



SPRING 2020

Using Lean Launchpad to Build an Innovation Ecosystem at a Historically Black University

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INTRODUCTION

The lack of racial diversity in the technology industry has been widely acknowledged, especially since 2014 when many Silicon Valley companies, like Google, Facebook, and Intel, released racial diversity data. (USEEOC 2014) Statistics indicate that Blacks and Hispanics are grossly underrepresented in professional careers within technology companies. While Blacks comprise over 14% of the workforce in all private industries in the United States, they account for only 7.4% of the high tech workforce, as defined by the United States Equal Employment Opportunity Commission. Similarly, Hispanic workers comprise just under 14% of jobs in all private U.S. industries, but less than 8% in high tech industries. By contrast, however, whites account for nearly 64% of the workforce in all private U.S. industries, but over 68% of the high tech workforce and Asian Americans comprise less than 6% of the private industry workforce in the U.S., but over 14% of the high tech workforce. (USEEOC 2017) Howard University faculty involved in tech entrepreneurship noticed this disparity first-hand as entrepreneurs themselves and as participants in entrepreneurship events and conferences. They set out to build an innovation ecosystem at Howard, a historically Black University, in order to address this gap and prepare more traditionally underrepresented engineering professionals for careers in the current and future technology innovation sector.

Building an innovation ecosystem was the preferred approach for the undergraduate engineering experience at Howard University because an ecosystem is, by definition, a sustainable environment that supports interconnected and often complex networks. More than a single program or course offering, an ecosystem would have a more prolonged and profound impact on increasing the presence of traditionally underrepresented populations in high tech industries. *This paper explores the building of an innovation ecosystem at Howard University and addresses how it started, what it entails, outcomes that have been observed thus far, and next steps.*



Key words: HBCU, underrepresentation, innovation

HOW IT STARTED

As a participant in the inaugural cohort of the *Pathways to Innovation* program, a team of engineering faculty and administrators at Howard University committed to integrating structured innovation and entrepreneurship learning experiences in the undergraduate engineering curriculum. *Pathways to Innovation* was a major focus of Epicenter - the National Center for Engineering Pathways to Innovation, funded by the National Science Foundation, whose goal was “to help institutions transform the experience of their undergraduate engineering students and fully incorporate innovation and entrepreneurship into a range of courses as well as strengthen co- and extra-curricular offerings.” (Epicenter 2018) Howard applied to be part of the *Pathways to Innovation* program in order to expand its capacity to prepare traditionally underrepresented engineering students of high academic standing and potential to become leaders in tech innovation and entrepreneurship.

At the time, Howard had select engineering and computer science faculty members introducing coursework and advising design projects that engaged students in structured innovation and entrepreneurship experiences, but participating in *Pathways to Innovation* became the catalyst to moving from isolated efforts to a coordinated initiative. The team decided on three primary projects with high impact potential to kickstart the initiative - integrating innovation into the required *Introduction to Engineering* course, expanding student experiences with lean startup principles in the *Bison Start-Up* technical elective course, and using lean startup principles as a means for introducing new transfer students to the engineering and computer science programs and the University community.

The Lean Startup approach had been applied, for years, as a method for launching entrepreneurial efforts in a more experiential way than traditional business plan development. The key features of the Lean Launchpad model are proposing a business model, exposing the underlying hypotheses associated with that model, and performing experiments to validate or invalidate assumptions about that model. There was little in the literature, at that time, about the impact of the approach on student engagement, especially for traditionally underrepresented student populations. Thus, Howard used lean startup principles as an experiential learning construct to engage engineering students, explore its effects, and build an innovation ecosystem for the University.

WHAT THE LITERATURE SAYS

Successful entrepreneurship programs have combined elective, curricular and co-curricular experiences with structured mentoring in comprehensive offerings that increase participants' knowledge



and opportunities to interact with and experience entrepreneurship in real-world, hands-on contexts. (Barbe, Magids, and Thornton 2003) Despite the growing popularity of entrepreneurship programs, traditionally underrepresented students are not participating in entrepreneurial courses at the same rate as their peers. In a study of the impacts of entrepreneurship education on 343 engineering students from three universities, only 18 students (approximately 5%) were Black or Hispanic. The same study suggests that engineering students benefit from entrepreneurship learning experiences, by developing entrepreneurial self-efficacy and skillsets, but engineering students are largely not exposed to entrepreneurial education, even in universities where formal entrepreneurship programs are in place. (Duval-Couetil, Reed-Rhoads, and Haghighi 2011)

This highlights the need to increase the participation of traditionally underrepresented engineering students in entrepreneurship programming at all levels. First-year engineering students have demonstrated ability to complete conceptual designs without “the detailed technical knowledge they acquire only later in the curriculum” and these experiences have been found to improve interest, performance, and retention in engineering study among traditionally underrepresented students. (Dym, et. al. 2005). Exposure to the Lean LaunchPad methodology, specifically, has demonstrated influence on engineering students’ entrepreneurial self-efficacy, though no statistically significant correlation to entrepreneurial behavior has been proven. (Huang-Saad, Morton, and Libarkin 2016)

In a study of 93 African American students enrolled in business courses at multiple HBCUs, prior exposure to entrepreneurial activities was associated with stronger entrepreneurial attitudes. (Gibson, et al. 2014) This supports the potential for participation in entrepreneurship programming to increase the number of traditionally underrepresented students who develop an entrepreneurial mindset and participate in the high-tech workforce as entrepreneurs and intrapreneurs. An entrepreneurial mindset is discovery driven, similar to the skills students acquire by participating in lean startup exercises and programming. (Gunther and MacMillan 2000)

INNOVATION ECOSYSTEM OUTCOMES AT HOWARD UNIVERSITY

Students

What began as individual implementations of structured experiences with innovation and entrepreneurship at Howard University has become a growing ecosystem, comprised of numerous stakeholders and beneficiaries. Over six hundred Howard University engineering students enrolled in required and elective courses in 2014, 2015, and 2016 became part of the growing ecosystem. This represents over half of the total undergraduate engineering population during that time. The majority of students involved were enrolled in the *Introduction to Engineering* course. Early engagement of students in their first year

**Table 1. Pre/Post Scores for First-Year Students' Confidence in Engineering Skills.**

Semester	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016
Before Class Mean (sample size)	4.03 (66)	3.69 (149)	3.80 (167)	3.82 (196)	3.69 (144)
After Class Mean	4.06	3.93	4.09	3.98	4.09
t Statistic	0.276	2.37	3.14	1.63	4.07
P	0.78	0.02	0.002	0.11	0.00006
Significant?	No	Yes	Yes	No	Yes

of study was to provide two primary benefits – enhancing students' approach to design through empathy and customer discovery and introducing students to entrepreneurship opportunities available at Howard. The Lean Launchpad module was rated highly by *Introduction to Engineering* students (3.83 average rating of 5.0) and several students went on to pitch business ideas in order to be considered for enrollment in the *Bison Start-Up* technical elective course. An unexpected outcome was that *Introduction to Engineering* students experienced an increase in confidence in their engineering skills after completing the course, when the Lean Launchpad module was implemented in fall 2014. The confidence boost has generally been found to be increasingly statistically significant (see Table 1). One student from the fall 2014 class went on to win an innovation competition at the South by Southwest Music Festival in 2016.

A partnership with the United States Patent and Trademark Office (USPTO) is also enhancing the *Introduction to Engineering* course. Staff from the USPTO Office of Education and Outreach developed an intellectual property course module that introduces students to patents and trademarks. USPTO staff provide instruction for the module over three 80-minute class sessions. Students rate the USPTO module highly (3.9, on average, of 5.0). Although the increase in ratings is not statistically significant ($P=0.99$ and $P=0.51$ for comparison of 2014 to 2015 and 2015 to 2016 ratings), the annual rating trend is rising.

Nearly 40 students enrolled in the *Bison Start-Up* technical elective course over three academic years. Throughout the semester, student teams explored how multidisciplinary teams build high-tech companies using a hands-on approach to the business model canvas and Lean Launchpad methodology. Students were selected for the course based on pitching their business idea and developing a team of hackers (who construct the solution), hipsters (who engage the people), and hustlers (who organize the business). The success of the course led to the development of a second course, *Bison Accelerate*, in which student teams moved promising product ideas forward toward commercialization.

Resources

The innovation ecosystem at Howard has grown to involve a network of resources. New relationships with high tech companies have produced an increase in the number of these companies

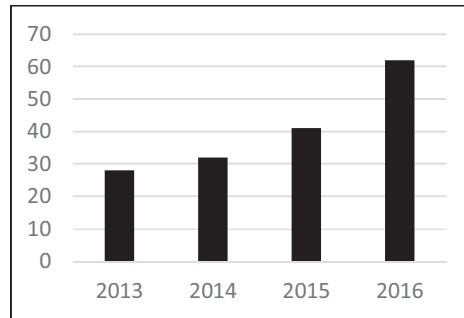


Figure 1. High Tech Companies Recruiting in Engineering and Computer Science at Howard University.

who recruit engineering and computer science students for internships and full-time careers (see Figure 1). These partnerships include career fair participation, skills workshops, corporate mentoring, and other student programming.

Partnerships with other universities have also proved beneficial. In 2014, Howard was awarded a grant from the National Science Foundation to fund equipment and materials for a world-class maker space. The University also provided resources in support of this effort, including \$1 million for maker space construction and salary to hire a Director of Innovation and Entrepreneurship.

Another proposal effort, in collaboration with New Mexico State University, also led to resources, in the form of a National Science Foundation Broadening Participation in Engineering grant, to advance minority participation in innovation and entrepreneurship. Using a weeklong adaptation of the Lean Launchpad curriculum, Howard and New Mexico State (a Hispanic-serving institution) engaged new transfer students in a design challenge to address campus needs, focusing on customer discovery and value proposition. In addition to gaining experiences with engineering design that mirror the experiences first-year students have in *Introduction to Engineering*, the summer program also introduced new transfer students to engineering faculty, students, and campus challenges and resources. Fourteen students completed the program at Howard in summer 2015 and summer 2016. Evaluation of their experience shows that the program is positively perceived. The lean startup topics covered were rated 3.6 of 5.0, on average. More importantly, statistically significant increases were observed in the students' motivation to major in engineering and pursue a career in engineering, based on an analysis of the combined participants at Howard and New Mexico State Universities.

In 2015, Howard was awarded National Science Foundation I-Corps Site funding, in partnership with Hampton University. This novel partnership involves two Historically Black Colleges and Universities (HBCUs), with integrated assistance from DC I-Corps, the regional I-Corps node supporting



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the DC-MD-VA region. The partnership enhances the participation of HBCU students and faculty in technology transfer and venture creation by leveraging DC I-Corps' expertise in the Lean Launchpad philosophy and curriculum. DC I-Corps benefits from the Site's regional alignment to accelerate the participation of African-Americans in I-Corps Node cohorts, thereby enhancing diversity within the node. Activity on each campus and structured assessment of programs also informs strategies for improving innovation and entrepreneurship interventions aimed at underrepresented groups and enhancing ongoing educational research at DC I-Corps. The Site is funded to provide seed investments in University startups so that the startups can pursue enhanced understanding of customer markets and potential product-market fit. To-date, over 50 teams have gone through the Site program and the reach of the program continues to grow. A 2016 TedX talk at Howard emphasized ways that HBCUs can build an innovation ecosystem as a means for economic recovery and rejuvenation in Black communities.

Collaborations

As a result of the emphasis innovation places on collaboration, Howard developed other partnerships, in addition to those aforementioned, including:

- a Memorandum of Understanding with IN Capital to fund startups founded at Howard;
- a partnership agreement with 1776, a local co-working space and accelerator, that provides Howard students access to 1776 events and programming;
- a partnership with AccelerateDC, a venture mentor network, to build a Howard alumni mentor network; and
- a partnership with the DC Small Business Development Center to provide a workshop on Tech Entrepreneurship.

LOOKING FORWARD

Increasing the involvement of traditionally underrepresented groups in structured innovation and entrepreneurship experiences are among the critical changes in workforce development needed to address their low level of participation in the high-tech industry. Minority-serving institutions (MSIs) enroll more than one-third of all U.S. underrepresented students, which allow them unparalleled access to service these students. The development of an innovation ecosystem at Howard University is one step toward addressing this need. Implementing lean startup principles into engineering coursework was the start of an initiative that has grown into a multifaceted ecosystem that is preparing traditionally underrepresented students for careers in tech innovation.



Moving forward, Howard University has already been funded to extend the core objectives of the Howard - Hampton I-Corps Site to include participation by the Atlanta University Center (AUC) Consortium. The program proposes a guided customer discovery activity that would simultaneously expose faculty in the AUC to the Lean Launchpad methodology and help to highlight value propositions that satisfy internal customer needs around innovation and entrepreneurship. The culmination of the program would be an AUC-focused I-Corps Site submission and inclusion in the National Innovation Network. The intent is then to use a similar model to engage other HBCUs.

Howard University is also partnering with the Score3 Angel Group to build a network of Angel Investors focused on investing in traditionally underrepresented- and women-led startups. The Angel Network will work closely with HBCUs to engage their alumni bases as the foundation for the network members. There will be a strong focus on funding startups originating in HBCUs and other MSIs.

ACKNOWLEDGEMENT

This material is based upon work supported by the National Science Foundation through an Independent Research and Development project. Any opinion, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Grant Warner is an Associate Professor of Mechanical Engineering at Howard University, an entrepreneur, certified Lean Launchpad Educator, and a nationally trained I-Corps Instructor. He leads the *HowU Innovate* interdisciplinary initiative, which provides campus-wide programming in innovation and entrepreneurship at Howard University. He also directs the Howard University - Hampton University I-Corps Site. Dr. Warner has a focused interest in increasing Black participation in technology startups.



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