

**BROADENING ADVANCED TECHNOLOGICAL EDUCATION CONNECTIONS
THROUGH COMMUNITY ENGAGEMENT**

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Final Project

Higher Ed 622 Community Engagement in Higher Education

12/10/14

Abstract

The purpose of this paper is to investigate if the Tech Apprentice High School Internship Program is using some of the best practices in community engagement from higher education to address the shortage of skilled labor in Information Technology (IT) in Boston, Massachusetts. The principals of democracy and the theories of education, reciprocity, and community engagement informed this analysis. The research questions are as follows: (1) Using “the partnership as a unit of analysis,” does the High School Tech Apprentice Program contribute to a “net increase in the community assets?” (Cruz & Giles, 2000); (2) Do the employers, the students and the other partners experience reciprocal benefits from their collaboration? (3) Does this partnership improve the status quo for the minority students that it serves within the Boston Public High Schools?

Background

The Tech Apprentice High School Internship Program is the result of a collaborative and innovative partnership between TechBoston, the Boston Public Schools' Office of Instructional and Information Technology, and the Boston Private Industry Council (PIC). The successful implementation of this partnership is sponsored and supported by Broadening Advanced Technological Education Connections (BATEC). BATEC is a National Science Foundation-funded center of excellence for Computing and Information Technologies (IT) headquartered at the University of Massachusetts Boston. The partnership was formed in 2006 to address the shortage of skilled labor in Information Technology in Boston. In the past eight years, the Boston Private Industry Council has matched approximately 950 underserved high school students from the Boston Public High Schools (BPS) and Metro Boston with local employers in paid summer and semester-long internships through the "Tech Apprentice" High School Internship Program.

Problems Addressed

Racial Disparities in Boston Post-Secondary Education

Racial disparities are getting national attention after the deaths of three black youth in Ferguson, Missouri, New York and Cleveland. Many scholars in Boston are being asked to comment on the problem. In a December 2014 *Boston Globe* article, John Stauffer, Professor of English and of African and African American Studies, Harvard University, describes Boston as "a classic 'donut' city: poor blacks and minorities in the inner city; lily upper-middle-class whites in suburbs." According to the Boston Public Schools website, 78% of the 57,230 students enrolled in BPS are low income and 86% are students of color: 41% Hispanic; 36% Black; 13% White; 8% Asian and 1% other/multiracial. In 2012, the BPS high school graduation rate was 64% which equates to a 36% drop-out rate. Since Boston Public Schools educate 74% of the

children in the city of Boston, the impact on the communities is significant with high levels of unemployment.

High Unemployment among Massachusetts Youth

The Center for Labor Market Studies at Northeastern University examined the employment outcomes for young high school graduates in Massachusetts. In October 2013, Andrew Sum, Ishwar Khatiwada, and Walter McHugh published their findings in “The Labor Market Problems of Massachusetts’ Workers in the Recovery from the Great Recession: The Great Socioeconomic Divergence.” They determined that “the least well educated workers in our state were 6 times as likely to be unemployed as the best educated group of workers.”

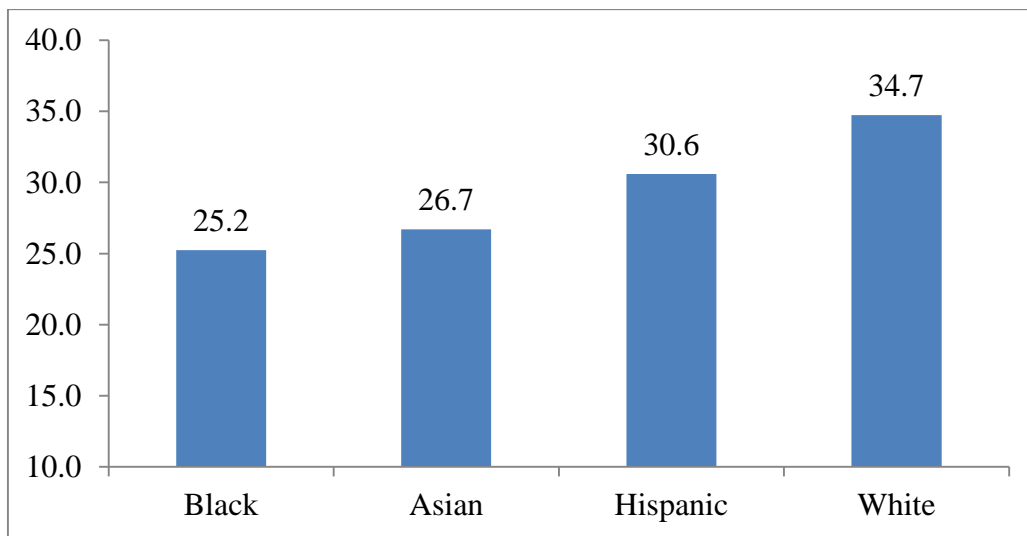


Figure 1: Employment Rates of Teens (16-19) in Massachusetts by Race-Ethnic Group, 2012 (in %). 2012 American Community Survey (ACS), public use files, U.S. Census Bureau, tabulations by Center for Labor Market Studies, Northeastern University.

The Tech Apprentice Program is an attempt to introduce minority populations in urban Boston areas to well-paying IT jobs through paid internships in Boston companies that suffer from a shortage of trained IT workers. Apprentices receive pay of \$10/hour for 35 hours/week or \$2500 for the summer. With 70%-75% unemployment among inner-city, minority Boston youth,

a summer job through Tech Apprentice is one step in the right direction toward equity and equal opportunity.

In June 2012, the Massachusetts Board of Elementary and Secondary Education Task Force on Integrating College and Career Readiness issued its report “From Cradle to Career: Educating Our Students for Lifelong Success.” The board recommended a major expansion of job opportunities, internships, and career awareness activities for high school students. The Tech Apprentice program fits the task force’s recommendation.

Significance of the Problem Nationally

The U.S. Bureau of Labor Statistics also issued a report on the college enrollment/labor market status of high school graduates from the Class of 2012 as of October 2012.

- Employment rates are extremely low for Black (29%) and low income youth (31%).
- The full time employment rate for non-college enrolled graduates was only 19%.

Clearly, our current educational system is failing to adequately prepare our youth for the workforce. Only 19% of the youth with no post-secondary education are employed full-time. 81% unemployment among youth is a national disgrace.

A 2014 *Boston Globe* article by Jay Fitzgerald frames the problem differently. Entitled “Workers’ skills aren’t matching available jobs,” the article argues that our high schools and colleges are not preparing students with the skills this knowledge-based economy demands. Fitzgerald writes, “But the real problem is that many large companies, particularly manufacturers, no longer take it upon themselves to train workers through apprenticeships, internships, and other programs...and the consequence is a labor force not prepared to perform many modern jobs.”

The Boston Mayor's Office supports the Tech Apprentice High School Internship Program and programs like it to help alleviate this serious unemployment problem. According to BATEC Director Lou Piazza, former Mayor Menino's strong commitment to the city of Boston's summer job program helped grow Tech Apprentice's employer participation.

Shortage of IT Trained Workers

The shortage of skilled labor in Science, Technology, Engineering and Mathematics (STEM) fields nationwide is well documented by the U.S. Department of Education and the Department of Labor. The U.S. educational system is not creating a large enough pipeline of future STEM employees to meet the demand. Information Technology is one part of the STEM pipeline. STEM jobs are expected to grow by 17% during the 2008-2018 period versus 9.8% growth for non-STEM jobs (Massachusetts Business Alliance for Education, 2008, p. 2). In addition, "the average annual wage for all STEM occupations was \$77,880 in May 2009, significantly above the U.S. average of \$43,460 for non-STEM occupations" (National Governors Association, 2011, p. 4).

A two-year study by the Harvard Graduate School of Education, *Pathways to Prosperity* (2011), reported that roughly one-third of the jobs created in the coming years will require an associate's degree or occupational credentials. Equipping students with the technical skills required by jobs is a democratic imperative. According to *Educating a 21st Century Workforce* (October, 2008), "many of our students graduate from high school unprepared for college and a career, too few pursue the scientific and technical disciplines our knowledge-based economy demands, and an unacceptably high proportion leave high school before graduating, especially in underserved communities" (Massachusetts Business Alliance for Education, 2008, p. 2).

Inquiry Questions

Using “the partnership as a unit of analysis,” does the High School Tech Apprentice Program contribute to a “net increase in the community assets?” (Cruz & Giles, 2000). Some of the community assets Tech Apprentice can increase are: professional development of teachers, curriculum development, skill building by students, job creation, better pathways from school to the workforce, access to public higher education, and qualification for national grants to benefit local communities. Analysis of the responses from 55 apprentices and 18 employers from the summer of 2014 Tech Apprentice program will address whether the collaboration among these multiple partners contributes to a significant increase in community assets. Other questions remain: Do the employers, the students and the other partners experience reciprocal benefits from their collaboration? Does this partnership improve the status quo for the minority students it serves within the Boston Public High Schools? Further analysis of the research will provide answers to these questions.

Literature Review

John Dewey’s philosophy of education called for dramatic educational reform in 1916 when he published *Democracy and Education*. Ernest Boyer emphasized the need for reform again in 1983 when he served on President Reagan’s National Commission on Excellence in Education and contributed to the report, “A Nation At Risk, The Imperative For Educational Reform.” Boyer reminds us that education is a continuum. He wrote, “You can’t have good colleges if you don’t have good (high) schools” (1983). The continued need for educational reform in 2014, based on the serious problems cited in this paper, is evident.

John Reiff, Director of the University Of Massachusetts Amherst Office Of Community Service Learning, said Dewey called education the “midwife of democracy” and suggested that

democracy must be reborn with each generation. It is clear that improving education and achieving democracy for every student are constant works in progress. The Tech Apprenticeship High School Internship Program epitomizes Dewey's recommendation to integrate school with society. Dewey, Boyer, Rice and others proposed that integration and application of knowledge lead to better acquisition and retention of knowledge learned in the classroom. Dewey asserted that students learn best through direct personal experience. Much of Dewey's work pertains to K-12 education. For example, the Laboratory School he founded in Chicago was based on experimentation, learning by doing, and solving problems. The Tech Apprentice program is an experiment too, and one that shows promise: the National Science Foundation renewed BATEC's grant for five million dollars to expand Tech Apprentice from Boston to three other cities.

Dewey and Boyer were strong advocates for public education and social justice. If they were alive today, they would probably support former President Bush's landmark No Child Left Behind Act of 2001 which calls for dramatic education reform in K-12 schools. The opportunity that the Tech Apprentice program gives low-income, minority students from Boston Public Schools is more than mere job training. It allows students to experiment, to test their knowledge and aptitude for IT, and to experience whether IT work is what they enjoy.

In *Democracy and Education*, Dewey based his philosophy of education on Plato's philosophy. Dewey said of Plato: "No one could better express than did he the fact that a society is stably organized when each individual is doing that for which he has aptitude by nature in such a way as to be useful to others (or to contribute to the whole to which he belongs); and that it is the business of education to discover these aptitudes and progressively train them for social use." (1916, p. 88). When you combine education with the democracy of equal opportunity as Tech

Apprentice does, education has a chance to realize more of its full potential. Paul Watanabe, Director, Institute for Asian American Studies, UMass Boston, echoes Dewey's philosophy this way. Watanabe told *The Boston Globe*: "Diversity and inclusion enhance mutually beneficial opportunities. For individuals, it can mean opportunities to realize their full potential. For the society as a whole, it means the opportunity to benefit from the talents and contributions of everyone." (2014)

Tech Apprentice is a form of community engagement that links the talents of inner city, Boston high school juniors and seniors with job experience in highly-respected companies. Although the Tech Apprentice Program does not fit the Bringle and Hatcher definition of service learning because the apprentice is not "...a credit-bearing, educational experience" (Bringle and Hatcher, 1995), many of the benefits that a student receives from service learning are similar to ones received through an apprenticeship or internship. The integration and application of knowledge are two of the four faculty priorities which Boyer and Rice consider to be essential to learning. Teaching and research are not enough. Engagement with the community provides context and adds value.

The Difference between an Apprenticeship and an Internship

The Tech *Apprentice* High School *Internship* Program is a blend between an apprenticeship and a paid internship. The founders use these terms interchangeably. By design, the student earns academic credit in coursework prior to the apprenticeship that will help the student be valuable to an employer. The high school students work at companies in technical positions as low-cost labor and learn more valuable IT skills.

Apprenticeships have been traditionally associated with blue-collar industries such as construction or manual labor. Some would argue that internships are typical of white-collar

industries, but the Tech Apprentice program is an example of how apprenticeships can apply to professional services. Dewey reminds us that in the past, surgeons, physicians, plumbers, valets, and barbers learned their occupations by apprenticeships. “Education has been much more vocational...the education of the masses was distinctly utilitarian,” said Dewey (1916).

Internships give students a chance to explore multiple career options and to gain experience. There is research about the value of mentor/mentee relationship in student success. Some internships offer mentoring relationships. Although the summer Tech Apprenticeship only lasts seven weeks, there are semester-long apprenticeships. Several BPS students have participated in three apprenticeships back to back that have led to full-time jobs. One student honored at the 2014 Boston Industry Council’s annual meeting is the perfect example. His part-time job led to full-time employment at the Federal Reserve.

Collaboration and reciprocity are key principles of good community engagement (Saltmarsh and Hartley, 2011). Saltmarsh, Cruz, Giles and others in the field of community engagement often cite the lack of reciprocity in some community partnerships. Research conducted “on” the community instead of “with” the community is not reciprocal. Trying to solve the root causes of problems is much more beneficial to all parties. Solving problems in the community requires collaboration, a long-term commitment, and community involvement. Tech Apprentice demonstrates all three of these attributes.

The literature on service learning informed this analysis. Tech apprentices apply and integrate knowledge. So do service learners. Both are forms of community engagement. We learn in “Where is the Service in Service Learning” that the “literature is almost devoid of research that looks at the impact on the community” (Cruz & Giles, 2000). Cruz and Giles recommend using “the partnership as the unit of analysis” to measure whether a partnership is

making a positive impact. Although Tech Apprentice is not an example of service learning, it is an example of a community partnership focused precisely on creating a positive impact on the community. As each member of the partnership contributes its assets to the Tech Apprentice program, we can evaluate whether there is a “net increase in the community assets.”

Another way to measure impact on community assets is suggested in the itemized list below by Saltmarsh and Hartley who pose this question in their book *To Serve a Larger Purpose*: “Can institutions of higher learning fulfill their various purposes (job preparation, economic development, knowledge creation, cultural resource provisions) and also act to promote a strong democracy?” (2011). This list is a tall order for higher education to achieve; however, BATEC and UMass Boston provided the higher education perspective that, to build a strong pipeline of IT talent, you must start as early as high school. Tech Apprentice addresses precisely what Saltmarsh and Hartley speak of in *To Serve a Larger Purpose*: job preparation, economic development, knowledge transfer, resource sharing and democracy – equal opportunity.

Another test of effectiveness borrowed from Cruz and Giles is to ask whether either PIC or BATEC could accomplish separately what they accomplished together. The answer is no.

Methods Used to Gather Data

Employers must complete an online internship recruitment form requesting certain skills. Students must apply and submit a resume listing their technical skills. The TechBoston Employer Account Manager for the Boston Private Industry Council (PIC) matches employers with students. The Tech Apprentice program is open to Boston and Metro Boston residents and generally caters to BPS students.

PIC and BATEC evaluate the success and incremental effect of the internships using surveys to measure if the net effect of the partnership is positive. They established qualitative assessments to measure its impact. Each student tech apprentice is given the opportunity to complete two surveys: a pre-survey and a post internship survey. Employers complete one survey at the end of the student's internship. Neither the employers nor the students were incentivized in any way to complete these surveys.

In the pre-survey, students are asked nine questions:

1. School attended
2. Gender
3. Race/Ethnic Group
4. Grade
5. Tech classes
6. Previous internships
7. Impact of internship
8. Intentions after high school
9. College and career goals

A post survey asks these same students to report what they learned during their internship and to rate their level of interest in studying technology further. To protect the privacy of minors in high school, the Boston Industry Council administers all of the surveys and keeps them anonymous. These methods capture students' opinions about the helpfulness of the program and their likelihood of pursuing a job or further study in the technology field. In addition to computer training, students also receive "Employability Skills" training that includes the ability to work effectively as part of a team, provide excellent customer service, and solve problems.

Findings

During the spring of 2014, Boston Private Industry Council (PIC) matched 76 Boston Public High School and Metro Boston students with paid summer internships at 32 local companies in the technology field. Some of the employers included the Massachusetts Institute of Technology, State Street Bank, the Federal Reserve, UMass Boston, Microsoft, Boston Properties, Akamai Technologies, Gemvara, Blue Cross Blue Shield of MA, and New England Baptist Hospital. PIC shared the anonymous responses of the 18 of the 32 employers who responded to the fourteen-question post internship survey. PIC achieved a 56% response rate. 44% of the companies did not complete the survey despite multiple email reminders.

Questions Asked Employers

In response to the question “why did you hire a Tech Apprentice student?” the employers chose the following as the three most common reasons: (1) “Needed extra help” (2) “Opportunity to mentor a young person” and (3) “Take advantage of low-cost labor.” Mentoring a young person is a valuable feature of a true apprenticeship in which a highly-skilled employee takes time to teach a new person how to do the job.

In response the question, “what types of work did your Tech Apprentice complete during the course of the internship?” employers checked all of the following job responsibilities: database management, data entry, collecting and analyzing data, administrative support, graphic design, 3D animation and social media.

In response to “were you satisfied with your Tech Apprentice?” an impressive 95% of the employer respondents said they were “highly satisfied or mostly satisfied.” Of these, 78% were “highly satisfied” (14/18) and 17% were “mostly satisfied” (3/18). Only one employer was “not

satisfied” (1/18 or 5%). This high rate of positive responses suggests that there may have been some employer self-selection bias in the sample.

In the video of Tech Apprentice success stories found on the TechBoston website, James Whalen, SVP and CIO of Boston Properties, spoke about the value Boston Public Schools (BPS) students added to his operation. He said: “BPS students have a raw talent...growing up with the Internet...they bring a fresh and different perspective to my team.” Clearly, there is reciprocity in this relationship. It is not a one-way street. Boston Properties is not participating in charity work or lending a helping hand to low-income minority students. These apprentices are being paid \$2,500 for their contributions.

The one employer who was not satisfied had very high expectations of a high school intern. These included skills in the following areas: "programming, Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Access/database, web design, collecting/analyzing data." The intern did not possess basic computing skills in this employer's estimation.

In response to “how could the PIC improve support to employers prior to or during the internship?” employers replied:

- “Evaluation form was cumbersome - could be streamlined. Also make it available and explained before the start date.”
- “If at all possible, mail the checks to the student when the employer uses the PIC to do the administrative work and pay so the student doesn't take time off from work to go pick it up.”
- “The orientation should be in person.”
- “Also, the interns had a requirement to document their experience and, although that was their responsibility, it became an opportunity to discuss the progress of the internship.”

This last comment points to the value one employer noted of a written reflection which is a best practice according to the literature. According to Olu Ibrahim, TechBoston Employer Account Manager for the Boston Private Industry Council, other questions asked to the employers were as follows:

- Were you satisfied with the support provided by the PIC prior to the start of the internship?
- Were you satisfied with the support provided by the PIC during the internship?
- At the outset, was your Tech Apprentice sufficiently skilled with technology to manage their project?
- At the end, was your Tech Apprentice sufficiently skilled with technology to manage their project?
- What ADDITIONAL skills, if any, would have made your Tech Apprentice a more immediately valuable employee? (Please check all that apply; list any others)
- If you checked off or listed an additional skill in your response to question 8A, please describe how this skill would have made your Tech Apprentice more valuable?
- Please describe how your Tech Apprentice grew technically during their internship.
- At the outset, was your Tech Apprentice professional in the workplace?
- At the end, was your Tech Apprentice professional in the workplace?
- What PROFESSIONAL skills, if any, would make your Tech Apprentice a more immediately valuable employee? (Please check all that apply; list any others)
- Would you consider hiring another Tech Apprentice in the future?

Summary of Pre-Surveys from Student Participants

PIC received 55 responses out of 76 participants to the pre-survey from high school students prior to the internship, achieving a 72% response rate. Pre-Surveys are distributed to the students at a mandatory orientation program and are completed by hand. A summary of the faxed paper pre-survey responses revealed that the students came from the following eleven schools:

- 47% Boston Latin School (26/55) – exam school
- 13% John D. O’Bryant School of Science and Mathematics (7/55) – exam school
- 7% Tech Boston (4/55)
- 5% Madison Park (3/55)
- 4% West Roxbury (2/55)
- 4% Community Academy of Science and Health (2/55)
- 2% Newton North High School (1/55)*
- 2% North Andover Academy (1/55)*
- 2% Wellesley High School (1/55)*
- 2% Fenway High School (1/55)
- 2% Jeremiah High School (1/55)

The three participants labeled with an asterisk above qualify for participation because their parents pay taxes to the city of Boston and these children are part of METCO, a state-funded grant program run by the Massachusetts Department of Elementary and Secondary Education. “The mission of METCO is two-fold: (1) to give students from Boston’s under-performing school districts the opportunity to attend a high-performing school and increase their educational opportunities and (2) to decrease racial isolation and increase diversity in the suburban schools” (2011).

Most of the tech apprentices were male. 73% of the interns were male (40/55) and 27% of the interns were female (15/55). They were quite diverse:

- 36% Asian (20/55)
- 27% African American (15/55)
- 15% Hispanic (8/55)
- 13% Caucasian (7/55)
- 4% Caribbean (2/55)

2% Haitian (1/55)
2% Indian (1/55)
2% Native American (1/55)

A noticeable trend was that 36% took AP Computer Science in high school (20/55) so they showed strong interest in technical subjects and commitment to challenge them. According to the pre-surveys, an impressive 95% of the interns planned to attend college (52/55).

Summary of Post-Surveys by Student Participants

Only 31 of the 76 High School Tech Apprentices responded to the post-survey administered via email, achieving a 41% response rate. The post-survey questions to student apprentices were as follows:

- How did your Tech Apprentice experience affect your interest in pursuing a technology degree or job?
- How did you feel about your internship? (please check all that apply)
- What technology skills did you gain or develop during your internship? (please check all that apply; list any other)
- What technology skills would you be most excited to work on? (please check all that apply)
- What professional skills did you gain or develop during your internship? (please check all that apply and list below)
- How did this experience help you understand whether technology is of interest to you?
- Why would you or wouldn't you recommend Tech Apprentice to a friend?

The majority of the apprentices said it was a positive experience and would recommend it to others: 48% reported an increased interest in a career in technology (15/31), while 39% reported their interest stayed high (12/31). Only 6.5% reported their interest stayed low (2/31). One student explained, "I wouldn't recommend it to people who either don't like technology or don't have the patience to learn." The way these interns described the impact of

their internships fell into two main categories: 29% gained valuable “experience” (16/55) with some referring to their internship as gaining “real world” or “hands on” experience and 13% gained valuable skills (7/55).

Some Other Comments

“I would recommend Tech Apprentice because you are put into a job that is catered to your skills. It really does teach you a lot and you grow in your field doing projects that you never thought you would be doing. These projects actually create an impact for the places that you work at and you leave feeling accomplished and full of knowledge.”

“I would definitely recommend the Tech Apprentice program to anybody because in these 3 years of working with you guys I've learned a lot and have had great experiences.”

Only 6.5% said they would not recommend a tech internship to a friend (2/31) and only 6.5% reported their interest decreased (2/31). Finding out that a career in IT is not for them is also a valuable outcome for such a young person. They have plenty of time to pursue different interests without wasting more years in school training for a career that for which they are not suited. This resonates with Dewey’s assertion that education should help student reach their full potential.

One student relays a difference between their expectations and the employer’s expectations: “I think the Tech Apprentice Internship is a great opportunity without a doubt. During the ceremony on August 15th you can see how many cool projects other interns did at their location. At my location, it was the total opposite. We never touched on technology at all during the whole internship. All I personally did was just work with Excel sheets and copy and paste information from one sheet to another which didn't really teach me anything at all. I found my location to not even being a technology internship because I will not walk out this building

with a technology skill I never knew.” Working in Excel is required in some entry-level jobs.

What this student learned is that manipulating Excel documents for hours is not their idea of meaningful work. Certainly a student who took AP Computer Science in high school may have different goals for summer work.

When asked about their plans for college in their post-surveys, some of the students were very explicit and wrote that they planned to pursue “aeronautical engineering” at BU or MIT and work for “NASA” as their career goal. One wanted to become: a director, animator or script writer” and study “film and animation.” Another wished to pursue “robotics or auto manufacturing.” One wrote that they planned to study “software encryption at Harvard Extension.” One student from Boston Latin wants to “open a donut shop” and combine the study of business with computer science and HTML.

According to a BATEC executive summary, approximately 98% of Tech Apprentices since 2006 have indicated in their post-internship survey that they intend to attend college. Over 76% indicate an interest in computing-based majors.

Conclusions and Implications

Using “the partnership as a unit of analysis,” the High School Tech Apprentice Program has contributed to a “net increase in the community assets” and offers reciprocal benefits to all partners as demonstrated by the following results:

- 10,000 teacher hours of professional development and direct assistance to schools to implement courses such as Advanced Placement (AP) Computer Science, Web Development, Cisco Networking, Cisco IT Essentials, Microsoft Office Specialist and Robotics was provided by TechBoston.

- 5,000 BPS students took coursework in IT from multiple teachers in multiple high schools.
- \$2,375,000 earned by 950 urban Boston and Metro Boston high school students at \$2,500 each.
- 950 jobs demanding IT skills filled by local Boston companies.
- \$5,000,000 in NSF grant funding awarded to BATEC.
- UMass Boston provides access to public higher education to significant portion of BPS graduates who choose to pursue 4-year degrees and a smaller population seeking an IT degree. The university graduates IT talent helping to supply the workforce pipeline. In fact, the founding director of BATEC who helped implement the Tech Apprenticeship program is a UMass Boston graduate.
- UMass Boston employs some of the Tech Apprentices.

Another way to measure this net positive effect is to ask if Tech Apprenticeship helps address three goals stated by the Boston Private Industry Council. Does Tech Apprenticeship “connect downtown to the neighborhoods?” Yes. Does Tech Apprenticeship pursue an agenda of “economic growth and economic justice?” Yes. Does Tech Apprenticeships provide “meaningful employment (that) changes lives, lifts people out of poverty and strengthens the local economy?” Yes.

Based on the survey responses being very positive and the success stories and awards presented to students and employers at the PIC annual meeting, the employers, the students and the other partners experience reciprocal benefits from their collaboration which is a best practice of community engagement. Has this partnership improved the status quo for the 950 minority students it served? Yes. The fact that BATEC and the Tech Apprenticeship program are narrowly

focused on reversing the shortage of IT skilled workers is a key to their success. The program and its multiple partners are not attempting to solve huge problems of racial inequities and social injustice, but are helping to reduce inequities and share the wealth of opportunities. The partnership is increasing specific community assets little by little in the IT space over the last eight years. The economic impact of \$2,375,000 is substantial, but is not the full picture. We must consider the potential unemployment and welfare costs that could have become the fate of these students without the partnership's vision and support of alternatives to the status quo. The fact that the Tech Apprentice program is continuing into its ninth year is also promising and indicative of future, positive economic growth.

BATEC is also successfully challenging the assumption that students need four-year degrees to qualify for entry-level jobs in IT. By consulting industry experts frequently, PIC and BATEC learned that certain IT jobs only require skills that can be obtained in certificate programs. Other IT jobs require an Associate's degree and still other IT jobs require a Bachelor's degree. The IT professionals who work with existing computer systems do not need the same level of education and training computer scientists who program computer systems do. BATEC is educating students and teachers that there is ample opportunity to work in IT at many different levels. IT job growth is expected to outpace average job growth through 2020. BATEC is also building a pipeline of skilled Information Technology talent among teachers and students at the certificate level, the Associate's degree level and the Bachelor's degree level. Three levels of education give a greater number of students multiple options to train for jobs that pay better than non-STEM jobs, whether they complete four-year degrees or not.

By choosing diverse students from Boston Public Schools and the METCO program, the partnership is contributing to a more democratic society where 950 mostly minority students are

offered the opportunity to work for pay in a tech apprenticeship. "Closing achievement gaps and leveling the playing field is a long-term undertaking" of the Boston Compact according to its tri-chairs, Melissa Dodd, Chris Fliieger, and Shannah Varon. The fact that BATEC has been refining this program for eight years in Boston and have taken it national with a five million dollar NSF grant could have even greater positive long-term effects.

UMass Boston has been selected to receive the 2015 Community Engagement Classification as one of only 361 institutions that hold this Carnegie distinction out of 4000 institutions of higher education nationwide. Chancellor J. Keith Motley of UMass Boston is a member of the Board of Directors of Boston Private Industry Council. UMass Boston's and the Chancellor's commitment to BATEC and community engagement are factors in the success of Tech Apprentice.

The American Association of State Colleges and Universities (AASCU) in Washington, D.C. identified BATEC "as a model for institutions seeking ways to advance practices in the field" and recognized The University of Massachusetts Boston on October 19, 2014 with its Excellence and Innovation Award for Regional and Economic Development. With a \$5,000,000 grant from the National Science Foundation's (NSF) Advanced Technological Education (ATE) Program, BATEC is working closely with IT industry experts to close the gap between what students are taught in computer science classes and what they actually need to know to be successful in entry-level IT jobs.

According to www.BATEC.org, "Employment gaps exist between industry and academia. Unless they are working in close collaboration, (they) tend to drift apart in their understanding of the requirements for proficiency with advanced tools, new programming languages, and emerging skill standards. High growth economic cycles followed by deep

corrections have only served to accentuate the tendency to drift apart.” This observation accentuates the fact that community engagement is essential to high-quality education that is relevant. Close collaboration is required.

Limitations and Future Research

The fact that 60% of the summer of 2014 apprentices came from two of Boston's three exam schools, 47% from Boston Latin School and 13% from John D. O'Bryant School of Science and Mathematics, indicates that the Tech Apprentice program favors smart, motivated, well-prepared students who test well. The students who apply are probably encouraged to do so by the teachers in their IT courses and the pattern is perpetuated year after year. A good experience leads to positive word-of-mouth advertising and more students from the same school apply the following year. The high percentage of students from two of the eleven schools also suggests that the account manager could be harvesting low-hanging fruit. Rather than making a concerted effort to change the demographic of the applicant pool, it is easier to leave well enough alone. The program could benefit from diversifying its source of applicants and expand its efforts to recruit more females who account for 27% of the apprentices.

There are many other opportunities for BATEC to connect even more dots and collaborate across additional siloes. For example, although BATEC is headquartered right on the UMass Boston campus and built our BS in IT program, the pathways for these motivated high school students or community college partners like Bunker Hill Community College to consider UMass Boston for a 4 year degree in IT could be much stronger and more well developed. BATEC has built strong relationships with the following community colleges: Bunker Hill Community College, Quinsigamond Community College, Middlesex Community College and North Essex Community College. UMass Boston has articulation agreements with many of these

schools and linked programs through MASS Transfer. Still recruiting and transfer credits remain a challenge.

Although UMass Boston's relationships with certain Boston Public High Schools is strong and so are its relationships with some community colleges, Tech Apprentice relies too much on exam schools like Boston Latin. Also 73% of the apprentices were male. There could be a more concerted effort made to recruit or encourage females in IT apprenticeships and IT study. While the 55 responders to the pre-survey are diverse, there could be even greater diversity achieved by recruiting fewer students from Boston Latin and spreading the wealth of internships to other Boston Public Schools.

The post-surveys for employers and students were long. Shorter surveys could lead to better response rates. The short pre-survey for students had the best response rate.

BATEC Director Louis Piazza has proposed that we survey all 950 tech apprentices from the past eight years. A longitudinal study is planned. Louis Piazza wants help to test if students who are exposed to technical jobs early in their careers through the High School Tech Apprentice Program are more likely to pursue college and technical majors in college because of their internships.

In addition to The Tech Apprentice High School Program, there is a Tech Apprentice Community College Program that builds a pipeline to a two-year degree. By collaborating with IT industry leaders and building up-to-date IT curriculum into a long-term partnership steeped in reciprocity and the democratic ideals of equal opportunity, Tech Apprentice demonstrates the impressive results that are possible when the best practices in community engagement are put to the test.

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