

Hacking Diversity: A Nationally Scalable Program to Increase Diversity in the Tech Sector

Ellen Rhudy 16 November 2016

Summary

The tech industry has a deserved reputation for failing to achieve diversity in its workforce, with the vast majority of technical roles being held by men, and the majority of those being white or Asian. Despite rhetoric from the sector around taking proactive steps to improve diversity, little has changed. Improving the STEM education pipeline for underrepresented demographics could lead to improved rates of diverse hiring. This is in the best interest of the sector as it relates to an improved bottom line. This article poses a pilot program to assess the viability of a community college-based, blended learning platform to enhance STEM education and, ultimately, diversity in the tech workplace.

Introduction

The HBO show Silicon Valley has, over its three seasons, come under fire for the lack of diversity in its cast: nearly all the main characters, and the majority of its supporting

and background characters, are white men. But as the show's executive producer Alec Berg has shared, the show merely reflects the lack of diversity in the real Silicon Valley, where the majority of technical roles are held by white or Asian males.^{1, 2} Google's workforce, for example, is only 2% black and 4% Latino.³ Seventy percent of Google's employees are men.⁴ These dismal numbers, unfortunately, are the norm for major tech companies.

While it's been no secret that the tech industry struggles with diversity, this half-hour comedy has helped to shine light on the problem, and has been part of a growing conversation on the homogeneity of the industry. In 2014, facing increasing criticism from civil rights leaders, Google and other major companies began to release their diversity figures.⁵ These reports have for the most part underscored only the lack of progress major tech companies are making year over year.⁵

Why worry about the diversity of this one business sector? The tech industry has long been associated with Silicon Valley, and as such the lack of diversity can read as a troubling but contained problem. The tech sector, however, is unique in that it has "no referents," or no clear boundaries; the definition of "high-tech" shifts with technology, and includes fields such as robotics, computers and IT, telecommunications, medical devices, and aerospace.⁶ A lack of diversity in tech is a problem not just for Silicon Valley, but a problem that extends across many areas of the "knowledge economy" that

many countries now consider an integral part of their business climate.⁶

Problem Statement

The tech sector has come under increasing fire in recent years for the lack of diversity in its workforce, which is mostly composed of white or Asian men.⁷ Since 2014 industry leaders have begun to recognize the problem more openly, sharing information on the diversity of their workforces and vowing to do better, but the industry has failed to make significant progress on diversity measures.⁵ Facebook, for example, vowed to do better in both its 2014 and 2015 reports, but its percentage of Hispanic (4%) and black (2%) employees remained flat despite this public commitment.⁵ As this problem has gained more attention, training programs targeting underrepresented groups (such as Girls Who Code or Girl Develop It for women, or the Hidden Genius Project for young black men) have sprung up across the country, aiming to both provide technical training to these groups and to help a more diverse group of people recognize the opportunities the tech industry holds for them.

These small-scale efforts are insufficient, and it is time to explore the design and likely efficacy of a national, scalable program targeting underrepresented groups. From 2010 to 2015 the percentage of women in computer/mathematical operations actually worsened, and the numbers improved only slightly for

underrepresented racial and ethnic minorities.⁸ Individual companies have made progress on diversity measures, with Intel in particular being an outlier: the company has been releasing its diversity data since 2005, sets ambitious diversity goals, and says it will be “the first high technology company to achieve 'full representation' of women and underrepresented minorities by 2020.”⁹ The industry as a whole must echo this commitment and progress towards a more diverse workforce.

The tech industry needs to increase its diversity not only to improve public relations; there is a clear connection to the bottom line across industries¹⁰ as well as specifically in STEM roles.¹¹ In 2013 Fast Company noted that the lack of diversity within the tech sector, particularly within startups, is limiting innovation and profit. Startups “disproportionately target the young, suburban/urban, and middle-to-upper class. Because of that, the technology world is missing out on a lot of innovation—and, even more importantly to the companies behind technology, missing out on potential profits.”¹² Even major companies have missed large and seemingly obvious opportunities due to a lack of diversity, as when Apple failed to include an option to track menstrual cycles within its Health app.¹³

Further compounding the challenges presented by a lack of diversity, the tech industry is projected to grow faster than average through 2020. According to the Bureau of Labor Statistics, there will be particularly strong job

growth for software developers, web developers, systems analysts, and information security analysts.¹⁴ Deloitte projects strong growth for the tech industry, noting that “the rate of change and the level of disruption driven by modern technology are exponential.”¹⁵ A talent pipeline that excludes large segments of the population limits the growth of the tech industry, as some industry leaders have begun to recognize by launching recruitment programs targeting underrepresented groups such as women returning to the workforce.¹⁶ Major tech companies have lobbied aggressively to increase the cap on H-1B visas, arguing that they are unable to meet talent needs without foreign talent;^{17, 18} increasing the number and diversity of U.S. Citizens in the tech pipeline can fill that talent gap. Increasing diversity in the sector, then, is not simply a matter of “doing good” and opening new opportunities to groups currently underrepresented in the tech industry, but is also clearly tied to the bottom line and the continued growth of the sector and profitability of companies within the tech space.

The diversity problem in tech is multilayered: the industry needs to build a more diverse pipeline, have more diverse leadership, and move away from what Forbes has labeled a culture that “forces talented female and minority employees to leave.”⁷ Google has begun to make some efforts on this front, by providing Black Girls Who Code with office space in Google's New York headquarters,¹⁹ and by placing Google engineers on the campuses of

historically black colleges and universities (HBCUs) with the aim of promoting diversity in STEM.²⁰ These efforts are admirable and necessary, but a broader program, extending beyond one company's recruitments efforts, and with the potential to be nationally scalable, is necessary to tackle the intransigent challenge of increasing the diversity of tech's talent pipeline.

Proposed Solution

For an industry that prides itself on innovating and ascribing to mantras such as "fail fast,"²¹ it is not a great stretch to imagine the type of large-scale, media-friendly program that might begin to change the narrative around diversity in tech, as well as move the needle on diversity. Given that many tech startups utilize online platforms, it is natural to envision an online program focused on recruitment, training, and community building. By developing online programming that can sit alongside existing degree programs at two- and four-year colleges, as part of a blended learning program combining traditional face-to-face instruction and online learning in hybrid, the industry can leverage those existing face-to-face learning resources in order to scale quickly. I recommend that an association of tech companies collaborate with the American Association of Community Colleges, community college leaders, community college professors, and online instructional designers, in developing a program focused on students attending two-

year community colleges. This design partnership and focus on community college students ensures that the program meets tech industry needs and college delivery capabilities, and allows for the development of pathways both for students earning a two-year degree and those who plan to continue to a four-year college.

Further, by coordinating education with community colleges, the industry is able to take advantage of the fact that minority students are disproportionately represented at community colleges versus four-year programs: while 45% of undergraduate students as a whole attend community college, 62% of Native American students, 57% of Hispanic students, and 52% of black students attend community college versus a four-year program.²² These students represent an untapped resource for the tech industry, a path to innovation and profit currently lying fallow.

The tech industry, unfortunately, does not currently have a means of tapping the diverse pool of students at community colleges across the nation. To do so requires a program that is scalable, can change the narrative of a tech industry unwelcoming to women and minorities, and introduces students to opportunities and mentors in the tech industry. To scale quickly and affordably, such a program should take advantage of existing classes and resources for those interested in the tech sector. The aforementioned blended e-learning program, with online industry-approved tracks running alongside face-to-face

classes and resources, may fit the bill in terms of cost, scalability, and effectively connecting students to an online community and local resources. A program utilizing online delivery has numerous benefits: colleges have flexibility in how they incorporate the online program alongside their face-to-face classes;²³ students have the flexibility to participate in the online program at the times and locations that are most convenient for them;²³ instructors and students are able to connect across geographic barriers, bringing new expertise and opportunities to students;²⁴ and an online program, while requiring upfront investments of time and money, is less expensive to scale than a comparable face-to-face program.²³

Literature Review

Online learning is a clear and growing trend in education.²⁵ An estimated 32% of college students have taken an online course, and 69.1% of chief academic officers report that online learning is critical to their long-term strategy,²⁶ indicating that college administrators may not only be open to such a program, but may already be running their own online courses. The tech industry can take advantage of this growing interest in online learning by proposing a collaborative program design effort including tech industry leaders, community college leaders, community college professors, and instructional designers specializing in online learning. It is critical that

all parties be involved from the earliest design stages to ensure the program meets industry needs and fits within the delivery capabilities of local college partners.

Broadly speaking, "online learning" falls into one of three categories: web-facilitated courses, which use some web technology to enhance a face-to-face class; blended/hybrid courses, which more fully blend face-to-face and web technology; and online courses, in which the vast majority of content and coursework is delivered or completed online.²⁶ My vision of an online program that runs for the duration of a student's college career, during which time they take classes offered directly by their school, most closely mirrors the blended/hybrid approach. As we consider the role of blended learning, it is important to keep the following points in mind:

- Does e-learning have a negative or positive impact on student achievement? This is likely to be of concern to educational institutions considering incorporating online learning into their face-to-face course offerings, as proposed in our blended learning approach.
- Does e-learning have any impact on students' sense of community? This point is of concern mainly to the tech industry, which anecdotally has struggled to create a community welcoming to a more diverse workforce. This may also be of interest to community colleges that have struggled with low student completion rates.²⁷

- How can the design of online learning programs encourage the development of a student learning community? This point is of interest to the tech industry and the professors and instructional designers responsible for designing online components of a blended learning program.

I consider these points both for e-learning programs in general and, more specifically, in terms of the blended/hybrid approach I recommend.

Student Achievement

Contrary to popular views of online learning as a poor alternative to face-to-face learning,²⁸ the U.S. Department of Education found in 2010 that students in online classes perform slightly better than students learning the same material through face-to-face instruction.²⁵ Further, in the same 2010 meta-analysis of over one thousand empirical studies on online learning outcomes for adult learners in college or professional settings, the U.S. Department of Education found that blended learning programs performed better than did either online-only or face-to-face instruction.²⁵ These positive learning outcomes may be realized due to the opportunity for continuous student dialogue, and because online learning is paced at the speed of the student's learning rather than at the speed of teaching.²⁹

The flexibility of online learning enables students to more

successfully integrate the varied elements of their college experience, including academic, social, and psychological.³⁰ In their study of a nationally representative sample of students, Shea and Bidjerano find that early participation in online learning predicts higher rates of degree attainment.³⁰ Further, they find that, on the national level, even less prepared students who participate in online learning early in their college degrees are more likely to earn a degree than those students who did not have early participation in online learning.³⁰

These findings are of note for this program because they indicate that online learning, or the online components of a blended learning program, are an effective means of transferring knowledge. That one of the reasons for the effectiveness of online learning seems to be the ability of the learner to approach the material at his or her own pace is particularly notable. This indicates that an online program may be an important resource for students who lack in-depth familiarity with the tech industry, in allowing them to process information and respond to prompts at the pace that feels most comfortable to them.

Students' Sense of Community

A blended learning program does not serve a solely academic purpose, but may also be designed with the specific aim of building a sense of community among students, one of the key aims for this blended learning

program. Two types of informal interaction define the student experience in online learning: student-student and student-instructor.³¹ Learner-learner is of special note for community building, as it provides an opportunity for students to collaborate, share ideas, and construct knowledge beyond the confines of a formal learning environment.³² Instructor-learner interaction is critical to ensuring students feel supported throughout their online learning experience.³² Appropriately incorporating these two types of informal interaction into online learning can yield tremendous benefit, especially when compared to more traditional or restrictive types of learning interaction.³²

These informal interactions are so important because they allow students in online learning environments to develop supportive peer groups that enable social integration.³³ These learning communities and the informal interactions they incorporate encourage a collaborative learning environment in which students join together to accomplish common learning goals.³³ This sense of community is important in large part because it increases student persistence in online courses.³¹ One of the questions we must then consider is whether that persistence may extend beyond the world of a course; might a broader learning community extending across many courses similarly increase student persistence in the program as a whole? And, beyond persistence in the program, what might be the benefits—to both students

and the tech industry—of developing a strong community?

Designing a Blended Program

As with any course or program development, the design of a blended learning program significantly impacts learner results. Studies on online learning have found that student-directed independent learning, or interactive and collaborative learning, are both much more effective than instructor-directed learning.²⁵ Designing online courses as a platform for interaction and collaboration, rather than for the presentation of material, ensures the focus is on “active learning,” during which students are highly engaged with their peers and instructors.³¹ In courses that fail to stimulate student interaction in this way, online learners lose motivation.³⁴ Given this, it is important that learners' motivation be prioritized during the development of participatory online courses.³⁴ A strong blended program, in which students are less likely to drop out, is relevant to students' lives and offers students opportunities to apply their knowledge to real situations.^{34, 35}

Throughout the design process for a blended learning program, careful attention must be paid to community creation and the course management strategies that will be deployed to encourage complex interactions among students.³⁶ A thoughtfully designed online class can provide a source of continual motivation and

community,³⁵ and enable students to create “meaning of their own learning,”³⁶ particularly important for our tech-targeted program. Two types of discussion threads can effectively build community: fairly unstructured discussions that allow students to freely collaborate and build community;³⁷ and more structured discussions that enable high-level reasoning and strong relationships among learners.³⁸ It is important to design for both types of discussion and interaction.

Blended programs make possible new forms of community and connectedness, particularly when compared to online-only learning.³⁶ Findings on the effectiveness of blended learning suggest that we may design online components of a blended program to build upon and further develop the community students build in their face-to-face classes. That said, a blended program must be carefully designed in order to drive high-level reasoning and relationships,^{36, 38} and a blended program that enables both will require significant resources (in terms of both time and money) from the outset. Given the identified potential for blended courses to effectively build community, connectedness, and high-level reasoning, how do we design for these outcomes?

Recommendations

Blended learning programs have been found effective both in terms of academics and building student learning communities. An online program that is centrally designed

with the expert input of instructional designers—a different design and development model than many existing online programs follow³⁹—is easier to scale than would be a comparable face-to-face program. A program built upon online learning also benefits from economies of scale; one-time development costs are likely to be higher than for a comparable face-to-face program, but the ongoing costs and delivery costs are likely to be lower.⁴⁰ Given these benefits of online learning in terms of cost, scale, and community, I recommend the creation of an online learning program with community creation as its specific goal.

Program Design

The online component of the proposed blended program will focus on community building, and sit alongside existing academic resources. The specific learning resources in the online program will focus heavily on career development, for example: outlining career paths in the tech field, as well as the education and work experience necessary to hold those roles; connecting students to resources to find paid internships or part-time/contract work locally; and having in-platform mentors who can respond to students' specific questions about their education and career path. Envisioning this program for community college students, the online program will be designed to run alongside a full degree period, for two years, or four semesters. (The question of

how to incorporate students taking longer than two years to complete their degree, or whether to limit this program to students able to carry a full course load, is one to address with community college administrators during the design process.)

In order to truly create a virtual learning community, students must participate regularly in the program; I recommend activities falling on a weekly basis so students are in the habit of logging on at regularly scheduled intervals. The design of these weekly activities should vary slightly but generally center on learner-learner or learner-instruction interaction: a cohort discussion, an exchange with a virtual mentor, an assignment to seek out someone who works in tech locally and report back to the cohort. The aim of these activities is two-fold: to provide students a sense of community as they interact with peers working through the same questions on education pathways and career tracks, and to ensure students keep an eye on their end goal of a career in the tech field. With many students, of all backgrounds, dropping out of STEM programs early in their studies,⁴¹ the design focus should center on ensuring students have the community, motivation, and support to persist in their degree programs.

Though the online components of this blended program function mainly as a social-collaborative community, rather than as a learning community, new content is necessary to retain student interest for the duration of the

program. Again, this content should focus on building community and student awareness of career paths, such as: interviews with those who have built successful careers in the tech field; guidance on the variety of careers students may find open to them with their degree; and examples of the innovative work major tech companies are doing. Though it may be tempting to provide only positive views of the industry through this content, I recommend also giving students the opportunity to tackle challenging questions they are likely to encounter during their career: whether the industry is focused on the "right" innovations, why women's participation in computer science began to fall in the 1980s, and so on. Finally, in order to encourage persistence and a sense of belonging, students should be able to envision themselves in these careers rather than viewing themselves as outliers or anomalies;⁴² they will benefit from reading articles by and having discussions with people who look like them.

Again, the focus of this program through the pilot is on community building and broadening students' awareness of the career opportunities open to them. That said, researchers have found the online learning environment to be well suited for problem-based learning, particularly when the learning is computer-focused.⁴³ Asynchronous discussions, of the type that we use in this blended learning program, have been found an effective strategy in online vocational training,⁴⁴ and online vocational

learning has been found an effective means of preparing students for the collaborative nature of today's work environment.⁴⁵ These findings on vocational learning indicate a potential to further develop the learning aspects of the online components of the program by, for example, adding coding exercises or other problem-based learning activities, should employers and colleges conclude such an approach is beneficial for students. There is great potential to iterate upon the initial versions of this program, allowing employers and colleges to build a program of increasing value for all involved parties.

Program Delivery

I recommend an initial focus on and partnership with community colleges, for several reasons. First, community colleges play a central role in STEM education, particularly in the STEM education of those students who are currently underrepresented in the tech industry.⁴¹ Next, most community colleges, while generally operating independently of one another and collaborating on a limited basis,⁴⁶ do operate with a shared mission to “serve all segments of society through an open-access admissions policy” and a commitment to affordable tuition.⁴⁷ This shared mission makes it an easier task for the tech industry to collaborate with the schools on a broad scale, as compared to a group of disconnected programs. Third, community colleges, more than most schools or education programs, focus on workforce

development in their local communities,⁴⁸ which may in the future enable local internship opportunities to be connected to the blended learning program, giving students the opportunity to gain hands-on experience before seeking full-time employment in a technical role.

Interaction with program faculty in online or blended programs is an important element in the student experience. Because the majority of technical learning will be occurring in face-to-face classes delivered at the community college, I recommend viewing online faculty as mentors, akin to Google's approach to its Google in Residence program on HBCU campuses.⁴⁹ Unlike the Google in Residence program, faculty members for the online program will be able to continue in their regular roles, with a part-time commitment to their faculty role in the online program. As in Google in Residence, the intention is that these faculty provide insights on their personal experience in the field, advise on technical questions, and advise students on questions as varied as writing a cover letter to whether, and how, to apply to specific jobs.⁴⁹ In a slight departure from the Google in Residence model, these online faculty members should be regarded as industry ambassadors, rather than as representatives of a single company.

Effective program delivery requires an ongoing relationship with community college partners. The program should therefore have a full-time staff responsible for ensuring smooth delivery and open

communications with partners. Community college faculty should be provided auditor status to view the online course, as well as provided with an overview of course goals, discussion topics, and assignments. It is critical that face-to-face faculty are knowledgeable about this program, and that students know their face-to-face faculty are aware of their participation in this program. While the blended learning program does exist across a “divide” between the face-to-face and online components, with an unusual design utilizing different faculty members for the online and face-to-face components, students should feel the two “halves” of the program exist as part of one larger whole. This can be achieved in part through design of the online components, and in part by ensuring community college faculty are informed and able to check in with their students on their participation and experience in the online program.

Program Pilot

For our initial pilot I recommend seeking government funding so no program costs are passed on to students or cash-strapped community colleges.⁵⁰ Members of the tech association guiding the effort from the employer side will donate their time and expertise to program design, as well as donating the time of those employees acting as online faculty. Should the program be expanded after the pilot, I recommend seeking additional funding from private sources and in the form of minor student fees (with

waived fees available for those without the financial means to pay). The Gates Foundation, for instance, has established postsecondary success as a focus area⁵¹ and may therefore be interested in contributing to this project focusing on the type of flexible, career-oriented learning they typically fund.

Across the United States, there are 1,108 community colleges.²² I recommend an initial pilot take place in ten of these community colleges, centered in one or two regions, with up to 300 students participating in the blended program and up to 300 face-to-face students acting as a control group. Students should be randomly enrolled into the pilot program or the control group, in order to avoid skewing results via an opt-in program. The pilot program will last for two years, during which time I recommend tracking: student participation in the online program; persistence in the online program; progress made towards a degree; placement in a technical role within the tech industry (specific role types to be defined before program launch); student perception of community; and employer perception of student preparedness for technical roles. Comparing student persistence, placement rates for technical roles, and employer perceptions across the pilot and control groups will offer a clearer sense of whether the blended program is a viable means of increasing industry diversity.

During this pilot, students should be placed in cohorts of approximately 30 students. Although there is little

agreement among experts on the ideal cohort size in the online learning environment, I believe 30 is the maximum that will allow online faculty to build meaningful relationships with students, and students with one another.⁵² Further, these moderately sized cohorts minimize any community disruption that attrition may cause, and which would be amplified in a smaller cohort. For this pilot, I recommend constructing cohorts by community college campus, so students are participating in the online community and face-to-face classes with many of the same students. Constructing cohorts by college campus may offer some additional benefit in terms of degree persistence, a benefit likely to be of interest to community colleges struggling to retain students.^{27, 53}

Several critical challenges may emerge during this pilot phase. First, as already alluded to, community colleges struggle with student retention.^{27, 53} Retention for STEM community college students is stronger than for non-STEM students (37% of STEM students drop out after six years, compared with 52% of non-STEM students⁵⁴), but the combination of attrition and slower-than-expected degree completion may negatively affect the community experience of students enrolled in the pilot. This is an area I recommend watching closely throughout the pilot. There exists a related challenge in the retention of online faculty playing a mentorship role; should a faculty member transition out of his or her company during the program,

we run the risk of losing them as faculty and disrupting the student experience. At the end of this pilot, I recommend comparing results across cohorts that did and did not experience a faculty disruption, in order to determine whether additional study or alternative faculty models are necessary.

Further Considerations

The diversity of the talent pipeline at the secondary level is not the only challenge the tech industry faces. To most effectively address the diversity issue, the industry would be well served to consider two other points.

First is that increasing the access of underrepresented students to computers and computing classes at a younger age will increase the size and diversity of the STEM pipeline at the college level. Increased access will also reduce challenges related to students arriving at college academically unprepared for a STEM major.⁴¹ Even introductory computer science classes at the college level assume students have a long history of playing with computers and coding.⁵⁵ The extreme decline in female computer science majors in the mid-1980s demonstrates how easily the pipeline can lose diversity when students feel they are behind at the outset.⁵⁵ Programs such as Girls Who Code and Black Girls CODE target members of underrepresented groups, and a survey of Girls Who Code alumni found that 84% plan to pursue a career in technology or computer

science.⁵⁶ These programs, however, are not large enough to systemically address the issue of youth access; Girls Who Code, one of the best-known programs, has just over 10,000 alumni.⁵⁷ In order to increase the number of students and regions served, the industry should partner with schools and nonprofit organizations to increase student opportunities to meaningfully engage with computers, and develop their interests and skills, well before reaching college.

The second critical issue is to address the culture within tech companies, specifically focusing on reducing the implicit bias that drives hiring and management decisions. Implicit bias lies behind many of the challenges limiting diversity in the field, from the pipeline to hiring decisions to retention of underrepresented groups.⁸ Recent data showing that blacks and Latinos are graduating college with tech degrees at much higher rates than leading tech companies are hiring them³ indicates that tech companies must address their cultural issues rather than the pipeline alone. A larger and more diverse pipeline cannot by itself solve the tech industry's diversity problem. Without addressing and correcting the implicit biases that have brought the industry to its current state of uniformity, that more diverse pipeline will simply become "leaky" as students embark on their careers.

By bringing an intense focus to the tech pipeline, the industry can increase the diversity of its pipeline, open new opportunities to students who may otherwise have

not pursued a career in STEM, and open new profit opportunities as diversified employee groups coalesce. Those leaders that approach diversity with an open mindset, that view this as an opportunity rather than an obligation, now have the ability to drive the conversation and action around diversity, and shape the future state not just of their organization, but of the tech industry as a whole.

Author bio

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