, and Representative Khana. Sustainably of the program will be manages through partnerships and the VISTA positions (4), which were established last month. In general, early exposure is key and we introducing CS education to minority students through fun and empowering media.

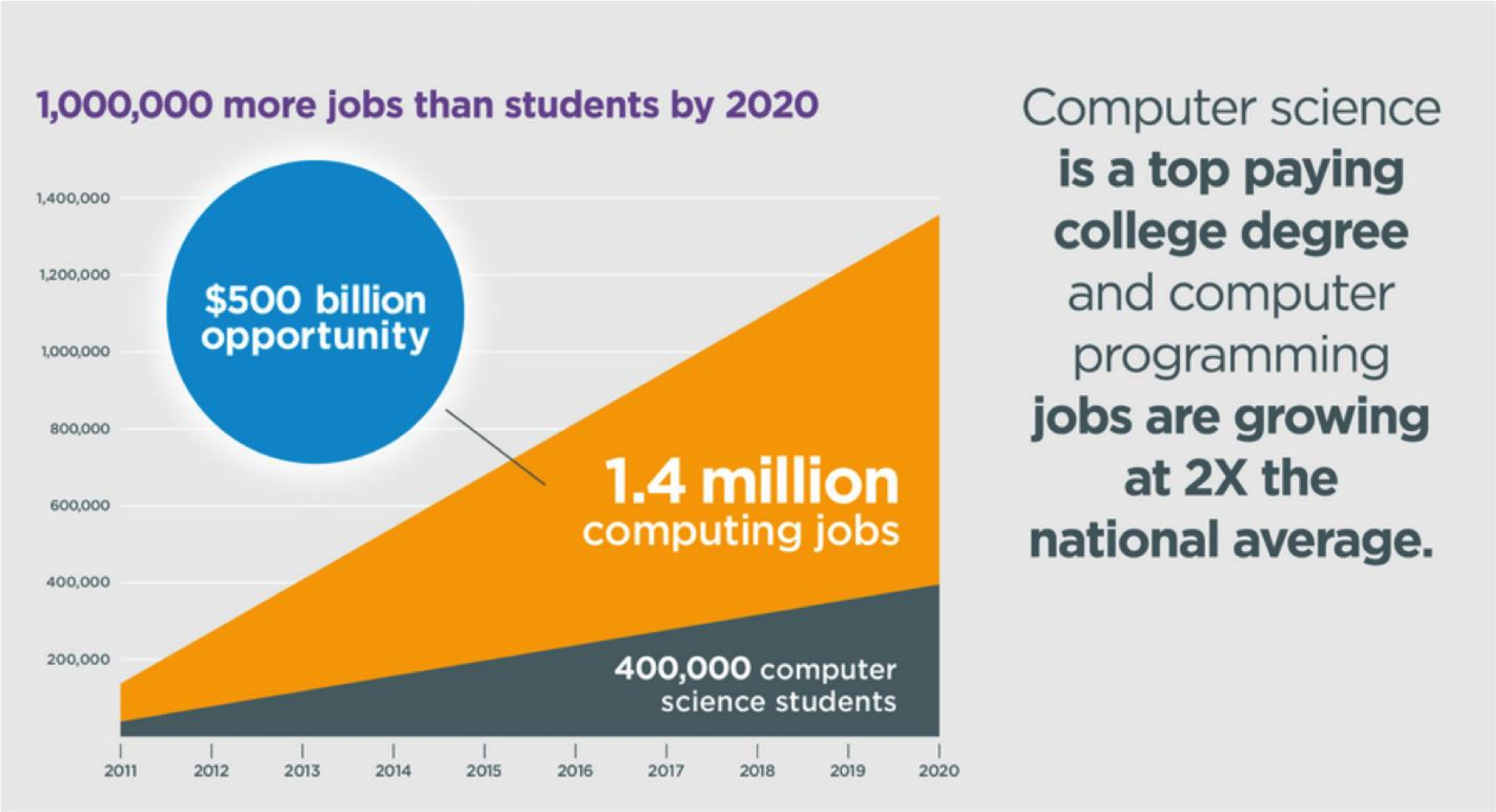
Student Signature 5/8/2017 Date

Appendix E: MPH Program Competency Inventory

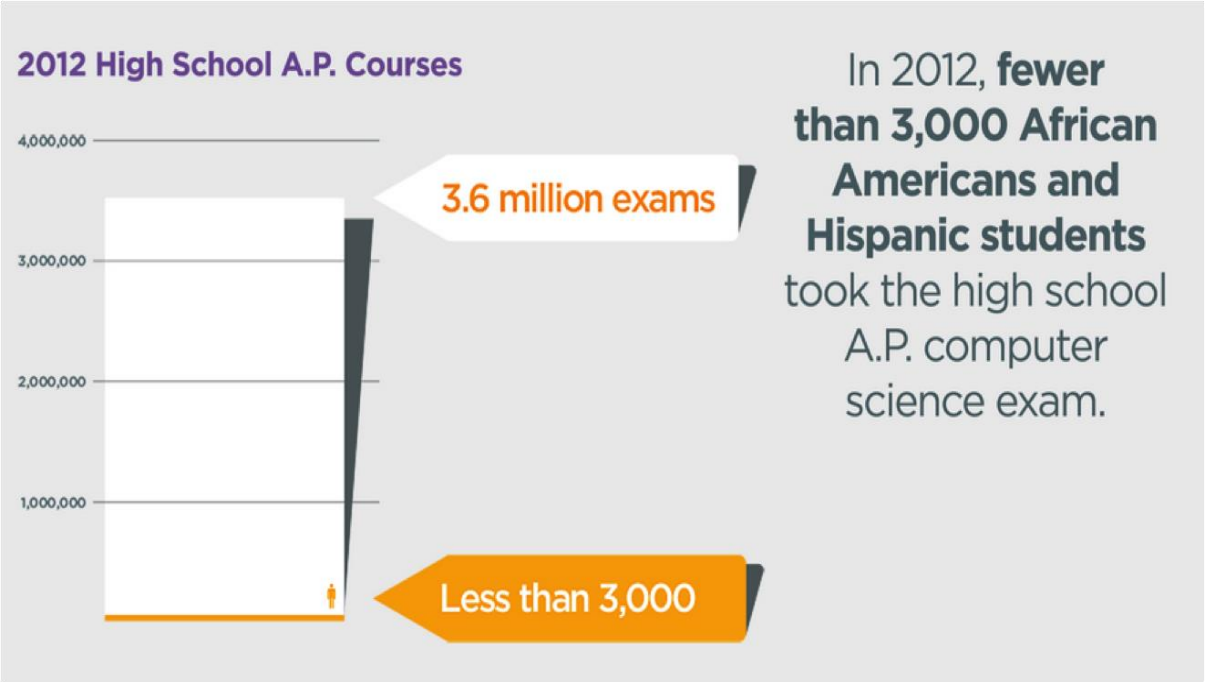
Appendix II. Competency matrix explaining which program competencies were satisfied and how each was achieved.	
USF MPH Competencies	**Method of Achievement**
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	I performed data collection for all three organizations through student and teacher/volunteer surveys. Items included demographics, capacity scales and personal feedback/ input.
10. Explain basic principles and tools of budget and resource management	BGCSV maintains non-profit budget, pre set for a year and part of my work required fundraising and GIK donations, for which I needed to follow protocol. I constantly reviewed non-profit management techniques and communicated with the admin staff.
20. Describe the importance of cultural competence in communicating public health content	Working as a VISTA with BGCSV required both cultural competency and humility as both my peers and students were often low-income and minorities. All digital and personal communications needed to be deemed appropriate by my superior sand aimed towards capacity building.
6. Discuss the means by which structural bias, social inequities, and racism undermine health and create challenges to achieving health equity at organizational, community, and societal levels planning & management to promote health.	The overarching goal of my fieldwork is to promote health through capacity building and enviably decrease the allostatic load of members and their communities who face all the presented challenges.
22. Apply systems thinking tools to a public health issue	My work cultivated capacity and sustainability through communal, societal, national, international, individual SEM levels. I often worked with one student to entire organization through curriculum and program implementation.
18. Select communication strategies for different audiences and sectors.	I created media both virtually and physically to target multiple audiences. This included flyers, professional letters, e-mails, training, presentations and curricula for various ages, education levels, and cultures.
21. Perform effectively on inter-professional teams.	Throughout my fieldwork I collaborated with three organizations: BGCA, Google, and AmeriCorps. I also worked with all levels of BGCSV staff including directors, admin, volunteers, and students; I needed constant communication and collaboration skills.

Appendix F: Google Workforce Demographics Graphic

Appendix G: Code.org CS Jobs Graphic



Appendix H: High School A.P. Course Graphic



Appendix I: Google Code Corps Annual Report (Silicon Valley)

Final Report: Initial Draft
Club Organization: Boys & Girls Clubs of Silicon Valley
VISTA: Wendy Du, Jordan Arnold
Final: Three (All information should reflect time period April 1, 2016 - April 31, 2017)

Demographics

Measure	#Number	Include details, date, & community contacts, etc.
# of community volunteers recruited during the reporting period	42	Q1: 0 Q2: 4 Q3: 13 Q4: 25
# of community volunteers managed during the reporting period	24	Q1: 4 Q2: 9 Q3: 4 Q4: 7
# of staff and community volunteers that received training	75	Q1: 9 Q2: 17 Q3: 21 Q4: 28
# of Service Hours performed by Community Volunteers who were recruited	211	Q1: 0 Q2: 8 Q3: 83 Q4: 120
# of Service Hours performed by Community Volunteers who were managed	402	Q1: 68 Q2: 79 Q3: 130 Q4: 125
$ Dollar value of cash resources leveraged during the reporting period	$1,485.00	Q1: 0 Q2: 0 Q3: $1485.00 Q4: 0
$ Dollar value of in-kind resources leveraged during the reporting period	$4,810.2	Q1: 0 Q2: $450.00 Q3: $1,405.20 Q4: $2,955.00

Anti-Poverty Outcome

Measure	#Number	Include details, date, & community contacts, etc.
# of Pre & Post Tests in computer science for low income students typically underrepresented in STEM fields	299	Q1: 96 Q2: 57 Q3: 66 Q4: 80
# of Students expressing interest in computer science and STEM, greater comfort with their skills	272	Q1: 90 Q2: 53 Q3: 49 Q4: 80

Capacity Building Performance Measures

Measures	#Number	List #, details, date, & community contacts, etc.

G3-3.11: Number of new systems /business processes or enhancements put in place		• **Social Media:**
		  ○ **(10/31/16) Weebly website**
		  ○ **(11/09/16) Twitter**
		• **Fundraising:**
		  ○ **(12/19/16) GoFundMe:**
		• **Volunteer Outreach:**
		  ○ **(03/24/17):** Hosted (annual) Volunteer Appreciation event with 40 attendees
		• **CS First**

G3-3.18: Total number of youth that received services (returning and new can be included in this number)	441	Q1: 191 Q2: 73 Q3: 86 Q4: 91
G3-3.19: Number of new youth from targeted populations this quarter	389	Q1: 191 Q2: 57 Q3: 61 Q4: 80

Member Development:

Content	Notes	Midyear #	Current #	Yearly Total #
On-Site Orientation	"On-site" orientation of how Boys & Girls Clubs of Silicon Valley is run, and what we have to do in our VAD. Meeting with COO, Director of Program Services to discuss plans for CS First and tech events for the year.	10	0	10
Community Outreach	Boys & Girls Clubs of Silicon Valley newsletter Representative Ro Khanna's visit.	5	5	10
Community Volunteer Generation/Recruitment	Reach out to colleges, tech companies, and other organizations for volunteers.	50	15	65
Effective Volunteer Management	Hosted Volunteer Appreciation Event	20	20	40
Resource Mapping	Utilize apps a to determine community business and services. Allocate food and GIK donations. Locate other CS education, events and services using volunteermatch, Eventbrite and other websites.	7	3	10
Grant Writing	Assist with Symantec Grant. Collaborate with Michelle to review BGCSV policies and procedures regarding GIK, foundations and grants.	2	0	2
Organizational Development	Attended Summer all staff meeting for professional development. Attended Tech Core meetings every month.	15	6	21
Information Technology	Exploratorium training for Google Science Journal Kit materials.	0	16	16
Developing On-Site Orientations and Training Plans	Used Google Spreadsheets and Presentation to develop orientations and trainings for volunteers.	15	5	20

Appendix J: Sample CS First Student Survey

Activity 1 Survey

What grade are you in? *

- 1st
- 2nd
- 3rd
- 4th
- 5th
- 6th
- 7th
- 8th
- 9th
- Does not apply

When you get stuck on a problem on the computer, what do you do? *

- Ask a teacher for help
- Try to solve a smaller part of the problem first
- Skip the problem and come back to it later
- Ask a friend for help
- Give up
- Try a new way of solving the problem

In your own words, what is computer science? *

For each item, choose the answer that is true for you. *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I can create things with computer science.					
I don't really understand computer science.					
If I get stuck on a computer science problem, I know how I might fix it.					
I like programming.					

Appendix K: CS First Student Surveys Stratified Data

Clubhouse, Quarter, Year, # of Students:		Smythe, Summer 2016, Fashion, 16			El Toro, Fall 2016, Sports 8	
Question	Student	Response		Student	Response	
1. When you get stuck on a problem on the computer, what do you do		pre	Post		Pre	Post
Ask a teacher for help		56% (9 of 16)	81% (13 of 16)		62% (5 of 8)	87% (7 of 8)
Try to solve a smaller part of the problem first		18% (3 of 16)	37% (6 of 16)		12% (1 of 8)	12% (1 of 8)
Skip the problem and come back to it later	NA	62% (10 of 16)	43% (7 of 16)	NA	37% (3 of 8)	25% (2 of 8)
Ask a friend for help		43% (7 of 16)	43% (7 of 16)		12% (1 of 8)	37% (3 of 8)
Give up		6% (1 of 16)	0% (0 of 16)		0% (0 of 8)	0% (0 of 8)
Try a new way of solving the problem		37% (6 of 16)	43% (7 of 16)		50% (4 of 8)	25% (2 of 8)
		Pre	Post		Pre	Post
	cs406429	the study of the principles and use of computers , like coding is an example of computer science	i dont know	cs443075	computer sience is like if you were studying or telling a computer what to do.	to create something on a computer.
	cs406432	computerscience isthe study of computer.	its how computer works and all the different things you can do. ex-programming	cs443076	I don't know.	i dont't know
	cs406436	i dont know	idk	cs443078	I don't know.	Engineering
	cs406438	I'm not sure but i predict its doing science in a computer.	computer science is some science that you do on a computer and you learn facts about science	cs443079	IDK	i don't know?
	cs406444	idk	It's science in computer	cs443080	i don't know	Computer science is when you make your own inventions and make friends.
	cs406445	A computer science is it is a electronic device that helps you with science and every thing to need help on but sometimes it could be ugly and say stuff disgusting.	i don't know	cs443081	Math	science
	cs406447	A computer that helps people with science.	I dont now.	cs443082	I like pizza.	I dont know
own words, what is comput	cs406449	computer science is like coding but instead of typing it you have to drag it to the thing.	computer science is like coding but instead of typing you drag it and it will do what u want it to do.	cs443083	I don't know	I don't know
	cs406453	idk?	i dont know			
	cs407131	I think that is when you learn science o the computer.	i dont know			
	cs407132	computer science is like coding but instead you have to drag it.	in my own words its like coding but you drag.			