Urban Science Academy, Boston, MA

Urban Science Academy: A Case Study of an Inclusive STEM-Focused High School in Boston, Massachusetts

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1.0 EXECUTIVE SUMMARY

This case study of Urban Science Academy (USA) is the fifth in a set of eight school-level cases on inclusive STEM-focused high schools (ISHSs). In contrast to highly selective STEM-focused schools that target students already identified as being STEM gifted/talented, the goal of ISHSs is to develop new sources of STEM talent among a wide range of students underrepresented in STEM fields, and provide them with the means to succeed in school and in STEM college majors, jobs and careers. USA is one such ISHS located in Boston, Massachusetts. The school was founded in 2005 when Boston Public Schools received a multi-million dollar grant from the Bill and Melinda Gates Foundation to create smaller high schools where students could receive more individualized attention to help them achieve.

This case study provides an in-depth look at USA’s design, implementation, and outcomes, examining the school using a framework of 10 candidate critical components pulled from the research literature. A team of six researchers visited the school in March 2013 and systematically collected data from classroom observations, interviews, and focus groups, as well as examining public information documents and outcome records. This examination of USA revealed valuable insights into a successful ISHS; the school provided a unique approach to organizing the curriculum to move students to increased rigor, accepting students who may not have had an outstanding academic record, and supporting the students through innovative partnerships with business, industry, and nearby colleges. The faculty and administration had high expectations for the students and were aware of the supports that were needed to help their students succeed. This environment fostered a community of students and teachers who were open to creating opportunity structures for students and taking advantage of them.

Analyses showed that some of the 10 candidate critical components were more salient than others at USA. Of the 10 components examined in this study, many were prominently featured at USA; however our findings suggest that the Supports for Underrepresented Students and Inclusive STEM Mission played dominant roles in characterizing the school. The school’s Well-Prepared Teaching Staff, Administrative Structure, Early College Level Coursework, along with its STEM Focused Curriculum were also important to the school’s program. USA also included evidence of Blended Formal/Informal Learning Beyond the Typical School Day, Week or Year; Reform Instructional Strategies and Project Based Learning; Integrated Innovative Technology Use; and, Real-World STEM Partnerships.

Additionally, themes that emerged from the data that were not covered within the 10 candidate critical components included the use of Data-driven Decisions that USA stakeholders made that were instrumental in the relevance of supports offered to students. Furthermore, the development of a caring School Culture was another emergent theme identified where the entire school community expected students to be high performing and take risks. All students at USA were supported by a core group of teachers, administrators, and larger community who worked beyond expectations to support their academic and personal growth.
2.0 INTRODUCTION

The inclusive STEM-focused high school (ISHS) is a new type of school gaining momentum across the United States. ISHSs focus on increasing literacy in science, technology, engineering, and mathematics through innovative approaches to providing opportunities for academically average students, including students entering high school below grade level, to master rigorous college preparatory STEM coursework. Thus, they create pathways for students from groups under-represented in college STEM majors and careers. In 2010, President Obama issued a challenge to create more than 1,000 new STEM-focused schools over the next decade (Obama, 2010) based on recommendations of the President’s Council of Advisors on Science and Technology in their report, *Prepare and Inspire: K-12 Education in STEM for America’s Future* (PCAST, 2010). As early ISHSs have demonstrated success in engaging and broadening participation of underrepresented groups in college preparatory STEM coursework, new ones are cropping up all over the country. However, there has been no significant characterization or definition of this type of school to date. Under a grant from the National Science Foundation (NSF), this study: *Multiple Instrumental Case Studies: Opportunity Structures for Preparation and Inspiration (OSPrI)*, seeks to characterize and identify the structures of successful ISHSs by examining their design, implementation, and outcomes within the context of their community.

This case, Urban Science Academy (USA), represents the fifth in a set of cases describing the characteristics of successful ISHSs diverse in terms of geographic location, student demographics, and context. USA is unique to our first set of eight case studies in that it is a science-themed high school in a large urban public school district in the Northeast. Its context is also unique because the school district has tiers of high schools with different levels of academic achievement required for admission. USA, as an ISHS positioned in the lower tier open to students regardless of prior academic achievement, expands opportunities for students who might not otherwise be challenged and supported in attaining STEM literacy and college preparedness.

2.1 FRAMING THE STUDY

This case study of Urban Science Academy asks:

1. Is there evidence of each of the candidate critical components (shown in Table 1) in the design of USA, the school that is the focus of the case study?
2. How are the critical components implemented at USA? Do other components emerge from the data collected on-site that are critical to the school’s character and success?
3. What are the contextual affordances and constraints that influence USA’s design, implementation and student outcomes?
4. How do USA’s student STEM outcomes compare with those of the school district and state (e.g., STEM achievement measures, graduation rates, college acceptance rates)?

Our research approach is to explore three dimensions of an ISHS--design, implementation, and student outcomes--focusing on the ten candidate critical components defined in Table 1. Additionally, the study was designed to capture themes that emerged from the data. Note that the
order of the candidate critical components in Table 1 is not intended to indicate relative importance. Each case study reports on the prominence of particular components based on the findings.

Table 1

<table>
<thead>
<tr>
<th>Definitions of Candidate Critical Components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. STEM-Focused Curriculum.</strong> Strong courses in all 4 STEM areas, or, engineering and technology explicitly, intentionally integrated into STEM subjects and non-STEM subjects.</td>
</tr>
<tr>
<td><strong>2. Reform Instructional Strategies and Project-Based Learning.</strong> STEM classes emphasizing active, immersive, and authentic instructional practices/strategies informed by research; opportunities for project-based learning and student production; performance-based assessment practices that have an authentic fit with STEM disciplines.</td>
</tr>
<tr>
<td><strong>3. Integrated, Innovative Technology Use.</strong> Technology used to connect students with information systems, models, databases, STEM research resources, teachers, mentors, social networking resources for STEM ideas; includes during and outside the school day.</td>
</tr>
<tr>
<td><strong>4. Blended Formal/Informal Learning beyond the Typical School Day, Week, or Year.</strong> Learning opportunities not bounded but ubiquitous; learning spills into areas regarded as informal STEM education, including apprenticeships, mentoring, social networking, and doing STEM in locations off of the school site, e.g., in the community, museums and STEM centers, and business and industry.</td>
</tr>
<tr>
<td><strong>5. Real-World STEM Partnerships.</strong> Students connecting to business/industry/world of work via mentorships, internships, or projects that occur within or outside the normal school day/year.</td>
</tr>
<tr>
<td><strong>6. Early College-Level Coursework.</strong> Opportunities for students to take college level course work and earn college credits, e.g., AP classes, online college courses, college classes at institutions of higher education; facilitated by flexible school schedule.</td>
</tr>
<tr>
<td><strong>7. Well-Prepared STEM Teaching Staff.</strong> Teachers certified to teach in their STEM subject areas and having advanced STEM content knowledge and/or practical experience in STEM careers; opportunities for professional development.</td>
</tr>
<tr>
<td><strong>8. Inclusive STEM Mission.</strong> Stated mission/goals to prepare students for STEM, with emphasis on recruiting students from underrepresented groups.</td>
</tr>
<tr>
<td><strong>9. Administrative Structure.</strong> Various structures (e.g., school-within-school, charter school, magnet school), affected by the school’s age and provenance, i.e., whether the school was converted from another model or was created “from scratch” as a STEM school; various funding structures.</td>
</tr>
<tr>
<td><strong>10. Supports for Underrepresented Students.</strong> Bridge programs, tutoring programs, extended school day, extended school year, or looping to strengthen student transitions to STEM-focused curriculum; altered, improved opportunity structures, i.e., students positioned for STEM college majors, careers, and jobs.</td>
</tr>
</tbody>
</table>

This case study includes a brief summary of school selection and data collection methods. The reader is referred to the Research Framework document located on the OSPrI project website

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1 Herein after referred to simply as critical components, with the understanding that they are theorized to be critical to the success of an ISHS.
(ospri.research.gwu.edu) for details on the rationale for examining the ten critical components, and methods for school selection and recruitment, data collection, and data analysis.

2.2. SELECTION OF URBAN SCIENCE ACADEMY

The goal of the OSPri study is to characterize a set of *exemplar inclusive STEM-focused* high schools and conduct a cross-case analysis to develop a theory of action for scaling up such schools. By *exemplar*, we mean that the school has demonstrated successful student outcomes (e.g., graduation rates, college acceptance rates, science and mathematics achievement scores), including some unusual successes with its unique student population in comparison to school district or state averages, given the demographically appropriate comparison groups. We define *inclusive* in terms of the school’s admission criteria and process. An inclusive school is designed for a range of students, not just gifted and talented. A school that is inclusive may use a lottery system if more students apply to the school than there are spaces. While it may have goals for a student body that is demographically diverse, it does not have overly restrictive academic admissions criteria that would exclude students from a challenging college preparatory academic program because of prior academic achievement. Such inclusive schools typically have at least 50% or more of their students from groups underrepresented in STEM fields (e.g., African Americans, Hispanics, low income students, and those who would be the first in their family to attend college). By *STEM-focused*, we mean that the school requires more rigorous mathematics and science courses to graduate than district and state requirements; or that its science, technology, engineering and mathematics classes are more integrated than traditional schools. We were primarily interested in STEM-focused high schools that required all their students to complete college preparatory courses including at least four years of mathematics; and four years of science. The school may or may not also require engineering or technology courses.

Urban Science Academy was selected as the fifth ISHS for our research study seeking to define the phenomena of inclusive STEM-focused high schools. Each school was chosen as a critical case (Yin, 2009), with a unique governing structure and academic organization likely to have broad effects on implementation and outcomes. Urban Science Academy was included after being recommended by a member of the Council of State Science Supervisors (CSSS). After reviewing publically available data on the school, we found that the school matched our selection criteria for outcomes, inclusiveness, and STEM-focus, as will be described in this case study. We approached the school administration with the intended purpose of our study and our research request was approved.

2.3. DATA COLLECTION

Data collection began before the site visit to the school, by using publicly available data and documents found on the school and district websites, to begin to understand the school’s design and context, and to collect demographic and outcome data. Also, two online questionnaires were completed prior to the visit: a school description questionnaire completed by a school administrator, and a survey completed by the school’s teachers. Phone interviews were conducted with the administrator to follow up on questionnaire responses. To understand implementation, the OSPri study team visited the school and collected design and
implementation data using observation instruments and focus group and interview protocols. The data collection activities during the site visit are shown in Table 2.

Table 2.
*Data Collection Activities during USA Site Visit*

<table>
<thead>
<tr>
<th>Classroom Observations</th>
<th>Non-STEM Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEM Classes</strong></td>
<td></td>
</tr>
<tr>
<td>Algebra I</td>
<td>10th Grade Humanities</td>
</tr>
<tr>
<td>AP Calculus</td>
<td>12th Grade Humanities</td>
</tr>
<tr>
<td>AP Chemistry</td>
<td></td>
</tr>
<tr>
<td>AP Statistics</td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
</tr>
<tr>
<td>Geometry</td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td></td>
</tr>
<tr>
<td>Psychology</td>
<td></td>
</tr>
<tr>
<td>Technology Class</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Focus Groups</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers/Administration</td>
<td>11th/12th AP STEM students</td>
</tr>
<tr>
<td>Teachers of Science</td>
<td>9th Grade Students</td>
</tr>
<tr>
<td>Teachers of Mathematics</td>
<td>Student Leadership Team</td>
</tr>
<tr>
<td>Instructional Teacher Leaders</td>
<td></td>
</tr>
<tr>
<td>Teachers on Use of Technology</td>
<td></td>
</tr>
<tr>
<td>School Leadership Team</td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interviews</th>
<th>Non-School Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Personnel</td>
<td></td>
</tr>
<tr>
<td>Guidance Counselor</td>
<td>Brigham &amp; Women’s Hospital</td>
</tr>
<tr>
<td>Assistant Headmaster</td>
<td>JFY NetWorks Program Director</td>
</tr>
<tr>
<td>Family/Community Engagement Specialist</td>
<td>PEER Health Exchange</td>
</tr>
<tr>
<td>Resource Teacher</td>
<td>Boston CollegeBound Program</td>
</tr>
<tr>
<td></td>
<td>Cloud Foundation</td>
</tr>
<tr>
<td></td>
<td>Technology Goes Home</td>
</tr>
</tbody>
</table>

| Other Activities |                  |
| School Tour |                  |

<table>
<thead>
<tr>
<th>Researcher Activities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Debrief – Day 1</td>
<td></td>
</tr>
<tr>
<td>Team Debrief – Day 2</td>
<td></td>
</tr>
</tbody>
</table>

This case study is organized to inform the reader about the context underlying the case, then presents findings in two sections, one exploring the design and implementation dimensions, and the other, the outcomes dimension.
3.0 CONTEXT

This case describes Urban Science Academy, an ISHS and urban public school in Boston, Massachusetts. This context section positions USA within the public school system and Boston community, and describes its founding and evolution up to the time of this case study.

3.1. BOSTON PUBLIC SCHOOLS

USA is part of Boston Public Schools (BPS), an urban school system that is the oldest school system in the United States, founded in 1647. The demographics of students in this school system are described later in the Context section where it is compared to USA’s student demographics.

3.1.1. Types of Schools

BPS operates several types of high schools: exam, pilot, innovation, in-district charter, and traditional comprehensive public high schools (Table 3). A student entering high school through the BPS system may apply to any of the several types of high schools, with the exception that, for a student to attend an exam and some pilot schools, the student will need to meet certain selection requirements, as described in the section that follows.

<table>
<thead>
<tr>
<th>Table 3. Boston Public School High School Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Another Course to College ◊</td>
</tr>
<tr>
<td>Boston Adult Tech. Academy</td>
</tr>
<tr>
<td>Boston Arts Academy ◊</td>
</tr>
<tr>
<td>Boston Community Leadership Acad. ◊</td>
</tr>
<tr>
<td>Boston Day &amp; Evening Academy □</td>
</tr>
<tr>
<td>Boston Green Academy ◊</td>
</tr>
<tr>
<td>Boston International HS</td>
</tr>
<tr>
<td>Boston Latin Academy I-</td>
</tr>
<tr>
<td>Boston Latin School I-</td>
</tr>
<tr>
<td>Brighton High</td>
</tr>
<tr>
<td>Burke High</td>
</tr>
<tr>
<td>Charlestown High</td>
</tr>
<tr>
<td>Comm. Acad. Sci. Health</td>
</tr>
<tr>
<td>Community Academy</td>
</tr>
<tr>
<td>Dearborn (6-12)</td>
</tr>
<tr>
<td>Dorchester Academy</td>
</tr>
<tr>
<td>East Boston High</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>


The exam schools in Boston are the most selective. Admission is based entirely on two documents, a student’s transcript and scores on the Independent School Entrance Exam (ISEE). When reviewing a student’s transcript, only the mathematics and English grades from a student’s seventh grade year and the first two marking periods of their eighth grade year are reviewed when a student is considered for admission (BPS Website). In order to be offered admission, students must have a competitive GPA on their middle school transcripts and a high score on the
ISEE. Of the 35 total public high schools in Boston, 3 are exam schools, and 21 are pilot schools, described next.

The pilot schools are part of the Boston Public School district but have autonomy over budget, staffing, governance, curriculum/assessment, and the school calendar, to provide increased flexibility. Boston Public Schools cites that these schools were explicitly created to be models of educational innovation and to serve as research and development sites for effective urban public schools (www.bostonpublicschools.org). While originally created to be laboratories of innovation for urban schools, pilot schools in Boston have been criticized as serving a less than representative sampling of students due to additional admission application requirements. Most if not all of the pilot schools require students to submit transcripts, teacher recommendations, personal essays, or even audition to be considered for admission (Center for Collaborative Education, 2007). While pilot schools do not have minimum GPA or test requirements, these additional application requirements have led to some criticism that pilot schools may actually be enrolling higher performing students than those that go to traditional schools in Boston. Depending on the pilot school, it may be using the same lottery system as the comprehensive high schools or it may have a separate selection process involving evaluation of applicant essays, teacher recommendations, transcripts, or auditions (Center for Collaborative Education, 2007).

Like the BPS pilot schools, Margarita Muñiz Academy, the one innovation school shown in Table 3 was given greater autonomy and flexibility in its budget, schedule, calendar, staffing policies and professional development. Unlike the pilot schools, it did not have the uniform set of exemptions to the teachers' contract. Rather, as an innovation school, its governing board has to negotiate waivers to facilitate the specific school plans.

In-district charter high schools, like Boston Day and Evening Academy, Boston Green Academy, and Kennedy Academy for Health Careers are schools whose applications must first be approved by a host school district and, with a few exceptions, the local teachers union. Teachers in in-district charter schools must belong to the local union, but they may be subject to a thin contract that waives most of the provisions not associated with compensation. In-district charter schools are authorized by the state Board of Elementary and Secondary Education and receive their funding through the state, but the amount they can keep and use at their discretion is usually a subject for negotiation with their sponsoring district.

Lastly, there are the traditional public high schools in Boston; USA is in this category. These schools are open to all students and a lottery system is used to place students if more students apply to a school than there are spots available. These schools are subject to the governance of Boston Public Schools, and rely on the district for curriculum and assessment support as well as staffing. Like the innovation school, these traditional high schools are subject to union rules and laws but would be required to negotiate a waiver to facilitate any changes in work conditions stipulated in the contract. Some of these schools have a theme that may attract particular students, such as the science theme at Urban Science Academy.

### 3.1.2. Boston Public School Teacher Union
The Boston Teachers Union has major influence in the operation of BPS. The union represents 5,500 teachers and other school professionals including nurses, psychologists, and guidance counselors, and is affiliated with the American Federation of Teachers, as described on the BPS website. Since the primary responsibilities of the union are to represent their members in negotiating and enforcing the contract, this positions the organization as a major influence in setting the culture and day-to-day school operations. The union enforces strict guidelines and acts as a constant reinforcement of the duties of both teacher and administration. The enforcement has created distinct hierarchical roles within the school, and the faculty and administration at USA have worked to progress the educational offerings despite the challenge of this inflexible system. The findings on administrative structure describe how USA has managed this challenge.

3.2. LOCATION

As shown in Figure 1, Urban Science Academy is located in West Roxbury, a neighborhood within Boston. This neighborhood can be characterized as a suburb within the city, as the streets are lined with large single family homes.

Figure 1

Location of Urban Science Academy, a Boston public high school in West Roxbury, MA. Urban Science Academy is located in a far southwest quadrant of Boston. Students and Staff both commented on the difficulty of reaching this school via public transportation, so the school transports students from the major subway stops to and from the school.

The school, shown in Figure 2, is located near the 19th Century site of Brook Farm in the watershed of the upper Charles River, situated between Millennium Park and a large wetland.
Within the wetland, there is an island accessible by a boardwalk from the shore behind the school where the Boston Schoolyard Initiative built an outdoor classroom and science education site in collaboration with the Urban Science Academy.

3.3. HISTORY

USA opened in 2005 when Boston Public Schools received a multi-million dollar grant from the Bill and Melinda Gates Foundation to address low student performance across the district. The strategy was to create smaller high schools where students could receive more individualized attention to help them achieve. With this money, BPS closed four large comprehensive high schools in the district and reopened facilities to house new smaller theme-based schools. As a result, the former high school site known as West Roxbury High School reopened as four smaller, themed schools: Media Communications Technology High School, Brook Farm Business & Service Career Academy, Parkway Academy of Technology and Health, and Urban Science Academy. USA chose an ecology/science theme to capitalize on the nearby natural resources and relative proximity to Boston College and the Urban Ecology Institute.

USA was initially a small school, serving a student body of approximately 300 students. From the time the school first opened in 2005 until 2011, USA established itself as a “School on the Move Finalist”, a highly selective competition held by EdVestors where only 5-10% of BPS are eligible to apply. The prize recognized rapidly improving schools that made exemplary progress in advancing the academic achievement of all students. Unfortunately not all the new smaller high schools in the district were able to boast the same level of improvement, and with the ending of the Gates funding, well-performing schools such as USA were asked to absorb lower
performing schools. So in the fall of 2011, three of the four schools inside the West Roxbury Education Complex were closed. Brook Farm Academy and Media Communications Technology High School were merged into one school now called West Roxbury Academy. Urban Science Academy, while keeping the same name and leadership, absorbed the teachers and students of Parkway Academy of Technology and Health. USA’s student body almost doubled to 576 students growing to a medium-sized high school, rather than a small high school. Since the merger, USA faced challenges due to the increased number of students, including those who had been in the technology and health-themed school, and the blending of teachers from other schools who might not have the same buy-in to USA’s theme and mission as its original teachers.

The school’s focus was on issues of science and ecology. The mission of Urban Science Academy was to challenge students through the essential question, “What is our place in the world?” Through this question, students were challenged to take part in exploring their interests and how they could contribute to the communities around them.

3.4. ADMISSIONS AND DEMOGRAPHICS

Students living within the boundaries of BPS who do not meet the application requirements of higher tier schools entered the BPS lottery system by rank ordering their preference for open admission high schools in the district. Students were then assigned by a computerized algorithm, which was based on the number of seats available in each school. USA experienced annual wait list of approximately 25-50 students, indicating recognition of their successful outcomes and recognition for outstanding improvement. Most students on the wait list attended their assigned school until there was an open space at USA. The administration at USA reported that around October any student who was on the waitlist would typically be offered a seat if they still wanted to attend.

At the time of our research visit, the School Directory Profile for the year prior (2011-2012) showed that Boston Public Schools served about 57,000 students, of whom approximately 43% were Hispanic, 34% African American, 13% White, 8% Asian, and 2% Other/Multiracial. Approximately 70% of district students were economically disadvantaged; almost 20% received special education services; and 30% percent were classified as limited English proficient (LEP). USA’s demographics were similarly diverse. With a student body of 587 students, about 45% were Hispanic, 45% African American, 6% White, 1% Asian, and 1% Other/Multiracial. USA’s percentage of students identified as economically disadvantaged (70%) and percentage of students receiving special education services (22%), were similar to the district rates. Unlike the school district, USA’s LEP rate was only 10%. However, it should be noted that this is a comparison of a grade 9-12 school to district data for grades PK-12. Typically, the LEP rate is highest in elementary and lowest in high school since all but newcomers to the U.S. educational system had by high school achieved sufficient English proficiency to be reclassified as English proficient.
4.0 EXPLORING THE DESIGN AND IMPLEMENTATION DIMENSIONS

In this section exploring the design and implementation dimensions of each critical component and the emergent themes, findings are organized by critical components and sub-organized into findings on the design dimension—what the school had built into its plans; and the implementation dimension—what we observed on the visit. A dedicated section on emergent themes concludes this portion of the case study.

4.1. STEM-FOCUSED CURRICULUM (CC1)

Strong courses in all four STEM areas, or, engineering and technology are explicitly, intentionally integrated into STEM subjects and non-STEM subjects.

4.1.1. Design

The school website describes USA as offering a “college preparatory program and a having focus on environmental science, technology, and the arts” (USA website). Students at USA took additional STEM coursework beyond the state requirements for graduation. While the state required 3 years of lab-based science, students at USA were required to complete 4 years of science including biology, physics, and chemistry. Massachusetts required 4 years of mathematics and successful completion of Algebra II; students at USA took 4 years of mathematics at a higher level than the state requirement, including college preparatory courses intended to prepare their students to take pre-calculus or calculus their senior year. In addition, USA required 6 credits of humanities, where English was integrated with history and social studies, and 2 credits of a world language. Typical course sequence, and electives in, STEM disciplines are shown in Table 4.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Science</th>
<th>Mathematics</th>
<th>Supplemental Math Courses</th>
<th>Technology Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>9th</td>
<td>Active Physics</td>
<td>Algebra 1 or Advanced Algebra</td>
<td>½ year of math enrichment</td>
<td>PC repair, networking, digital photography, tech support</td>
</tr>
<tr>
<td>10th</td>
<td>Chemistry</td>
<td>Geometry and ½ year of discrete mathematics</td>
<td>½ year of discrete math</td>
<td></td>
</tr>
<tr>
<td>11th</td>
<td>Biology</td>
<td>Advanced Algebra or Pre-calculus</td>
<td></td>
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</table>
All science and mathematics classes offered at USA were described as college preparatory. Students were required to take physics, biology, and chemistry plus at least one science elective; there were a number of options as shown in Table 4. For mathematics, students began with either Algebra 1, or if they had earned credit for that course in middle school, Advanced Algebra. This meant that some students would be ready for pre-calculus their junior year and AP Calculus their senior year and both those courses were offered at USA. Other students were assigned to their senior mathematics course based on their mastery of prior content and interest. USA strongly encouraged all students to take at least one AP class before graduation, and, as shown in Table 4, there were four science and two mathematics AP courses available to students. Technology courses were also available to students, but taken on an elective basis. Students interested in taking courses in technology had a number of options, as shown in Table 4.

4.1.2. Implementation
This section begins with discussion of the STEM focus and rigor, followed by a section on how USA expanded its curriculum through partnerships.

4.1.2.1. STEM-Focus and Rigor
The name of the school, Urban Science Academy, stood out among the large variety of BPS high schools as a science-themed high school choice for students and parents interested in a school with a strong science program. USA was designed to focus on science and to foster science-oriented career awareness for the students. The Assistant Headmaster summed up the student performance of USA and explained how their success had gained them a positive reputation:

Most of our kids have no problem passing the MCAS thanks to their hard work and the commitment on the part of their teachers. When the school first started, families didn’t know who we are. We were much more selected when we went into our 5th year – having a lot of success – making AYP – few of the schools in the district [did that] – coming here, going to college – families that had the time to do their homework on school selection – and staff at the middle school – said USA would be a good choice. That has contributed to us being more well-known. In 2011 we reached our pinnacle – we were a “School on the Move” finalist – most improved school over the 5 years – graduation rate went from in the low 50s to the mid 70s. Our graduate rate with special needs, and college going rate significantly increased going from roughly 30% to 80% of kids go to a 2-year or 4-year [college].

Two years prior to the site visit (2011), USA was required to combine with another small public school, and this consolidation doubled the number of students at USA. Despite the draw on resources, USA continued to offer a rigorous academic program. An Assistant Headmaster explained how USA met the challenge:

We absorbed another school about 2 years ago [Parkway Academy of Technology and Health (PATH)]. That school was underperforming and the superintendent required that we take it over. If you talk to any of the kids from the previous school, they’ll tell you that USA has a good curriculum and they [the students] work hard. Our teachers really require that from them [working hard on a more rigorous curriculum].
All core 9th and 10th grade classes at USA were co-taught either with one content and one special education faculty, or two content teachers with a background in special education:

We work with the 9th and 10th graders, but as they progress we cut the cord and there isn’t as much hand-holding. They resist that a lot. In the end, they’re thankful for it. I think the fact that we have co-teaching at the grade 9 and grade 10 levels is really big help. Those are new kids, the 9th graders are coming from middle school and the 10th graders just finished their first year of high school. I think having those classes at those two grade levels being co-taught makes a big difference in how our kids succeed, as it gives students the additional support necessary to successfully navigate through the transition from middle school.

All students, whether or not they had Individualized Education Plans, had two teachers helping them in the classroom during their first two years at USA. A teacher who did not originally teach at USA, but now teaches there after the consolidation explained how USA is unique, “For me it is totally different – all of the special education students were in separate classes [at her prior school]. The original headmaster [at USA] had a clear vision in mind that there would be 100% inclusion and there would not be leveling even in the inclusion. He wanted all of the kids to have the opportunity to take AP classes.

4.1.2.2. Guided inquiry and laboratories

The STEM curriculum offered at USA promoted rigor not only through the high level of content knowledge expected from the students, but also in the design of how students learned, typically through guided inquiry. The formal curriculum written for all public schools in Boston was conducive to teaching using inquiry. One science teacher commented, “The curriculum in Boston Public is designed from elementary through high school to develop inquiry. [In Physics] the curriculum I use is standard and based on inquiry

USA had on-site laboratories in Physics, Biology, Chemistry, and Forensics; many of the rooms had boxes stacked high with equipment. An Assistant Headmaster explained the resources that were placed into USA to build lab facilities, “Although the city spent a $100,000 renovating one of our chemistry labs, there is still a limited number of classrooms on the campus equipped for lab-based science courses--five to be specific. Obviously this limits the number of lab-based science courses that can be offered.

4.1.2.3. Curriculum supplementation

The USA teachers we spoke with during focus groups and post-observation interviews were aware that the curriculum offered at USA held high standards, and they were vigilant of the balance they must maintain between adequate academic rigor and ensuring each student’s success. A science teacher stated,

One of the positives of our team is that we realize that we need more rigor and we are constantly working on that. It is not a subject we take lightly. We do not say okay we reached a level and we are done... And teachers get excited about the challenge and rigor. The teachers desire to see our students struggle to use their brains. I may present the problem one way, and my co-teacher may present it a different way and the students benefit. We both circle around [the classroom]
and we can reach twice as many students that way. It allows us to support all the students so no one falls into the cracks.

USA teachers described putting a great deal of effort into supporting struggling students, but not to the exclusion of opportunities for students to be enriched. The mathematics teachers had developed a system to award an honors credit for students who excelled:

_The idea is that in the given class we want to challenge our top students a bit more. So as a math department we came up with the honors option. The honors option gives students that choose that option an extra problem a week, typically “a problem of the week,” to be done independent of the teacher; and the student submits it and the teacher gives them feedback and then the student works on it a bit more and then the student will submit the problem at the end of the week. For projects or any big assessments we usually have more challenging work for honors students._

USA was also aware of the needs of the average student, one who was not necessarily struggling, and offered Advancement Via Individual Determination (AVID) as a college readiness program focused on advanced learning, meaningfulness, and motivation. The AVID teacher explained the goal of the program at USA,

_AVID is a college readiness program through College Board. We have AVID in grades 9-12. The work they do is a little bit different. It is more college level work, not AP, but work that is preparing them for college. They target the regular “B-C” kids and give them support._

USA made every attempt to place students in courses where they would feel challenged but not overwhelmed, and they tried to move students into advanced courses even if that was not the typical sequence. A mathematics teacher described this in the context of a student who was placed out of sequence based on her abilities:

_Some ninth graders may come in already knowing Algebra 1 or Geometry. [A counselor] for example sent me a student in Algebra II in ninth grade. She assessed the student and saw the students already knew the material and sent him to me. So it depends on what the students already know. So some students get pushed ahead and it helps them to get onto the AP track. We don’t bring them into geometry, because in 10th grade they do geometry and MCAS review together, so we want them to be in Geometry in 10th grade, so we send them to Algebra II._

### 4.1.2.4. Impact of curriculum on post-secondary plans

The supportive and challenging learning environment created in the USA curriculum had positive effects on students’ choices to pursue science majors in college. In response to a question about students graduating and majoring in a science disciplines in college, an Assistant Headmaster explained:

_[In this year’s graduating class] I have 141 seniors. I would say that about 40 kids [are planning to major in science in college]. The fact is that we do stress science. The science teachers here, the whole faculty really, is really fantastic. The science teachers in addition really work hard in_
exposing our kids to careers. There’s an integrated art and science component that I just found out about that they’re doing in Chemistry. It sounds really exciting to me. The whole thing is to make it relevant, and that’s the key. I think our teachers do a really good job of making science relevant to kids.

4.1.2.5. AP Coursework

USA’s perspective on student performance in their AP courses was indicative of the teachers’ awareness of the needs of their students and the benefits of them all taking at least one AP course. The teachers and administrators at USA understood that the students might not score high on the exam\(^2\), but they wanted students to have the experience of being in an AP course and participating in the exam. All students in the AP courses (Biology, Chemistry, AB Calculus, English Literature, U.S. Government & Politics, Psychology, Spanish Language, Statistics) took the exam. USA had funding to pay for the exams, but during our site visit, they received a phone call from the funding source that funds would not be available to pay for the exams for the 2013-2014 school year. USA planned to seek funding from other sources. A biology teacher explained the positive outcome of this experience, “I’ve had many students return and say that even though they didn’t pass the AP exam, they felt they were prepared for college. They felt that their college biology course was a review.” The administration and faculty at USA were mindful of how they planned for and maintained rigor in their curriculum, particularly in STEM content areas. USA held high standards, supported the wide variety of students they served, and guided students to a post-high school plan that would help them increase the likelihood of being successful in life.

4.1.2.6. Engineering

Although science was a major focus at USA, engineering courses were not yet offered as part of the academic program. The Assistant Headmaster explained:

We were thinking of an engineering program and we are actually going to hold off on it. We need to do more research and also [there is] a staff capacity issue. The other piece obviously is we want to continue to expand on community partnership opportunities with STEM. We are talking to the Cloud foundation about possibly running a course in collaboration with them around a course to help kids think of STEM related ideas and making a marketable product—basically a design and implementation course. It’s a program they offer around the city as an after-school [program] but we want to bring it into the school.

A science teacher commented on the infusion of engineering within courses,

*Bioengineering and molecular engineering in my AP [Biology] course is about it. The students are connecting science and engineering. One of the challenges we face is that it’s tough to teach the difficult concepts in physics without the math. And then, from the students’ perspectives, if we*

\(^2\) As shown in the student outcomes findings later in the case study, less than 10% of USA students achieved a 3 or above.
teach 9th grade physics and then we expect them to take physics in college, it’s a big gap for students to wait between 9th grade physics and taking it in college.

4.1.2.7. Interdisciplinary Projects
USA made learning relevant to students not only through the day-to-day classes, but also in the interdisciplinary projects that were grassroots efforts developed by interested teachers. At the time of the visit, there were two interdisciplinary projects that were integrated into the curriculum, both in 10th grade: one on housing conditions of migrant workers with a science component (energy efficiency), a mathematics component (cost), and a communication component (Spanish class); and one on game design. These projects were described by a teacher during the mathematics teacher focus group.

There is a push to use narrative to introduce data. We do interdisciplinary units that bring all the disciplines together and we cross over a lot into science. As a 10th grade team we have done two week-long interdisciplinary units. In the first one, students were asked to be video game developers for the week and they had to design a video game for a teenage brain. So they wrote computer code for their game, science of the game, chemistry of the game, and they had to write a business proposal for their game. [In the other project] students took on the role as an architect and learned about the housing conditions of immigrants. So they became architects and designed to scale housing for 8 migrant workers and different architects from the city came in to look at their projects. We found out a lot about architectural opportunities for students that our kids can get involved in.

The game design project was such a success that the 10th grade team had decided to design another project to explore teenage dating violence, in which students would gather data and design a public service announcement on their research.

4.1.2.8. Expansion of Curriculum through Partnerships
USA was persistent in seeking partnerships to build and expand their curriculum. The Urban Ecology Institute at Boston University had partnered with USA science teachers to co-develop the Urban Ecology course, an elective at USA. USA had recently partnered with Bunker Hill Community College (BHCC) to offer a pre-nursing program, described in detail in the section titled partnerships. The Cloud Foundation supported science fair projects and science career awareness.

JFY NetWorks partnered with USA to provide support on the Accuplacer Exams, an exam used by Massachusetts colleges to determine whether or not students need to take developmental courses. A representative of JFY NetWorks described the impact of their partnership on student learning:

Specifically, [we] prepare students to take the Accuplacer assessments, which is what Massachusetts colleges use to determine whether or not students need to take developmental courses. We’re certified by the College Board to administer the Accuplacer assessment. We administer both the Accuplacer diagnostic and placement tests. What we do with that program is
first assess students using the diagnostics and then create learning tasks for them based on their diagnostic results. All of our programs are online. We then follow the progress of students over the course of their learning tasks and then give them the Accuplacer placement test to see if their scores have gone up high enough to meet the requirements for the university they’re interested in.

The Assistant Headmaster also discussed initiatives with the Gates Foundation to implement the Big History project in the near future, as well as a tutoring program.

One program that we are looking into for next year that is being funded by the Gates Foundation is Big History. We are excited about that possibility because it is an interdisciplinary course that connects the sciences and humanities. We have been invited to join the next phase of that pilot and we are trying to make that an integral part of the program and one of the integral questions of “what is our place in the world?” And that is a question to connect all the disciples and this course will bring that question to life again. We are thinking of making it part of our ninth grade program but there may be other iterations as well.

We are thinking of integrating tutorial programming in the main part of the school day with a focus on critical reading, writing, and math. Many of our kids come to us behind and we want to catch them up so they can access these AP courses and be in a position to do really well. We will be applying for a grant to support partnering with a tutoring-based organization.

**4.1.3. Summary**

USA, a science-themed urban public school in the Boston Public School District, required their students to take a challenging college preparatory curriculum. This was accomplished in the context of a highly supportive learning environment coupled with an inquiry-based curriculum with lab-based science core courses that was supplemented with curricular enhancements. The administration and teaching staff were very aware of the needs of the students, and committed to creating engaging approaches to curriculum design and implementation of the curriculum, such as the interdisciplinary projects for 10th graders. Additionally, there was a robust AVID program for “B/C” students to help them develop study skills and habits of mind to succeed in college. To support all students getting a good start on the path to rigorous coursework in 11th and 12th grades, team teaching was employed in 9th and 10th grade classes. This support for struggling students, achieving students, and others in between, was a critical part of the design and implementation of a rigorous STEM curriculum: USA expected all its students to take at least one AP (college-level) course, and offered a robust AP program including five STEM AP courses.

**4.2. INSTRUCTIONAL STRATEGIES (CC2)**

STEM classes emphasize active, immersive, and authentic instructional practices/strategies informed by research. The school offers opportunities for project-based learning and student production. Performance-based assessment practices that have an authentic fit with STEM disciplines.
4.2.1. Design
USA’s instructional design had two major design decisions that affected the educational program: a decision to implement a co-teaching model and a revised homework policy that supported mastery learning. These are discussed in the sections that follow.

4.2.1.1. Co-teaching Model
Within two years of being opened, USA was awarded a grant to reinvent their special education services delivery model. USA decided that all students, including special education students, would receive courses that were co-taught in 9th and 10th grades. As described by the Assistant Headmaster, USA decided on this plan because they believed based on their research that most high schools that had separate special education classes tended not to be as effective as those taught with a co-teaching model, and their decision was validated by the positive impact it had:

*Our graduation rate for kids with special needs was initially lower than the district, in the 30% range. We visited [other schools] across the state and it gave us good ideas for developing a comprehensive co-teaching model. Instead of kids being separated—for no good reason—it allows more support to be brought to every kid. Teachers in co-taught classes use differentiated instruction and co-teaching allows teachers to divvy up the roles in running a highly effective classroom."

USA’s co-teaching model was designed to have two to three teachers in a classroom, which reduced the student-teacher ratio significantly. Co-teachers had a common planning period every day, which was a powerful model evidenced by the success of the students on high-stakes tests and improvements in graduation rates. This impact is discussed in the Outcomes section of this case study, including the improvement in the graduation rate for special needs students at USA (21% of USA student body).

The teaching staff at USA belonged to a union and USA had to have a majority of the teachers agree by a vote to the new teaching model. The Headmaster explained how the model of co-teaching was designed and adopted:

[Since we are state subjected to union rules,] we have to vote and 67% of the union members would have to agree even if it’s not in violation of their contract... We researched for a year on co-teaching. We visited schools across the state, some within the district. And the vote that was put to the staff was: “I agree to make this a co-teaching school, but I also understand that I volunteer to co-teach”. And so when people weren’t willing to volunteer, [they had to move their teaching assignment from] the ninth grade because whoever is in the ninth grade is going to be someone who will volunteer to co-teach. So now people’s assignments were changing....The vote went through... and people were willing to try and people stepped up and said, “I will try that.” And some people said, “no I won’t” and we said, okay well then you are going to have to teach at the Grade 11 or 12 level instead of teaching at the Grade 9 or 10 level... [some teachers] were calling up the night before school started saying “I am not coming back.”
The new co-teaching model caused some of the teachers to change the grades they were teaching and others to change schools, but also solidified a core group of teachers who had a common goal of supporting students through this approach to teaching.

4.2.1.2. Homework Policy
In addition to the co-teaching policy, USA instituted a new policy shifting to performance-based grading the year of the site visit. The specific implementation would eliminate homework grades and move that portion of student assessment to performance assessments, such as labs, tests, and projects. USA chose this change in their homework policy based on research that the instructional leadership team did in 2012 regarding the grading practices. The leadership team reported that students were getting penalized for doing poorly on homework. They also found that grades did not necessarily indicate the true level of understanding students had in a subject area, so the school shifted to a model where grades were dependent on how students performed on summative assessments that were linked to the specific learning targets of a given unit.

The leadership team coupled this new policy with support for teachers to implement backwards planning (Wiggins and McTighe, 2005) to improve quality of instruction. With a backward design approach to curriculum planning, the leadership team promoted teaching toward learning goals which typically ensures that the content taught remains focused and organized. This, in turn, aims at promoting better understanding of the content or processes to be learned for students and students would get a clearer idea of where they were going at the beginning of the unit, as opposed to figuring that out as they went along. The leadership also felt that the timetable of student learning would be more flexible, because students would be given the opportunity to re-learn and re-take assessments. If a student were to fall short of a benchmark, they would be able to retake that part of the assessment, which would give the teachers a good idea of how they needed to support that student during instruction. Further discussion of the support for teachers is described in the section on the Teaching Staff.

4.2.2. Implementation
The implementation of the co-teaching model and the performance-based grading policy are discussed first, followed by a subsection on reform-based instructional practices at USA.

4.2.2.1. Co-teaching Model
The co-teaching model as implemented at USA has had a large impact on student achievement (as discussed in the Outcomes section of this case study). Despite these gains, the co-teaching model at USA had to be scaled back due to funding reductions and the consolidation of high schools that occurred.

Co-teachers had a common planning period every day, and teachers had transitioned into their new roles smoothly. Part of the smooth transition could be attributed to the clear message that the administration provided to the teachers in the form of a written document listing the responsibilities for all combinations of teacher pairs for the co-teaching model. Because of the co-teaching model, USA teachers worked more collaboratively than they had in the past. The Assistant Headmaster explained the benefits of USA switching to a co-teaching model and the long-term changes that it had influenced, including the expansion of the AP program:
Many teachers are working together working in a fluid way, and kids don’t know who is the content specialist and who is the special educator. The other piece is teachers like the model because they can better respond to students. Students increase their own investment and then teachers can raise the expectations for their own students. High expectations coupled with high support. Unfortunately, we can’t do the co-teaching school-wide; we don’t have enough resources beyond 9th and 10th grade. If the kids can get through 10th grade and get to 11th grade, then the kids have developed the independence to help them carry them through the final years. We still have a resource center for students with IEPs and ELLs.

Now the students are prepared so we can seek an aggressive AP expansion – we got a $50,000 grant [for the purposes of expanding from] one AP class to having seven AP classes. For a non-exam high school, we have a good number of AP offerings. We want all kids to take an AP class. About half of them do. Just having the college level rigor—regardless of how they do on the AP exam—it is about having them have the college course experience— we want more kids to pass the exams, but that is the next step.

4.2.2.2. Change in homework policy

The new policy shift to performance assessment grading has led to an increase in the percentage of students that were passing their classes, about a 15 point difference. If a student came up short on a benchmark for a respective unit, they then had the opportunity to retake that component of that assessment or multiple components to demonstrate proficiency of 70% or higher. In order to retake the assessment, the student first had to meet with the teacher after school or during lunch to figure out their mistakes and learn from them. The leadership team felt that it sent a message that learning doesn’t have to take place in a fixed amount of time and that the important thing is that learning is taking place. Proficiency on learning targets is acknowledged and the students are also motivated by the monitoring and feedback. USA offered teachers professional development to support the implementation of the performance assessment initiative, as described in the professional development section on the teaching staff. The Assistant Headmaster explained how this policy arose from teachers’ concerns:

[Teachers] spearheaded [the decision to change], based on frustration on the prior grading system... what does this grade really mean? Is it based on compliance? Or evidence of learning? Our working group suggested that we focus more on evidence of learning. This is a big shift for us--most teachers are used to grading in a very traditional way. We try to support teachers--your whole practice has to shift; the way that you teach and the way that you have class has to change, too, to align. One of our PDs [professional development] has focused on performance-based grading. Change is hard. Everyone may not be 100% on board but we are moving in that direction. People talk about it—it’s a common topic of conversation--but underneath that is really instructional practices, teachers’ beliefs about students and what our role is—all these things come to the surface when you talk about grading. We knew that it would be hard. As far as I’m concerned, there is no argument on the table about whether the old system is better, but it only works to the extent that people believe in it and support it.
Students, during a focus group, expressed their perspective of the implementation of the new policy. A 9th grade student explained:

Homework doesn’t count in our school. They only grade projects, quizzes, and tests. They said that homework is just for practice and they give us feedback so we know what we did wrong and right immediately. Once they heard about that rule, some kids said “homework doesn’t count, so I’m not doing it.” Some still don’t do it, maybe the rest still do it just for practice if they’re struggling with their lessons.

Although the 9th graders expressed a casual attitude toward homework, some upperclassmen interviewed had recognized that, as you progressed in grade levels, you come to realize how important ungraded practice is for success in the assessments.

4.2.2.3. Reform-based practices
USA’s school leadership team believes in the importance of quality professional development to enact their reform-based goals and practices. The professional development provided by the administration and fellow teachers at the school supports the administration’s unifying vision of reform-based instruction. The Assistant Headmaster explained how these professional development sessions aided teachers in building a common practice:

For teachers, it has been a big learning curve. One of the key components of doing this work is backwards planning learning principles. So we had a mini course on the backwards planning approach to unit planning and the reason why that is essential--because kids have to know where they are being taken so that they are clear on what the target is. And teachers have to be clear on that too. So PD supports that piece.

Another initiative at USA was to ensure that instruction was rigorous and gives students opportunities to practice higher order thinking. The Assistant Headmaster described the wide range in assessment practices among USA teachers:

Some of the teachers have gotten to the place where their summative assessment is at a place where they are comfortable with having multiple opportunities, but now for some teachers, the transition we are making is that at the beginning of the unit, students can still have the opportunity to do higher level thinking activities.

The BPS curriculum is designed developmentally from elementary through high school to develop inquiry skills in all content areas. USA added value to the design of the district curriculum by working as a school to vertically articulate themes in all courses across all grade levels. The Assistant Headmaster explained this effort:

We are working on improving basic skills and using a common language right from 9th grade onwards. We are doing a vertical teaming with all the science teachers. We are having a common website where we’ll have testable questions. This is the next topic that we’re working on--that we all use the common language...common techniques, teaching students those basic skills of writing lab reports, writing testable questions, writing hypotheses, identifying variables,
designing experiments, doing conversions. So by the time they make it to senior year, we don’t have to explain it any more. We were already scaffolding their learning, but...we want to make it coherent such that by the time they become seniors, this will all be second nature.

### 4.2.2.4. Science class Instruction

During a focus group with the science teachers, teachers from different content areas explained how they implement inquiry:

(Physics teacher) *In Physics, the curriculum I use is standard and based on inquiry, but from there you supplement and make it your own. We walk a thin line between demo, activity, and lab. We try to give them different materials to use to access the curriculum. Some of the skill sets that our students are missing affect what we can do. We have to change it from what is a typical level because of what we might be dealing with. We already know the skill level of what is coming to us so we might have to change it a little from what we are given: the reading skills, writing, responsibility.*

(Biology teacher) *In past years I’ve taken inquiry based PD some on my own, but as a department last year we had a pretty big focus on inquiry, we had a collaborative coaching model. But with the shift this year – we’ve had a lot of changes this year so we’ve kind of had to shelf that while we focus our department meeting time onto keeping up with the new teacher evaluations, and performance based grading, and things like that. So with all of these changes this year it’s taken kind of a back seat, but all curricula are designed around inquiry, so if you’re teaching from the curricula you can’t avoid that. Guided inquiry would be the goal – where students come up with testable questions, and make hypotheses and then design experiment. I attempt that every year... based on prior knowledge or the general skills that students come to the classroom with. The labs where I have students come up with their own design, their own experiments, are much harder for me. It has discouraged me. I find I have to scaffold much more than I’d like to. I have gotten better on the follow-up piece, but am still working on helping students figure out how to write a testable hypothesis. I’m still giving students a lot of up-front information, structuring this aspect of the lab.*

(Biology teacher) *It’s a combination, mostly. A few years ago it would have been through the curriculum: BSCS using the 5 E model. A lot of the activities and the labs were taken from this, but a lot of others were taken from PD and courses I’ve taken. I took a contextualized content course that was a lot of alternative approaches to things in BSCS. We would take a topic and then take a few anchoring activities and build a unit from there. Also there were activities from the AP summer institute and I’ve changed to use here.*

(Chemistry teacher) *Last year we did observe other teachers doing inquiry, and I do take workshops on inquiry. In chemistry, my curriculum is more activities based. There are weeks when we don’t have any labs involved so I try to have a fun lab on Friday if otherwise we wouldn’t have a lab. The real labs that the students think of as chemistry come later in the year. I tried to do one where students design their own lab, like a very simple one: like how would you design an experiment to dissolve a sugar cube faster in lab? I felt in my goal of having students do more complex labs, we are missing some of the more basic skills. They students’ don’t even
know how to do some of the simpler activities. So I’m moving forward in the content, but the basic skills aren’t very strong in my chemistry classes. I use Living by Chemistry in my classrooms.

The science teachers were unified by a need to teach using student-centered methods and they expressed a need to continuously challenge their students and push them to higher levels. Given that USA is a public school, and that in Boston that often means more prepared students attend private, pilot, or exam schools, teachers at USA were providing learning environments where students were supported, but also expected to take on a responsibility for learning.

4.2.2.5. Technology classes
USA offered technology elective courses that were intended to mitigate vast differences in knowledge about technology among their students. The technology teacher described the variety of backgrounds students at USA possessed:

Most of them communicate by sending emails – the usual baseline. They know where the keys on the keyboard are. Sometimes there is a range – there is a student in the upper range who knows PowerPoint. Some students can pick a program on their own and use it. Some don’t know Microsoft word – they hit return at the end of the line. Most of them know basic processing skills. There is a very wide range. 10th graders come in very mixed. Some can do email. Others have no idea – can’t upload an attachment. Some can upload Youtube and take screen shots. Some can use the basic functions of a calculator, but we have to teach them more than that. They know how to use the graphing calculator, but not much.

Teachers across content areas reported that only about 25% of the students at USA had home access to a computer and the internet, and as a result the students came to USA with varied backgrounds in technology. Typically teachers taught technology skills embedded in the content area, and they had to make difficult decisions about how to allocate limited class time. As an added resource, the technology teacher adapted the elective curriculum to meet the needs of the students so that they left USA with requisite technology skills. The technology teacher explained:

For the calculator, I will teach what they need to know and they need reminders along the way. For Excel, I’ll teach it to them explicitly. Design tool – some of them come in savvy and they can do it very fast. Others need training – I’ll provide that – some of them don’t know how to make folders or organize files. We utilize the kids that already know and the peers teach them. We do some planning and think about their deficiencies. Sometimes it is an opportunity and sometimes it is a hindrance. Then we need to balance how much time we want to teach the program and how much time we need to teach the content.

4.2.2.6. Mathematics classes
The mathematics teachers worked together to develop their lessons from various sources to meet academic standards and the needs of the students. USA teachers drew lessons from various resources and tailored the instruction to meet the students’ academic level, as described by two mathematics teachers in the mathematics teachers’ focus group:
So yes, so what we try to do is replicate the book experience. We take out the section with notes and simplify in student-friendly language so they can understand it. We take out examples that best illustrate the concept. Instead of 4 or 5 examples, we give 1 or 2, and then give similar problems to practice. So if the students are stuck, we want them to have a notebook to refer to. So the textbook becomes unnecessary, everything they do, they participate in, they write it down; they remember that way.

For the teachers that teach advanced algebra, I pull together a weekly map of what to teach for the week. I go home and do the research through Glencoe and the internet and whatever I find out, is what I put together for all the advanced algebra teachers. Then every Wednesday, we get together and we go over the scope and sequence because this year is a transition year, the scope and sequence changed, so the chapters do not line up the same way [because of the new Common Core standards].

The mathematics teachers were especially central to the efforts to integrate common themes across the school, as one of the teachers explained:

One of the things we focus on is vocabulary and writing in math. The expectation, what their writing should look like--I would say about 75% of our students cannot explain their thinking and we really want to get them to a point where they can explain, using mathematical terms, their thinking and what they are doing. For instance, in my class everybody has it set up differently, but in my class, I have them keep a glossary. It is harder this year because I cannot grade it. Previously I was able to get them to buy into the glossary, this year it’s harder. The purpose of the glossary is that it doesn’t go into their notebook, it goes into their binder because you can always put the notebook aside, but the glossary should travel with them year after year after year. We talk over grade levels as to what vocab words are expected for students and we start in ninth grade to use that when talking to them so that we are consistent over grade levels.

4.2.2.7. Vignette of biology class
In order to convey a more comprehensive description of instructional strategies, what follows is an account of one biology class observed during our site visit, conducted by Mr. Brown (pseudonym), a teacher with five years of experience.

The classroom is decorated by student work and has the objectives, activities and assessments for the day on the white board. Mr. Brown asks students to think about what they already know about how their circulatory and respiratory systems work together when they exercise. “What do the lungs do? What does the heart do? What do the lungs and the heart do to maintain homeostasis during exercise? If you don't know the exact answer now that's ok, maybe you'll know more after this exercise.” Mr. Brown encourages students who are sitting alone to move to join other groups so they can engage in conversation. He asks students to discuss together the answers to the questions he just posed that are also on the board. Mr. Brown says, “I hear one conversation up here (pointing to the front of the room) and I think I hear another one back here. It's not important that you get it right (the answer to the question); it's important that you make a guess, that you think about why this might be what happens.” Thus, he encouraged students to
think about what they already knew, to answer the question by thinking about prior knowledge. More students engaged in conversation about what the heart does to maintain homeostasis during exercise.

Mr. Brown asks students to wrap up their conversations, and shows a diagram that indicates what was going on in this process in the various parts of the body. There are no explanations offered yet for what is happening, just a diagram showing the various changes taking place in a schematic way, and the diagram is meant to help students organize their thoughts.

In a whole class setting, students volunteer generalizations about heart rate and breathing rate. One girl describes how she had looked up information about her father's heart rate and found that recommended heart rates varied by age and other factors, and the teacher acknowledges this by saying, "Yes, heart rate is different for different ages and weights." Now that the students have accessed their prior knowledge, Mr. Brown directs them to a description of how to do the lab and how to measure both heart rate and breathing rate before, during, and after exercise to standardize the process. He passes out timers for everyone and students start taking resting breathing and pulse rates.

Students ask about different values obtained for pulse and breathing rate. “Are these results normal?” asks one student. Mr. Brown comments, "You must be a pretty relaxed guy," and the students laugh, evidence of a comfortable working relationship the teacher has with the students. The mutual respect and caring is clearly evident in the class: the conversation is relaxed but students are polite and respectful of the teacher and their classmates. The students call the teacher, "Mister." There is a little hesitancy when students are joining into groups to work together, but once working, students seem to be cooperative and respectful.

Mr. Brown tells the students that they must get his signature on their results before they can begin the rest of the experiment. This scaffolding technique is to make sure that the students are doing the measurements correctly. Also, all students in the group must have the same hypothesis so he makes sure that both students have the information and are on the right track. He moves around the room reading the results that students are getting, then he either signs their lab sheets or talks with the students about what they are missing.

Students then scatter to various parts of the classroom and into the hallway to do the exercise part of the activity. The test subject needs to exercise for one minute intervals, so some go to where they can exercise (doing an exercise of their choice). One student in the hallway is waving his arms around which to the observer doesn't seem to be highly athletic, but it’s not entirely clear whether he's the test subject - it turns out he's not; he's just biding his time waiting for the person exercising to finish. Students move freely in the halls and seem to self-supervise fairly well.

Students are running up and down the hallway for their one minute of exercise. Mr. Brown makes supportive and encouraging comments such as: "Nice steady pace--that's good." One student has her pulse and breathing measured and then rests for one more minute and does the process again. Mr. Brown moves among the groups and helps out a group with only two students
(the other groups have three students so one can measure heart rate and the other can measure breathing of the test subject).

Students are visibly actively working together, being productive, purposeful, and calm during the activity. The teacher asks to see numbers from groups, to make sure data is being collected. The students are quietly working together, and they seem intent. The students are asking valuable questions about the results they are seeing. One student asks the teacher for a ruler, but another student who is sitting in front of her quickly shares her ruler.

Students ask each other for ideas and turn to each other to figure things out. They also seek out the teacher if they have questions that they cannot answer just in their groups.

Mr. Brown begins to collect students’ ideas on their group work, “So, now that you've done the lab, how are your circulatory system and your respiratory system working together? The idea of there being constant change?” Some students share their observations, “My pulse increased for each stage of the exercise, but my breathing stayed pretty constant after it first increased.” And “My heart is stupid, or not working functionally. I tried harder the last time than the first time. The last time it was 190, and the one before was 168.”

Another student shares, “I worked really hard the last time and it [my heart rate] just didn't keep increasing.” Mr. Brown says, “So let’s think about this. On a graph it's going to look like this. [Teacher shows how the slope of the line graphing heart rate and breathing rate might look over time]. It's about your body trying to get back to normal levels.” He points back to the diagram introduced at the beginning of the class and identifies a part where a muscle cell is diagrammed. He asks, “Is more energy or less energy needed when you’re exercising? When you're at rest, the system works like this (moves around the diagram slowly) but when you exercise it looks like this (moves around the diagram much faster) so what does that mean for everything else in this diagram?” The music plays for passing time, and the class ends. Mr. Brown concludes class saying, “Think about this, and we'll talk about this some more tomorrow.”

When asked about the design of the lesson in a post-class interview, the teacher responded:

So I elicit prior knowledge, try to engage them. The activities and labs are exploratory in nature, I try to follow it up with some explanations, or the students provide an explanation to me about what they saw in the lab--kind of a workshop combined with an inquiry model. I am trying to make connections to themes that the students are already familiar with. Students are super curious about diabetes and how smoking can affect the body. I notice that students have a natural curiosity especially when things go wrong. So I revamped a few lessons this year, like oxygen exchange. Examples now look at what asthma can do with this, look at what smoking does. Kids would just be asking crazy amounts of questions. What happens when it’s this? What happens when it’s this? As a means of trying to encourage and get kids hooked on the material, this works well.

The teacher also talked about the challenges of the change in homework grading and how it had led him to reconsider his unit planning and teaching practices:
You have a lot of teachers who believe in traditional ways. Especially if we don’t take time to show the teachers why it’s worth doing things this way. Your students now know that homework is not going to affect their grades by 1%, [because of the new changes in homework policies] so now you have to convince them that homework is worth knowing/doing and can affect their understanding. The performance based grading moves away from that. Homework completion has really gone down. Harder to keep track of where students are. Have you taken this assessment, have you taken that assessment? Hard to keep track of. The biggest changes are that I had to get under the hood of all of my units that I thought were really good. Look at what standards I was teaching and what information I have. Information about whether the students are achieving these standards. I’ve had to have multiple versions of every assessment to allow students to retake them. Also need to make sure I have time to give adequate feedback or make sure that I’ve managed to provide adequate feedback. A lot of what makes this school a school is probably nothing you would see on paper. There’s a real family vibe here. Students really respect each other and the teachers.

4.2.3. Summary
The co-teaching model is the most unique feature of instruction at USA. All students experience courses that are co-taught in 9th and 10th grade. The implementation of the co-teaching structure is consistent throughout the school, as evidenced by the training documents that USA provided, and effectively reduces the student-teacher ratio in half in those courses. USA has guidelines for the roles of the teachers participating in co-teaching and actively seeks to place those teachers who embrace collaborative teaching in the 9th and 10th grade classes.

USA has very recently changed their homework policy in all courses. Prior to the visit, USA had in place a traditional grading structure, where homework counted for a percentage of the course grade. In 2012, USA instituted a policy where students only obtained grades for their performance on tests, quizzes, labs, and projects. Both the teachers and the students were adjusting to this new policy, and students who initially responded by not doing their homework because they didn’t feel like it counted, were beginning to realize the importance of practice before their performance as teachers worked to contextualize homework as beneficial to their learning and passing assessments.

As a BPS school, the most prevalent instructional strategy at USA was guided inquiry with significant scaffolding. Because the exam and pilot schools in Boston tended to have the most academically prepared students, often the students at open enrollment high schools, including USA, had gaps in their skills and knowledge. USA teachers worked to develop their pedagogical knowledge with professional development and collaboration so that they could offer courses where students took responsibility for learning, rather than being passive.

4.3. USE OF TECHNOLOGY (CC3)
Technology connects students with information systems, models, databases, STEM research; teachers; mentors; social networking resources for STEM ideas, during and outside the school day.
4.3.1. Design
As a BPS school, USA’s long and short range technology goals were set by the district. These plans were found online on the district website (http://www.bostonpublicschools.org) and explicitly stated the BPS goals and current initiatives, including a focus on access, information, and innovation in technology. These initiatives included developing a robust up-to-date technological infrastructure within the schools, developing a student information system database, and fostering unique teaching and learning opportunities with technology.

4.3.2. Implementation
Classroom observations showed a wide range of technological proficiency among the teachers and students. For example, one mathematics teacher used full functionality of her SmartBoard, and another mathematics teacher put worksheets on an overhead projector. In another class, the students emailed their homework to the teacher who graded it online. Although these observations represent a broad range of technology implementation, all observed methods of technology integration were effective in classroom teaching. Technology integration occurred in non-STEM classes also, particularly in the context of the interdisciplinary projects. A Humanities teacher in the teacher focus group on use of technology described the technology aspect of one such project, the video game project previously described in the section on STEM-focused curriculum. She noted that, from the Humanities perspective, their curriculum was infused with science:

We do interdisciplinary units that bring all the disciplines together and we [Humanities] cross over a lot into science.... In the first one, students were asked to be video game developers for the week and they had to design a video game for a teenage brain. So they wrote computer code for their game, [and they had to write about the] science of the game, [the] chemistry of the game; and they had to write a business proposal for their game.

4.3.2.1. Technology Goes Home Program
Though not unique to USA, the Technology Goes Home program was an important way the school offered opportunities for effective technology use for parents and students. The success of the program depended on a school staff member with energy and passion for continuing it, and it was assumed that the program would not continue without a dedicated staff person. The program is described in detail in the section on Formal/Informal Learning (CC4). In essence, parents/guardians could sign up for a steeply discounted computer ($50) as long as they committed to attending a number of workshops with their high school student covering various life-skill themes relating to technology use. For example, one workshop covered how to search online for college-related information, another, personal finance, and a third focused on word processing.

Based on the teacher survey results, teachers varied widely in their assessment of the students’ access to technology. While some claimed access was not an issue, others felt strongly that it was. For example, a mathematics teacher explained her concerns:

So technology is an issue with our students; not many have technology at home. Last year we tried to do the problem of the week with the honors students by creating a webpage for the
students to access. Again, it is not one of the things that students have much access to... We do an excel project in school. With this excel project they get emails from us, so the school gives everybody an email, and so everything comes through email, we have laptops at the school, so this is great for in-school. But a project outside of school, that is one of our biggest challenges.

Students who had access to internet at home (roughly one quarter of the students, according to teachers in the technology use focus group and interviews with the administration) could, thus, use email to have more communication with their teachers and to enrich their learning. One parent commented, “My son communicates with his teachers through email. Maybe homework, maybe sending assignments – which I think is excellent. He does Photoshop and there are tons and tons of technology over the place.” For example, an 11th grader commented, “I find myself sometimes texting my AP biology teacher at 8 in the night.”

In their focus group on use of technology, students were asked, “Is there any technology you wish you had here that you don’t currently have?” All responded “iPads!” Another student commented:

I prefer the laptops. I just wish we had a little bit more access to them, because of the regulations with the laptop carts is that there has to be a certain circumstance where we can rent them throughout the day in the school. Teachers have to sign a form to request them and we can’t get them out of the class. The teachers have to get them. It is very strict.”

In response to this, a second student added, “I feel that’s because of underclassmen that don’t appreciate anything. That’s what happens.” Based on a teacher survey given before the site visit, many of the teachers felt they were able to work within this system to provide students opportunities to use technology in the classroom.

4.3.2.2. Teachers’ Perspective on Student Use of Technology

The teachers who completed the online survey before our site visit indicated that students used computers in the classroom in a variety of ways. 77% of teachers expressed that students used technology to create visual presentations, 77% of teachers said students used technology to organize and store information, 73% of teachers thought students used technology to create visual displays of data, 73% of teachers expressed that students used technology, to plan, draft, proofread, revise and publish written text, 68% of teachers said students used technology to support individualized learning. And 50% of teachers reported that if student access to technology outside of school was not so limited, they would try technology-oriented solutions to the transportation challenges that were so prevalent. Because students come to USA from all over the city of Boston, many of them must take public transportation, which is sometimes unreliable and is not synced to the schedule of the school. One math teacher mentioned he would be willing to use Edmodo or a similar platform to host examples, lectures, and problems for students to catch up on what they missed. The idea would be that students would be able to catch up at home whenever they missed class. Currently, however, that is not happening on a wide scale because of technology challenges.
Teachers also used technology to find resources for their classrooms. USA teachers reported that they conducted independent research to create instructional materials. A humanities teacher explained her process,

*We get our materials from ourselves. There are websites that go with each unit that we will share with you and everything is on those websites. We use videos to supplement it. We pull from many different sources to incorporate the data and research that goes into these important topics.*

Teachers at USA were proficient in being able to incorporate technology to enhance learning and to increase opportunities for communication, but because of limited access for students at home, they could not extend these opportunities outside of the classroom.

### 4.3.2.3. Parent Perspectives on Student Use of Technology

From a parental perspective, the commitment to technology use at USA was an excellent learning opportunity. The Technology Goes Home Program, described above, was meant to address the gaps of parents who had little access to technology. Those parents that did have access to technology reported communicating with teachers online and checking their student’s grades online. One parent mentioned,

*My role is so busy at work, I can email and text the teacher and that is helpful. We have recently invested in computers for the children so they can have time to work outside of school – so that if they wanted to increase their mastery or research, they can do so at home. They have technology at school, but it is important to have it at home. Technology is in the front with the teachers. Even if they don’t have a computer, the students can email from their phone. I work odd hours, so being able to email the teachers, it helps me greatly. There are also components where you can check your child’s progress online. I am terrible at utilizing it because they changed it, but it is still helpful – you have the ability to check that.*

Thus, parents we spoke to acknowledged technology as an important factor in maintaining teacher-parent communication.

### 4.3.2.4. Computer Club

USA had a Computer Club comprised of students who assisted teachers having technology issues. This club was advised by a technology specialist/teacher, who also supervised them in their roles assisting teachers. The students had opportunities to learn coding in Computer Club as well as the basics about building computers. It met during the last period of the day and was open to students of any level who were available and interested. An 11th grade USA student explained how the Computer Club operated:

*Currently, we have a technology support class which is like an in-school internship. Part of the class, you learn how to learn code for computers and websites. The other part, if it’s needed, then you and another student will go around the school fixing things and bringing things to teachers. It really helps a lot and especially since the majority of people here want to go into some type of technology or engineering-based career.*
More details about the learning opportunities provided through the club are provided in the section titled Informal/Blended Learning. The club appeared to be highly active and served a highly important service to the school community through quick response to technology issues in the classrooms that could otherwise hamper effective classroom teaching and learning with technology.

4.3.2.5. Challenges and Technology Leadership

Broadband access and wireless internet connectivity were challenges faced at USA. If too many students tried to log into the network at USA, on both phones and laptops, the capacity was exceeded. The school leaders were aware of the issue, and were working to address it. They felt that the district was very supportive of the school and fought to get funding for school technology. USA had emerged as a leader among peer schools in Boston, and these schools were contacting USA to find out how they were implementing technology. For example, USA had implemented an open wireless free internet zone (Wi-Fi) in response to the inability to get MACs on the network.

4.3.3. Summary

USA teachers and administrators acknowledged challenges with technology, and they all seemed to originate from funding limitations, such as lack of updated equipment and connectivity. Regardless, teachers were able to work around these limitations to offer engaging instruction based on guided inquiry in which students engaged in experiences and developed their own ideas based on prior knowledge. The Computer Club was a creative way to address the issues with maintaining the USA’s current technology, and at the same time help students learn more about computers and coding. Parents could communicate with the school through technological means, and students could email or text their teachers outside of school hours. Teachers seemed to be poised to incorporate more technology into their teaching if more resources were made available, and were using technology as much as possible and effectively as possible given the circumstances.

4.4. FORMAL/INFORMAL LEARNING (CC4)

Learning opportunities are not bounded but ubiquitous. Learning spills into areas regarded as “informal STEM education." Include apprenticeships, mentoring, social networking and doing STEM in locations off of the school site, in the community, museums and STEM centers, and business and industry.

4.4.1. Design

USA designed its programs to include a significant number of informal learning opportunities. This focus primarily manifested itself in the many business partnerships through which students had internship opportunities. In addition, many of these businesses provided school and community-based coaching to help students make deeper connections with science content. While some of these activities occurred during the typical school day, they often extended past core hours with the intent of using informal learning experiences to provide real-world learning.
USA’s emphasis on college and career preparation was supported through many of their student internships. The school administration stated that it was their mission to make sure that every student had a concrete plan after graduation and these informal learning opportunities helped in pushing students to select a career trajectory to pursue after high school. The purpose of these internships was for students to engage in a real world career that enabled them to learn while working on problems of interest and concern to the larger community.

In addition to the internships, USA also offered several programs where students received additional coaching in STEM as well as enriching their 21st Century Skills. These programs included the College/Career Readiness Program, Boston College’s College Bound Program, Technology Goes Home, and the Cloud Foundation’s science fair mentoring program.

4.4.2. Implementation
USA implemented their informal learning opportunities primarily through internships, student coaching programs, and business partnerships. While this section discusses many partnerships with USA in regard to informal/formal learning opportunities for students, partnerships are discussed in greater detail in the section titled, Partnerships (CC5).

4.4.2.1. Internships
Internships were coordinated through the guidance department at the school. While there were many internship opportunities available for students, seeking out these internships were the responsibility of the students. The guidance department advertised internship opportunities as they arose and students had to seek out these internships by visiting the guidance department. The guidance counselor explained that once a student demonstrated interest, the school worked with the student to help them apply to the internship appropriately. Students in the 11th grade focus group confirmed this understanding, “They put it out there, if you want to get it, then you can” and “You know where to go to get internships. They hang up posters everywhere. They don’t go to every student, but you’ll see the posters around the school telling you to go to the office.”

USA offered two types of internships to their students. The first type of internship was an in-house internship where students could volunteer with various offices within the school. One of the most popular of these internships was the Computer Club, described in the section on Technology Use. The technology class teacher explained some of the activities in which the interns participated:

The class is looked at more like an internship. Like right now, it is totally random how projects come up. But right now we have to take student pictures, and the pictures were horrible, so we have to use photo booth [software] so we worked on 100 and some pictures where we had to clear up their background on their IDs.

The second type of internship was off campus and was coordinated with the school’s partners. The school had several internship partners including, but not limited to: Brigham and Women’s Hospital, Faulkner Hospital, Industry Partner Council, Massachusetts General Hospital, and Boston College.
Through the Student Success Jobs Program at Brigham and Women’s Hospital, USA students could apply for paid internships at Brigham and Women’s Hospital. In this internship, an employee was a mentor and the students worked with the nurses and doctors. The mission was to diversify the workforce and to identify students who might not have otherwise considered employment at the hospital. A number of USA students had participated in these internships, including seven students at the time of this study, according to an interview with a program administrator. She shared that the USA students had been very well received by the hospital and it was hoped more would apply in the future. The hospital might hire these students after high school graduation or even after college if they maintained a good relationship. The hospital stated that about 30% of all students who had participated in this program had worked at the hospital after graduation.

4.4.2.2. Student Coaching Programs

The College/Career Readiness Program was a series of talks given by various professionals to help students become familiar with a wide range of possible careers. The Family and Community Engagement Specialist hosted a number of on-campus programs to give students real-world experiences they might not get elsewhere.

We started them off with a panel in the library. We had a bunch of speakers come in. We have a large population of students who are new to the country and Black and Latino students and we always try to make sure we have a diverse panel so they know that this is something they could do. We had the students rotate to different classes. One class would be resume writing, another was interviewing. We had all of these workshops and they rotated. We had people come in from the Boston area and work with the students. We got a lot of good feedback. They felt like they were being prepared for life after high school. That was strictly around career, and some of the things you do to get prepared to be an employee working in a professional environment.

In addition to the College/Career Readiness program at USA, students could participate in the Boston College-Bound Program run every other Saturday, two weeks during the summer, and two institutes in February and April. The goal of College Bound was to provide urban students with the skills and motivation to reach their academic, leadership, and career potentials. Students met one-on-one with their mentor to talk about college readiness and participate in a number of other activities through College Bound including: classes to refine academic, study, test-taking, computer, and research skills; tutoring services; and other mentor relations. Students from Boston College were matched with students from USA to participate in cultural, recreational, family, and employment activities; and for exposure to the college campus. Boston College’s College Bound program had shifted their college workshops to a focus on STEM literacy and career interest among inner-city youth. According to the Boston College Director of Outreach:

When the kids first come to our program, we have them immersed in an urban planning, which has now morphed into urban health. Health related issues are important; we have a lot of kids who want to go into a medical field, nursing, things like that. They come to us and they’re in that program usually as a 9th or 10th grader and it helps get their science skills up to speed. Once they develop their STEM skills, they have a choice on whether they stay in that strand or whether
they want to jump over to the media or urban farming projects. It gives the kids a lot of choice and empowerment in where they want to go.

We ended up splitting the STEM into three strands. One strand was media journalism. That strand creates documentaries of the other two strands, so they have to come up with ways of explaining science happening in the other two strands. We have a lot of kids that are interested in being a journalist and there is a lot of technology you have to learn in order to be a good journalist. As a result of one of the projects [in another strand], we now have a hydroponics project where the kids sell produce at a local market.

Throughout these activities, Boston College student mentors worked with USA students to help them enrich basic skills, increase motivation to learn, develop career goals, and increase their awareness of career options. Overall, the program promoted positive thinking about themselves as learners, fostered growth and ability as student leaders, and helped USA students work toward acceptance into a quality four-year college or university. The College Bound Director of Urban Outreach commented on the impact of the program,

*I think that the young people themselves are able to re-envision their neighborhoods and rather than encouraging kids to leave where they live, to encourage them to think about ways to give back in a way that illustrates a college major and career- that gives them a pathway to give back.*

4.4.2.3 Informal Learning Opportunities for Students through Business Partnerships

Another partner, the Cloud Foundation, worked to help make deeper science content more accessible for a broader range of students. One of the goals of The Cloud Foundation was to help students to come up with creative project ideas for the Science Fair that were connected to their own passions. To get students motivated, the Cloud Foundation hosted an assembly with all USA 10th graders to talk about meaningful science fair projects and to brainstorm ideas in small groups. Then, Cloud Foundation facilitators paired students with participating scientists to give students background knowledge and support throughout the project. The Cloud Foundation representative stated, “They get a sense that science is for them. Science doesn’t have to be something that is removed from their interests.”

Technology Goes Home, described in the section titled Technology, was a nonprofit partner through the Boston government. USA began offering the Technology Goes Home project when they got a grant to make internet and basic computer literacy available throughout Boston. In this program through Boston Public Schools, the student and one parent or guardian registered and attended a series of workshop-style classes together focused on technological life skills; upon completion, they could procure a laptop for only $50 and even qualify for financial support for home internet access. This program provided opportunities for students and their parents to build skills such as how to use Microsoft Word and email and how to access the student’s grades online. Additionally, they learned about internet safety and how to research information online. The Technology Goes Home Coordinator for USA explained some of the positive effects that the program was having, “*We teach the parents how to access their student’s grades online. Not all*
of the students are excited about that. Once parents know how to do this, the kid’s grades usually go up because parents can monitor it at home.”

4.4.3. Summary
USA offered a variety of opportunities to extend the school day and enrich the learning that went on during classes, many of them with a focus on 21st Century Skills. This focus primarily manifested itself in the many business partnerships through which students had internship opportunities, and in the College Bound program through its partner, Boston College. In addition, many of these partners provided school and community-based coaching to help students make deeper connections with science content and to support them in career and college-going planning. USA was constantly engaging in reflective practice to determine what their students needed for success not only in high school, but in their lives beyond high school. All of the programs outside of school time were intended to collectively contribute to support students in meaningful and lifelong learning, as well as to open STEM career pathways.

4.5. PARTNERSHIPS (CC5)
Students connect to business/industry/world of work via mentorships, internships, or projects that occur within or outside the normal school day/year.

4.5.1. Design
USA considered partnerships so crucial to enhancing the school experience that they had a designated staff member. The Family and Community Engagement Specialist was in charge of finding, nurturing, and developing any and all partnerships. The person who was in the position the year of our study had been there since USA merged with PATH school in 2011. Her goals included both science partnerships and other kinds of programs that would help students develop 21st century skills. The partners’ representatives we interviewed reported that she was essential to the school’s partnerships. For example, the Cloud Foundation director explained:

One thing that is important to USA is that they have liaisons that focus on partner engagement and open up doors. Without that liaison, I doubt that this sort of thing would happen.

A representative of the Peer Health Exchange, who had worked with USA on career workshops through the College Career/Readiness program, praised USA for their exemplary organization and commitment:

What really helps is the very clear and effortless communication that I have with the outreach coordinator. She is not a teacher, but an administrator. As being the one person that I’m communicating with on a weekly basis, the fact that she is so organized and is proactive in emailing about schedule changes [matters]. She was very organized in terms of listing the teacher, the schedules, and the rooms. We have high schools that cancel on us the day before our volunteers show up and I’ve never had that happen with USA: they’re always very organized and stick to the dates whenever possible. If they do need to change them, they let me know ahead of time. When our volunteers show up, they’re ready and expecting us. It’s how organized and on-
top of things they are that makes it so easy on our end to execute the workshops on a weekly basis. I’m not worrying about whether they’ll actually be there, or if it's the right room. It operates like a well-oiled machine.

Forming partnerships was clearly a priority for the administration at USA, and the partners commented on USA’s commitment to developing partners to broaden student experiences. The head of JFY NetWorks, that partnered with USA to provide their students support in using the Accuplacer software program for college planning, described it in these terms:

Both [Assistant Headmaster] and [Headmaster] are very receptive to new ideas and have always been receptive to new ideas and to extension opportunities. They are pursuing a few other grant opportunities to expand some programs. The administration is very receptive and excited to hear new ideas and is always looking for ways to improve what they’re doing and do more for their students. They have a model of continuous improvement there, and you really see it from the administration all the way down to the faculty as well.

4.5.2. Implementation
USA maintained major partnerships with the College Bound Program, The Cloud Foundation, JFY NetWorks, the Peer Health Exchange, Brigham and Women’s Hospital, and the Urban Ecology Institute at Boston College.

4.5.2.1. Boston College/West Roxbury Community College: College Bound Program
The College Bound program was offered at a number of neighborhood schools within BPS, including USA. There were 60 students total enrolled in the program each year, and 20 of those positions were reserved for USA students. The College Bound Program originally focused on leadership and social justice and targeted students who were at risk of dropping out to become change agents in their community. Over time this program had evolved, and at the time of our visit focused on a combination of STEM and social justice, and was especially interested in reaching out to students who didn’t see themselves in STEM careers. As described in the section on Formal/Informal Learning, college student mentors from Boston College met with USA students to have lunch, attend STEM classes, and attend college and career coaching.

Teachers from USA were also involved in teaching College Bound courses during the summer at Boston College, and benefited from the close liaison with Boston College, according to the outreach director:

[The teachers] come to campus and learn about science and then bring that experience back to school. In fact, the College Bound STEM instructors are instructors from the school itself who also participate, particularly in the summer program. That allows the connection.... It allows the school to know what the kids are doing at BC and allows for easy communication. We’ve also been working with all of the teachers there on curriculum development and implementation at the school, so they’ve become more of a pilot site. We’ve got a number of projects where they get to be the lead in innovating something.
4.5.2.2. The Cloud Foundation
The Cloud Foundation/Art Science Prize program, like the College Bound Program, served schools city-wide in Boston. This partner worked with students in conjunction with a major science fair, did a creative workshop with 10th graders, and followed up with purposeful pairing of students and scientists for development of their science fair projects. The program’s mission lay at the intersection of art and science, and was intended to help make science content accessible to a wider range of students. The Director of the Cloud Foundation explained:

They [the high school students] get a sense that science is for them. Science doesn’t have to be something that is removed from their interests. [They] can be passionate about science, can be passionate about achieving their dreams. Their passion and desires can be actualized and they can change the world. That is the message that we deliver at all workshops.

4.5.2.3. JFY NetWorks
JFY NetWorks/Accuplacer Program was a nonprofit that supported USA students and teachers in taking advantage of the Accuplacer software program in preparation for taking the statewide assessment required for all students. This was the first year of this new partnership. The goal of the Accuplacer Program was to help students test out of remedial math courses once they got to college. JFY NetWorks provided on-site professional development to the teachers to sustain the support for accelerated learning during site visits, and also interacted with students, as described by the representative we interviewed:

In terms of site visits, we’re there to provide professional support and training for the instructor, and also to interact with the students and to monitor their progress in person. We will interact with the students and get their feedback on what they think of the program, what they think its strengths and weaknesses are; then do some on-the-spot interventions to help the teachers or students that are struggling with a particular subject.

Additionally, the Accuplacer Program gave diagnostic assessments to the juniors for the purpose of providing the USA faculty with information about their students’ academic achievement. A JFY NetWorks representative described the benefits in terms of college coursework:

For last year, for the students in one class [of graduating students], we were able to eliminate 6 arithmetic and 6 elementary algebra classes for a tuition savings of $6,000 for those students…The studies show that the fewer developmental courses taken, the greater the chance of graduating. Many schools have three developmental math levels. The students who only have one class, versus those who have three, have a greater chance of graduating. If there is time to eliminate classes altogether, to move students along a sequence of classes that they have to take-for every developmental class that we can eliminate, we can increase their chances of graduating.

4.5.2.4. Peer Health Exchange (PHE)
This organization, PHE is a national non-profit organization with offices in New York, Chicago, LA, Bay Area, DC, and Boston. They provide trained college volunteers to teach in high schools that lack comprehensive health education. PHE works with about 450 college volunteers drawn
from five Boston colleges. They train volunteers to teach a 13-week unit of health classes, covering issues ranging from alcohol and substance abuse to sexual health, nutrition, and physical activity. PHE college volunteers went to USA once a week and delivered the course in the freshman advisory classes. The curriculum focused on health behaviors and making good decisions, as described by a PHE representative:

*All of the workshops are very focused on decision-making and teaching students the skills to make their own decisions on these topics. Our goal is not to tell the teenagers what to do. We’re not telling them not to have sex in high school or not to drink. It’s more so saying that these are your options and the consequences of these decisions and how do you communicate this decision to other people. It’s true that if they want to go into college and be successful in high school and achieve their goals that these decisions about their health can have very serious consequences for their ability to achieve these goals. Not very college focused, but we do talk about how, for example, getting pregnant in high school may affect their ability to go to college.*

Administrators at USA had set up the program, focused on their ninth graders, in a way that was more intensive than at other high schools:

*At USA we get all of ninth graders. That’s not true at all of our high schools. Some are more targeted, but at USA we are lucky to work with all ninth graders during their extended advisory time on Fridays. [It] has been that way since I came on. I have been on the staff two years now and have managed USA for the past two program years. When I came on they already had this existing structure; it was always the extended advisory program on Fridays."

Due to the structure of the program, there were some additional opportunities for USA’s students to engage with volunteers about health careers on an ad-hoc basis. A PHE staff member describes:

*At the end of workshops, if they wrap up early, they always say that they will be sticking around and can answer questions about college or the workshop. ..... Some people take them up on their offer and others are happy to talk amongst each other and don’t ask the volunteers any questions.*

**4.5.2.5. Brigham and Women’s Hospital**

Through its Student Success Jobs Program, this hospital hosted 80 high school students from any of the Boston Public Schools each year, and approximately five to seven of these students came from USA. The program offered paid positions and was very competitive. Students worked with mentors at hospitals in health career positions, and the program particularly focused on students who might not otherwise have considered health careers. The Family and Community Engagement Specialist at USA was especially proud of this partnership,

*I really fought for the Brigham and Women’s partnership. We have been with them for at least 3 years. At the time, they were close with the school and I knew the potential of the students. I used to work with the entire complex [of four co-located small high schools], even before it became USA and was advocating for this program because it is excellent.*
4.5.2.6. The Urban Ecology Institute at Boston College

The Urban Ecology Institute partnered with high schools to provide an Urban Ecology science elective curriculum, and to support the designated urban ecology teacher from each school through collaboration with a team of professors. The Boston College professors provided professional development opportunities for the teachers, and graduate students involved in the program co-taught some of the classes with the high school science teachers. The Urban Ecology Institute also provided the specialized technology that accompanied the curriculum to record the sounds of birds and track the data. Additionally the Urban Ecology Institute hired students over the summer to attend the Urban Ecology Institute student summer experience. Each year, a large group of ninth graders from USA spent several weeks on the Boston College campus, doing science-related activities and getting paid for their time while on campus.

4.5.2.7. Benefits of Partnerships

The partnerships did a great deal to help promote a college-going culture at USA, through direct contact with professionals and academic settings. The variety of partners gave the students a broad sense of possibilities for the future. The Guidance Counselor explained the impact of the partnerships:

*It’s really important to have guest speakers that look like the population of students that we serve. That’s a big help. We work closely to build and maintain those relationships with local universities and colleges. The teachers are also involved. These are the role models. I remind students that teaching is one of the few fields that require two degrees. Many careers, you’re not required to have two degrees. When they see the teachers, and many of us come from the community and look like that, it does make a difference.”*

4.5.2.8. Challenges of partnerships

Although the partnerships with USA provided authentic experiences and promoted possibilities for future careers for the students, there were some challenges in maintaining so many contacts outside of the school. Some staff at the school commented on how the students have such a variety opportunities to choose from regarding internships that it was difficult to keep track of all the opportunities. Even within the school, some staff may know about certain opportunities that others did not know about.

A Guidance Counselor commented on the number of partners and opportunities at USA:

*We have so many partners here at USA. We’ve been involved with [Boston College’s] college bound program for years. I did one summer with them a couple years ago, it’s all about STEM careers and programs. We’ve done that for about the last 6-7 years. We have a lot of partnerships with hospitals, students working at Faulkner and Brigham Woman’s. ... In Boston, we have so many college and universities that are invested in our students. I have students who are involved in Harvard University’s Crimson Academy. They recruit freshman every year. I have my first graduating class now. The nice thing about that is that they actually participate in the Harvard graduation in June. It’s really nice. That’s just a few things, I can’t remember all, we have so many partnerships with schools, universities, and hospitals.”*
4.5.3. Summary
USA put a lot of effort into finding and cultivating partners for the primary goal of college readiness and life skills. Because of their location in Boston, USA was able to take advantage of many city and statewide programs, and the administration purposefully structured the opportunities to try to get as much out of the program offerings as possible. This was mostly because the administration and the Family and Community Engagement specialist made college readiness a priority. There were few industry partnerships; rather USA connected mostly with educational nonprofit organizations. The exception was a successful partnership with Brigham and Women’s hospital that a few of the top USA students were able to participate in each year. Although there were many partnerships with USA, transportation, logistical, and financial challenges continued to be a limitation to expanding this component of USA.

4.6. EARLY COLLEGE-LEVEL COURSEWORK (CC6)

School schedule is flexible, and designed to provide opportunities for students to take classes at institutions of higher education or online.

4.6.1. Design
USA built early college-level coursework into its design primarily through AP coursework that offered all students the opportunity to experience college level rigor. USA boasted the second highest number of AP course offerings outside of the BPS exam schools. In 2009, USA received a $50,000 grant from College Board to expand AP offerings from one course to seven courses. USA also cobbled together grant funding to pay for all of the AP exam fees for students. AP courses in science and mathematics included biology, chemistry, psychology, calculus, and statistics. Humanities were offered at the AP level in English literature, U. S. government and politics, and Spanish literature. AP courses were open to all students and many of these AP courses required participation in summer bridge programs. In addition to AP courses, USA offered opportunities for its students to earn college credits through its partnership with Bunker Hill Community College. This IHE had a partnership with all BPS high schools to offer a dual enrollment program, which provided both high school and college level credit.

As described by the guidance office and school administration, USA’s goal was for every student to take at least one AP course, but preferably two to three AP courses, before they graduated. The Guidance Counselor described USA’s philosophy on AP courses:

There are some schools that have requirements on who takes AP. We don’t do that here at USA. I have students who may not be the typical AP recruited students. We don’t limit that at USA. We allow everyone to take AP. If you have the interest and you’re committed to learning, take the course.

The school administration and teachers promoted a college-going culture and used AP courses as one of the means to create and drive this culture. USA supported students in taking on this more rigorous coursework through requisite summer bridge programs. These summer bridge programs were designed to scaffold student learning and give them an academic boost before they engaged
urban science academy, boston, MA

with content at the AP level during the school year. the assistant headmaster explained why AP courses were open to all students:

Because for us, the philosophy for our AP program is that if kids express interest and their willingness to do summer bridge work, they are welcome to participate in the class. We try to eliminate gatekeeping mechanisms…knowing that kids that experience the rigor of college courses in high school do better in college period.

4.6.2. Implementation
School administrators, teachers, and guidance counselors at USA all described the school’s goal to have all students take at least one, but preferably two to three AP courses before graduation. However, only about half of all students completed an AP course before graduation. Still, USA’s progress towards this goal was significant, and sufficient numbers of students were enrolling in these courses to continue offering eight AP courses, including biology, chemistry, calculus, statistics, and psychology. Given that the school served less than 600 students, this robust AP curriculum, of which five courses were in science and mathematics, reflected the school’s commitment to providing opportunities for students to engage in college-level coursework, particularly in science and mathematics.

The AP classes themselves were structured with extra supports and they fostered a sense of community of learners within the courses. A USA student explained the role of teachers mentoring students about AP coursework, and the peer support built into the design of the AP courses:

With most cases, there are usually one or two teachers that recommend you for it. My AP U.S. Government teacher and my Humanities III (?) teacher nominated me for AP [English] Literature, so it wasn’t necessarily a class where I felt like I might do well, being dyslexic; however the community within the class and the support really does make a difference.

4.6.2.1. Bridge Programs
The Bridge Programs were usually structured as an intensive two-week summer course focused on giving students additional knowledge and skills to be successful in certain AP courses. These programs were typically offered in the last week of June and the last week of August. The bridge programs occurred at the University of Massachusetts at Boston using their facilities. The Assistant Headmaster related the rationale for these bridge programs to the school year calendar:

Many of the math and science AP courses have bridge programs. The issue is that in Boston, we don’t start school until after Labor Day. We have many students across the nation that start school in August. If we didn’t have the bridge program, we would be so far behind, since all the AP exams are in May.

The Assistant Headmaster reported that USA students appreciated the Bridge Programs and felt pride in being part of it:
Now the kids know that if they are taking AP science or math, they have to devote the summer before. The first part of the bridge might be the last week of school. It’s an honor for them. It’s prestigious for them to say that they’re going to the summer bridge to take an AP class.

Despite the Bridge Programs at USA having been effective and well-received, funding constraints had led to a shortening of these bridge programs in the recent years. A biology teacher explained the implications for the reduced Bridge Programs:

Mine [biology] has had a bridge program for many years, but year after year it gets shorter and shorter. If I’m going to want this, I am probably going to have to put on my own program. By and large, the students really enjoy it. We can usually cover a unit or two before the year starts. It’s going to be challenging to not have this. It helps kids buy into the whole thing a little better.

4.6.2.2. AP Exam Support
USA administrators realized that not all students taking an AP exam associated with the course were going to score high enough to get college credit, but at the very least the USA students would be getting the experience of taking the AP exam. The Headmaster explained,

I don’t want the kids to feel like they took the AP class and [did] not take the exam. But for the most part they cannot afford it and I can’t afford it. About every year I get like a $3000 bill that I figure out how to pay. This year it will be around $8000 and there is no way [we can find funding this year].

During the school visit, the administration announced that they had lost another funding source and were exploring other options to pay for the exams.

4.6.2.3. Dual Enrollment Program
Bunker Hill Community College and all of BPS had a partnership to offer a dual enrollment program. This program focused on students who had received C’s and D’s in science and math, and the intention was to garner the interest of students who were on the verge of being at risk of not graduating. The Guidance Counselor explained, “Community college is not alternative Ed, but it gives them the option of doing something a bit different where they’re not in school the entire day and gives them a sense of independence.”

4.6.2.4. Students Taking Action for Nursing Diversity (STAND)
In addition to its dual credit partnership with BPS high schools, BHCC had a nursing degree program that was highly competitive for admission. Through a three-tiered program known as Students Taking Action for Nursing Diversity (STAND), students could enroll in a dual-credit nursing course during senior year of high school (tier one). Students who completed this course could continue at BHCC with a second tier consisting of pre-requisite BHCC coursework. Students who completed this second tier, and passed the Test of Essential Academic Skills (TEAS) were guaranteed acceptance into the College’s highly competitive nursing program.

Launched to level the playing field in healthcare careers, STAND reached out to students in Boston’s inner-city neighborhoods and guided them through the necessary prerequisite courses
for nursing. Students who completed the STAND program requirements and BHCC’s course prerequisites and who achieved passing scores on the Test of Essential Academic Skills (TEAS) were guaranteed acceptance into the College’s highly competitive Nursing Program. Thus, STAND offered USA seniors interested in a career in nursing the opportunity to get an early start on this STEM-related career path.

4.6.2.5. Influences of early college courses on USA culture

The prevalence of AP courses and the large percentage of students taking AP courses at USA (almost 50%) had created a school culture focused on students pursuing higher educational experiences. All students at USA were encouraged to push themselves to take early college courses. The Guidance Counselor explained USA’s very inclusive policy on dual credit that mirrored their open policy towards AP coursework:

*It’s common [for students to take community college courses]. For USA, it’s becoming more common because our emphasis was AP... It’s becoming more common now because we have more kids that might be in the C-D range who might do better taking a college community course in the evening. We’re being creative. We’re not X-ing out anything; we’re including everything so that our kids will be successful.*

The parents shared success stories about the positive effect that teachers had had on students, particularly the support and encouragement that teachers offered. One USA parent provided an example:

*I think the best example that I can give is to share with you how my 10th grade daughter participated in the AP Statistics class. I appreciate that her instructors from her 9th grade year encouraged her. It is unusual for a 10th grader to go into this class, but she went ahead and did it. Where she was struggling, the teacher was incredibly supportive and he found her strengths and weaknesses. He found a way to absorb her into the material.*

Students in the AP student focus group expressed the shared sense of community they felt in their AP classes:

*They [teachers] make it so that those groups of AP students are like a family, at least in AP Chemistry it’s like they’re together as a group and when you’re in that class you get work done, because you know you’re there for that reason.*

*You get to know the people in the class closer than other people you have in the other classes.*

*The community within the class and the support really does make a difference.*

The powerful combination of teacher encouragement and sense of belonging created an environment that students perceived as attainable and inviting, which in turn created a college-going culture at USA. When asked about this, the Guidance Counselor described the underlying philosophy:
We have a college-going culture at USA. When they know that they’re going to be taking AP classes—that is what gives them the rigor to do well and perform in college. It is an experience. College Board has done studies showing that just sitting in an AP class is good. We make all of our kids take the exam. AP is one of the main ways that we get the kids to start thinking outside the box, to start building up their critical thinking skills. Also, we have people partner with college and universities to build up their social and academic skills.

The expectation was that every student should be able to take the high level courses with support, and students in the focus group indicated that they and other students took these courses seriously:

All AP courses here, from what I’ve seen, it’s all taken very seriously. It is more shown like a privilege to be in that class.

Your success in that [AP] class shows or depicts your level of self-discipline.

4.6.3. Summary
USA fostered a college-going culture with students who might not typically attend college. The school did this primarily by offering seven AP courses, including biology, chemistry, psychology, calculus, and statistics, with associated summer bridge program to help students prepare in advance for the rigorous science and mathematics content. The intention of USA was for all students to have experienced at least one AP course. The school encouraged students and students felt part of a community in the AP courses. In the past, USA had obtained funding to pay for all of the students’ AP exam fees, but recently had experienced funding issues. With more students taking AP courses, the bill had grown to $8,000, and the loss of outside funding for the exam fees was a significant challenge to overcome. In addition to the AP courses, USA also offered early college coursework and career preparation through a dual enrollment program with Bunker Hill Community College, including the opportunity to gain entrance to a highly competitive nursing degree program by beginning with a dual credit course in nursing as seniors and subsequently completing pre-requisite work the year after graduating.

4.7. WELL-PREPARED TEACHING STAFF (CC7)

Teachers are qualified and have advanced STEM content knowledge and/or practical experience in STEM careers.

4.7.1. Design
Teachers in the BPS system were represented by a union and USA had to follow union rules related to the teaching staff. Any changes had to be approved by a faculty vote through a waiver process. Union hiring rules impacted staffing, particularly when USA doubled in size through absorption of the Parkway Academy of Technology and Health, another small high school located at the same site. Because of the teachers union policies, teachers from USA could be retained during the merger, but additionally all teachers from the absorbed school had to be offered positions at USA.
BPS teachers were required to participate in 24 hours annually of professional development, which at USA included six hours of teacher-proposed and teacher-led mini-courses. Teachers at USA could also take advantage of professional development opportunities offered by BPS. These included targeted events such as inquiry-based teaching workshops aligned with the BPS curriculum design. In addition, USA designed its teaching schedule to allow for department meetings and common planning time for teachers in the same content area.

According to the administrators and the teachers in focus groups, USA supported strong STEM teaching by organizing the teachers’ schedules so that they could participate in professional learning communities by content area and share a common planning time. The teachers were offered on-going professional development, and BPS professional development opportunities had a particular focus on inquiry learning, the underlying basis of its curriculum design, and offered system-wide professional development events.

4.7.2. Implementation
This section on implementation includes four subsections: hiring and shaping of the teaching staff; teacher demographics and qualifications; professional development; and general teacher culture.

4.7.2.1. Hiring and Shaping the Teaching Staff
USA administrators intentionally hired teachers to fit the culture of the school while complying with union rules. According to one of the teachers, the administration was “really looking to get the best teachers on the ground and getting all of the teachers to buy into the mission.” Supporting and guiding the teachers through vigilant and thorough observation and evaluation during the first couple of years provided teachers with feedback that both commended solid practice and supported continuous improvement. The administrators described their teachers as a group of “solid, committed teachers... at the core of the high school.” To get this group of committed teachers, the administration at USA used a process of evaluation to support effective teachers that bought into the school culture and to evaluate out ineffective teachers. An administrator described the initial process during the school’s start-up:

When this school first started it probably took about two years to turn over the staff and probably by year three everybody that was [still] part of the staff wanted to be here ... and knew the vision and knew the mission that they were buying into, and we [now] have a strong foundation. A lot of that staff are still with us today.

According to administrators, this solid teaching staff had “diminished more and more every year” with some teachers arriving through absorption of the neighbouring school and its teachers, and others as forced placements occurring by less senior teachers being bumped out by those with more seniority in BPS, or other required placements from the “Excess Pool”. While some of these additions were effective teachers who blended into the school culture, in other situations, the results were less successful placements in terms of both the teacher and the school.

When teachers were placed at USA who did not embrace USA’s culture, the administration described engaging in targeted efforts to guide these teachers to buy into the school culture
through an intensified process of observation and evaluation. One of the challenges was the time it took to guide reluctant teachers and the impact on the rest of the school. One administrator described this challenge:

*When people do not want to buy into your culture and [in the case of USA] not give up the formal ways of past schools, it takes a lot [of administrative time] to give them their feedback and support.*

The administrator described the impact on other teachers within the school:

*It doesn’t leave a lot of time for those teachers that are good and great and helping them improve, because they are clamouring for us to come into the classroom and provide support … There are teachers that will invite [administrators] in and say ‘I’ve got this going on, why don’t you come in and look at the class for support? [or] Judge a debate?’ This is something we were so used to doing when we were half the size we are now and we don’t get those same types of opportunities because you are literally running from the moment you get in the door.*

Besides the impact on a administrator’s time and the ripple effect it had on other teacher requests for administrators to visit their classrooms, this intensified observation and evaluation had a significant impact on the new USA teacher as well. Getting honest feedback on one’s teaching can be a jarring reality check for those teachers who had hoped to come to a school for a year or so of relative obscurity prior to retirement. Negative evaluations coming on the heels of little significant feedback during a lengthy career could challenge a teacher’s fortitude. One administrator described this impact:

*When you think about these folks that in some cases haven’t really gotten quality feedback, in some cases for 5, 10, 15, 20 years, and then all of a sudden they are being told “you are not meeting the standard,” that can be hard to take and at that point it is really hard to do a 180.*

The administration said that the doubling of the size of the school after starting with a solid existing structure was easier than starting with a larger school from scratch. The biggest struggle had been helping to orient students and staff previously not part of USA.

### 4.7.2.2. Teacher Demographics and Qualifications

Of the 22 teacher respondents to the Teacher Survey administered prior to the research site visit, 57% identified as white, 19% as Black or African American, 10% as Asian, and 14% as Hispanic or Latino. Teachers’ ages ranged from 25 to 49 with the mode in the 25-29 year group, and the mean about 35 years old. The average teacher at USA had been teaching for a little over 9 years, with a range from 2 to 25, and had taught at USA for an average of 4 years. Of the teachers responding to the survey, about half identified themselves as STEM teachers including four science teachers and six math teachers.

According to the survey, most teachers held teaching certifications and often degrees in the subject areas they are teaching. The majority of the teachers held master’s degrees, many in some aspect of education. Among the STEM teachers, all held significant and appropriate
subject area undergraduate degrees and 80% held master’s degrees; most of the science teachers had a major degree in their content area and they were all certified to teach their content area. The majority of the teachers received their bachelor’s and master’s degrees in the New England area, but a few held degrees from further afield. Within the last three years, 64% of the STEM teachers reported taking a college level course in a STEM content area, and 64% of the STEM teachers reported taking a college level course on the teaching of STEM within the past three years. Ninety-five percent of the STEM teachers reported that they were confident in teaching using investigative strategies, hands-on/project based work, and that they were able to recognize and respond to student diversity.

About half of the teachers actively sought out USA for its science focus; its reputation as a “place where teaching and learning are placed as a high priority;” as a school where “meeting the needs of all learners and on experiential learning for students” were important; where there was an opportunity to “work with a group of educators that was committed to the profession;” or because of the co-teaching model. Other teachers came from other teaching positions in BPS, were moved over from the absorbed sister school, or were recruited by the administration.

4.7.2.3. Teacher Professional Development

Teacher professional development at USA took a variety of forms and came from a variety of sources. For professional development taking place during the school year, there was time on Tuesday afternoons set aside for department meetings, all staff meetings, or meetings in teams. The monthly 75 minute department meetings were voluntary and participation came with a stipend. One focus of department meetings was on department-wide student learning goals where teachers identified a professional practice goal in conjunction with a Massachusetts specified student learning goal. Teachers answering the survey identified that the district offered professional development, which was generally described as “good,” but not enough. Teachers supported each other through teacher-led professional development to improve individual classroom instruction.

As noted in the design section, teachers were required to participate in 24 hours of professional development annually, which at USA included six hours of teacher-proposed and teacher-led mini-courses. Teachers also participated in fairs or exhibitions of their own best practices, and collaborated to come up with a curriculum for their own professional development. Outside of the professional development taking place during the school year, BPS provided resources for targeted teacher professional development that a teacher might seek out to expand his or her own content knowledge. One teacher commented:

I have not paid for any professional development and I have done so many – teaching science through inquiry, inquiry for chemistry, inquiry for AP chemistry. Boston Public Schools pays for anything. Even now I can go to chemistry workshops to collaborate with other chemistry teachers...and now we know other chemistry and AP chemistry teachers at other schools. Other people [outside of BPS] are paying to go to these [workshops]. Boston does provide us a lot of support.

In particular, because of a three-year program from Race to the Top funding through BPS,
throughout this time teachers were getting paid to go to professional development. Many teachers commented on the value of these experiences.

Within the past three years, most STEM teachers had attended a workshop on STEM teaching, but fewer than half had attended a national or state STEM teacher association meeting. More than half had taken a university STEM content course within the past three years that was not part of their undergraduate work. With respect to the benefits of their professional development, virtually all STEM teachers felt that their experiences either confirmed what they were already doing or encouraged them to change their teaching practices. (See Table 5)

Table 5

<table>
<thead>
<tr>
<th>Question - I am confident in my ability to:</th>
<th>Scale 1-3*</th>
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<tbody>
<tr>
<td>Deepening my own content knowledge</td>
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<tr>
<td>Understanding student thinking in S/T/E/M</td>
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</tr>
<tr>
<td>Learning how to use inquiry/investigation-oriented teaching strategies</td>
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<tr>
<td>Learning how to implement problem-based or project-based learning</td>
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<tr>
<td>Learning how to teach S/T/E/M across the high school curriculum</td>
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<td>Learning how to help students perform S/T/E/M research</td>
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<tr>
<td>Learning how to teach engineering or design concepts or activities</td>
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<td>Learning how to teach S/T/E/M in a class that includes students with special needs</td>
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</tr>
</tbody>
</table>

*1=little or no impact
2=Confirmed what I was already doing
3=Caused me to change my teaching practice

4.7.2.4. Administration Encouraging Collaboration

Determined that it was important that collaboration and a common sense of direction should be established among the teaching staff, the administration took the initiative to demonstrate for, and support teachers in, training on how to get the most out of their common planning time. Administrators initially sat in on common planning time, helping to set the agenda and model the conversation. At the time of our visit teachers expertly led the charge for grade level common planning time. Administrators noted that the teachers had come to truly value the time they have to collaborate, that they “really want to work together” and that they treat collective meeting time as sacred.

According to the Teacher Survey, of the STEM teachers, the majority had observed other teachers teaching STEM courses within the current school year as part of their own professional development. Additionally within the past two years, the majority had collaborated with other STEM teachers for the purpose of integrating content from diverse disciplines. About half of the STEM teachers had collaborated with non-STEM teachers for the purpose of integrating course content, and about half of the teachers met regularly with local teachers to discuss STEM teaching issues. With respect to professional development that teachers would like to have, most comments on the Teacher Survey tended toward a desire to learn how to incorporate technology
into projects and activities, using hands-on experiences in math, teaching to inclusive groups of students. One teacher specifically cited a need for more time to plan together with other teachers, "The best PD [professional development] I had was being able to plan for a whole school day in a room with my colleagues--when needed, I could ask for advice or suggestions."

4.7.2.5. Instructional leaders
The administration also supported the training of two teachers as Instructional Leaders through district-supported workshops. These teachers subsequently led the Instructional Leadership Team that facilitated departmental and other monthly meetings. The structure of this role has changed over the last two years. Whereas in the year prior there was a modest stipend for this position that also included common planning time, in the year of our visit the Instructional Leaders were instead given ninety minutes to focus on this work daily. So rather than teaching four, sixty minute block classes, Instructional Leaders taught for only three blocks and did not have advisory responsibilities.

These Instructional Leaders met bimonthly with the administration and crafted a vision for staff professional development, which they then took full and autonomous responsibility for planning and executing. One practice that the Instructional Leaders utilized to implement the professional development was Instructional Rounds. Every other month, teachers could participate in Instructional Rounds where teams of teachers observed classroom teaching by their fellow teachers. Involving a full-day commitment by participants, substitutes were brought in and working on a three-day cycle, groups of 6-9 teachers spent a day gathering data with a particular focus. As described by one of the Instructional Leaders, these observations were usually of four diverse classes per day, focused on the "instructional core" and the "triangle between content, teacher, and students." Nonjudgmental data were collected and viewed through particular lenses. Data were analyzed, to seek out patterns and make connections among the experiences leading to recommendations for changing teaching practices.

4.7.2.6. Vertical and horizontal alignment
Teachers collaborated to ensure vertical and horizontal alignment of their teaching. Teachers cited that they had previously been scaffolding students’ learning, but were aware of the use of differing language and techniques across the subject areas. In an effort toward greater coherence, they were working to reinforce basic skills and common language from ninth grade onward. All science teachers were engaged in vertical teaming. Using the frameworks for science that came out of Massachusetts, teachers focused on using common language and common techniques in teaching students the basic skills of writing lab reports, writing testable questions, writing hypotheses, identifying variables, and designing experiments, so by the time they were seniors, the techniques were routine and ingrained.

4.7.2.7. Higher order thinking
Another big initiative driven by the teachers was to ensure that instruction was rigorous and included opportunities for students to practice higher order thinking. An upcoming all-staff professional development was to be devoted to higher order thinking where teachers would share posters of how they embedded higher order thinking in early stages of units. One teacher described the approach to and the challenges of engaging higher order thinking skills at USA:
“One thing we try to do is to increase student access to higher order thinking: problem solving, being creative. That’s not easy, teachers write their own curriculum and this can be challenging.”

4.7.2.8. Inquiry teaching
In the past, teachers’ professional development has been based on inquiry and collaborative coaching models. “All [BPS] curricula are designed around inquiry, so if you’re teaching from the curricula you can’t avoid that.” More recently, with the shifts in focus, teacher professional development had moved toward keeping up with the new teacher evaluations and implementing performance-based grading.

Teachers indicated on the survey that they generally felt confident in classroom pedagogy. With very few exceptions, they felt capable of helping students investigate and use inquiry and project-based processes. They also felt reasonably confident in responding to student diversity and encouraging general interest in the STEM fields. They were less confident about strategies to involve females and minorities and to involve parents in STEM education.

4.7.2.9. Research-based change
The administration was focused on making decisions based on research. The Assistant Headmaster stated, “One of our overriding approaches to PD [professional development] is to bring in scholarly research; we don’t want [curriculum design] to be going off of anecdotes.”

Grading practices were found to be inconsistent and were felt to be inadvertently suppressing student achievement. It was suggested that practices such as the ways that homework was graded clouded the amount of actual growth that students were making towards a certain set of standards. Through a teacher-led initiative, the grading structure was undergoing a change where students were no longer graded for homework, effort, organization, or good conduct. Instead the grades reflected the level of proficiency students demonstrated towards learning targets in their classes.

Because teachers were used to grading in a more traditional fashion, teachers needed to be supported in changing their practices. According to one of the teacher leaders:

Your whole practice has to shift--the way that you teach and the way that you have class has to change, too, to align. One of our PDs has focused on performance-based grading. Change is hard…A heart change, an attitude change.”

In facilitating this transition, the administration supported the development of mini-courses on backwards planning led by master teachers to help teachers to achieve this new goal. Lessons were reverse-engineered and students were given a better sense of outcome expectations from the beginning of each unit. The time-to-learn became more flexible and students could re-take assessments if they fell short of the benchmarks. This change led to an increase in students passing their classes by about 15%.

4.7.2.10. Inclusion model
Another significant change in the approach to teaching at USA had its genesis in a large grant to reinvent the delivery of special education services. At USA, the needs of students with special needs and English Language Learners were primarily met within the classroom. Moving to a comprehensive co-teaching model, mathematics and humanities classes in the ninth grade at the time of our visit had at least two teachers always in the classroom. Co-teachers had a daily common planning period where they could collaborate.

This transition also represented a significant challenge, especially for some of the more seasoned teachers who had not experienced the necessity of differentiating their instruction. These senior teachers were often quite skilled in their content, but needed to both understand the needs of different learners, and then be willing to adjust their teaching practices to accommodate them. One administrator described a struggling teacher as,

*if they are not buying into supporting those things of a school [decisions made on instructional approaches] or working with their team, or developing their understanding or even getting feedback and not really doing anything with it, it kind of leaves you with no other choice [but to force teachers to comply through evaluation].*

### 4.7.2.11. General Teacher Culture

One teacher described the teacher culture at USA as “different” where teachers who entered the school with high ideals were able to act on them and see them to fruition, where they had a sense of common mission and willingness, even a delight, in working together to effect positive change. Teachers contributed as department leaders, science fair coordinators, and other roles, for example, engaging with students in informal activities such as marathon training. One teacher commented, “Everyone has something extra that they do in addition to classroom duties. It’s not something that we’re required to do, but I think that sets us apart.” Another teacher added, “I can’t think of a teacher who doesn’t have another project that they contribute to the school [beyond disciplinary coursework]; we all are invested in this school working.”

Teachers described a working environment that supported the building of a broader community through both formal and informal channels. “Every Friday four teachers are assigned to bring in breakfast – and then I get to see other teachers that I don’t get to see often.” During the workdays in the summer, “there is a sense of community” as teachers work together to plan for the upcoming year. “We actually like each other and spend a lot of time outside of work with each other. All of the teachers I work with are smart and have a ton of personality.”

One staff member described the school culture in these terms:

*The culture we envisioned, in some ways created – I don’t think we even had this vision in mind when we started really – has been one of just people who are professionals who are trying to do their best as a group. People are really trying to work together in authentic ways and I think that’s all we can ask.*

Teachers reported finding it both easier and harder to teach at USA than a typical high school: easier because of the common mission accepted by all, yet more difficult because of the high
expectations. In a school where less is expected of the students and the bar is lower, it’s easier to meet that goal. At USA, where the standard is high and every student is expected to succeed, teachers work tirelessly to meet that goal. One teacher’s comment that best illustrated this was,

*if you’re teaching for all the right reasons, then you are glad to be here. I am exhausted and I would much more have that than having the kids just doing ok. I joke that you are going to have to drag me out of here.*

From the Assistant Headmasters’ perspective, “*the genesis was a very small school to begin with, with maybe 35 instructors*” where teachers worked in a culture of contagious enthusiasm. Teachers were not required to take on extra responsibilities, although it was encouraged, and that was part of what drove the success of this school. “*Everyone wants to play on that tightly knit team. If this works for them they stay, if they don’t they move on.*” “*We have a critical mass of really good teachers who just work their butts off, and its’ really contagious.*”

One teacher described: “*We have a lot of good teacher leaders; if you walk into our meetings you see a lot of good teachers. Everyone is working on something. The focus and the goals, and follow-up are pretty clear.*”

Teachers who participated in focus groups or observation interviews affirmed that working at USA and doing a good job is hard work: they arrive early, stay late, and work weekends to ensure that they are meeting their students’ needs. However, as noted in the section on hiring and shaping the teaching staff, some teachers did not buy into the USA culture and this was the focus of the administrators in shaping the teaching staff.

Parents we interviewed expressed their appreciation for the teachers including their personalized attention to the needs of each student. As noted in the section on early college coursework, teachers played a strong role encouraging students to take on AP coursework and supporting students individually: “*Where she [daughter] was struggling, the teacher was incredibly supportive and he found her strengths and weaknesses. He found a way for her to absorb the material.*”

### 4.7.3. Summary

There were two cultures of teachers at USA, one where teachers were hired to fit a specific mold and the school culture envisioned by the school administrators, and another where teachers did not buy into the USA model but were placed there because of union hiring rules. To carry out their vision for USA as an innovative model school, administrators used an evaluation system to retain high quality teachers and support struggling teachers. The fact that the administrators were able to work proactively on this challenge deserves merit. The teachers at USA were well qualified, certified to teach their subject areas. STEM teachers all held undergraduate degrees in their subject areas and 80% held masters degrees. A majority of the STEM teachers had taken a a STEM-content or STEM-teaching related course within the past three years. Most had also participated in a STEM-related workshop within the past 3 years. BPS required 18 hours of professional development annually of which 6 hours were professional development developed by the Instructional Leaders at USA to target their specific needs, such as supporting teachers in
shifting to a performance-based grading system and reverse-engineering their curricula. Perhaps as a result of this strong support for professional development, 95% of the STEM teachers reported that they were confident in their ability to teach using investigative strategies and hands-on, project-based work; and that they recognized and responded to student diversity. Most of the teacher professional development at USA was led by fellow teacher Instructional Leaders who planned and implemented the professional development at the school. Teachers also collaborated with each other to align curriculum and co-teach in the 9th and 10th grades. The teachers were generally positive about the amount of time they had for planning and preparation of lessons as well as time available for professional development and collaborating with other teachers. They were also generally satisfied with technological access and support, although maintenance of technology was noted as a problem by a few teachers.

4.8. INCLUSIVE STEM-FOCUSED MISSION (CC8)

The school’s stated goals are to prepare students for STEM, with emphasis on recruiting students from underrepresented groups.

4.8.1. Design

USA’s Mission Statement, found on its website, described the school as a “small high school with an engaging science and technology curriculum designed to prepare students to excel in college and beyond.” BPS purposively had small to medium-sized high schools, and USA served about 550 students, more than BPS pilot schools in the district that had only 200 to 300 students, but smaller than a large comprehensive high school in BPS that might have 1,000 students.

USA prepared students for college and careers by offering a curriculum intended to engage students. There was an emphasis on making academic content relevant to students, and USA operationalized that across grades levels 9-12 with the theme “What is our place in the world?” -- an essential question built into the founding document for the school. The Guidance Counselor commented that, “When you make it relevant to the kids, the kids see that is doable. I think our teachers do a really good job of making science relevant to kids.” The Assistant Headmaster stated that, “It’s a goal where I would say close to 100% of our graduating seniors have a tangible post-secondary plan, college acceptance or locked in with money.”

The Core Values at USA were prominently displayed throughout the school: high expectations, high support, collaboration, commitment, respect, community. On its website, USA published its high expectations for its student body: “USA expects all students to achieve at the highest levels and to fully participate in our diverse community of learners.”

4.8.2 Implementation

There are two aspects to this critical component: inclusivity and STEM-focus. Their implementation at USA is described in this subsection.

4.8.2.1 Inclusivity

At the time of our visit, USA could be considered an inclusive STEM high school because the school served an ethnically diverse student population of about 576 students: about 51% African
American, 39% Hispanic, 7% White, 1% Asian, and 1% Multi-racial non-Hispanic. This compared to Boston Public Schools’ overall population of about 55,000 students of whom about 36% are African American, 40% Hispanic, 13% White, 9% Asian, and 2% Multi-racial. USA’s student body mirrored the school district’s in terms of socioeconomic status, with approximately 75% identified as economically disadvantaged compared to a district rate of 72%. Approximately 22% of USA students received special education services as compared to 19% in the district overall. USA also has a large number of students identified as Limited English Proficient, approximately 10% of their students. BPS had a larger percentage of students who were thus classified, 31%, but this was across PK-12 and such a comparison is not valid given the fact that students who had been enrolled in U.S. public schools for a few years would have been reclassified as English proficient before high school.

Parents and students agreed that, from their perspectives, USA was an inclusive school. One parent whose son had a learning disability reported that he transitioned well from small classes in 9th/10th grades (about 10 students) to larger classes (15-20 students) and his grades had stayed the same. An upper level student reported, “It’s definitely not like ‘you can’t come in because of this, this, and that.’ This school is really good at including everyone in everything.”

As an open enrollment public high school, any BPS student could apply to USA regardless of prior academic achievement. Students of all academic abilities applied to attend USA, unlike the elite exam schools and themed pilot schools, which were limited to students who had exhibited high academic achievement in middle school. Students in BPS rank ordered their preferences when applying for high schools. In USA’s early years, most students came to the school via assignment (i.e., not an active choice by the families). According to the Assistant Headmaster, “Now USA is at a point where families are choosing this school because of its success and the publicity associated with it. Many younger siblings of alumni have started attending the school.” As a result of USA’s success, fewer students had been placed there by assignment; most students chose to attend. While there was (typically?) a waiting list of about 25 to 50 students at the beginning of the school year, these students were generally able to enroll by the October timeframe. This is when slots become available based on actual enrollment data.

4.8.2.2. STEM Focus

In 2009, USA, in partnership with JFY NetWorks, expanded the Accuplacer college preparation initiative,

*infusing it into the curriculum so that when students get to college, they take either college preparatory courses from the get go. Or, if they need developmental courses, instead of needing 4 semesters of developmental math, they only need 1 or 2. And so, that is something that we are working to expand on.*

The college-going rate for USA seniors had increased steadily over the years; as of 2013, approximately 90% of graduates planned to go to a 2 or 4-year college, according to the Assistant Headmaster.
Students were strongly encouraged by USA to take AP level coursework for the experience of rigor, as described in the section titled Early College-level Coursework (CC6). According to the Assistant Headmaster,

*We want all kids to take an AP class. About half of them do. Just having the college level rigor, regardless of how they do on the AP exam, it is about having them have the college course experience. They do the summer bridge work and are enrolled in the classes. We are in our 4th or 5th year. We want more kids to pass the exams, but that is the next step.*

Because of a $50,000 grant, USA had been able to lead an aggressive AP expansion, and had increased its AP offerings from one to seven AP courses including two humanities as well as five science and mathematics (see CC6 Early College-level Coursework for more detail about AP course offerings).

Students at USA were supported and encouraged to take AP courses. The co-taught courses with small student-to-teacher ratios in all classes in 9th and 10th grades better prepared students for more rigorous coursework in the 11th and 12th grades. The Assistant Headmaster explained this impact on better academic support and raising rigor expectations: "*Teachers like the model because they can better respond to students. Students increase their own investment, and then teachers can raise the expectations for their own students.*"

USA had a focus on science, and as they gained a reputation for producing stronger student outcomes, more students were applying. Some, if not most, of the students were applying to the school for an enriched science education. Two students reported in a focus group of upperclassmen that they had chosen USA for its science focus since they were interested in careers in science and thought USA would be a good fit. The USA Guidance Counselor stated, "*The fact is we do stress science. The science teachers here, the whole faculty really, is really fantastic. The science teachers in addition really work hard in exposing our kids to careers.*" The Guidance Counselor estimated that about 40 kids out of 141 seniors seemed likely to pursue a STEM major in college. Although USA was well known for its focus on science, the rationale for teaching science lay in the life-long skills that the subject offered, such as problem solving and creative thinking. A teacher commented:

*I never think of us as a STEM school. One thing we try to do is try to increase student access to higher order thinking: problem solving, being creative. ...Yes, our name is USA, yes we have science electives, but I don’t see my role in teaching geometry is any different. We have the same challenges as other urban high schools. We have a higher percentage of kids who want to be engineers and doctors based on our name, but that’s it.*

### 4.8.3. Summary

USA served an ethnically diverse student body selected through a BPS process of students rank-ordering their top five choices. It was not restricted to students who had previously demonstrated high academic achievement. There were a large number of special education students who had access to resource rooms, but most were integrated into regular classes and supported in transitioning to more rigorous coursework through the co-teaching model in the first two years.
USA was recognized as a school that focused on science specifically and academic achievement as a whole, and had shown strong improvement in student outcomes in the first five years. The mission of the school was to prepare and inspire students to go to college and beyond by engaging students in learning through an inquiry-based curriculum infused with the essential question, “What is our place in the world?” Additionally, the mission was put into action through the variety of offerings of AP courses, including five in mathematics and science, with all students encouraged to take at least one. Teacher support, including the availability of two teachers in 9th and 10th grade classes, mentoring students about AP courses, and teaching bridge programs in the summer, was an important facet of implementing a rigorous STEM-focused curriculum, particularly for students who might have entered USA not well prepared for college-level work.

4.9. ADMINISTRATIVE STRUCTURE (CC9)

The administrative structure varies (e.g., magnet school, charter school, school-within-a-school), how the school was founded and changed over time, administrative organization and staffing, and funding structures.

4.9.1. Design
This subsection is organized to first describe the school structure and how it came to be; then to describe how it was aligned with the district, BPS, of which it was a part; and finally to describe the administrative organization and staffing at USA.

4.9.1.1. School Structure
USA opened in 2005, after BPS received a multi-million dollar grant from the Gates Foundation to address low student performance. BPS used this grant funding to close four large comprehensive high schools and establish small, theme-based high schools. The intent was to have smaller schools where students could get more attention and achieve more. The West Roxbury Educational Complex was converted into four small theme-based magnet schools (300 students or less) that shared common areas such as the gym, pool, and library. USA was designed as a magnet school, specifically, an urban science-themed high school. The design capitalized on natural resources adjacent to its location coupled with the proximity of an urban ecology institute of a private college. At the time of the visit in 2013, the four small themed-schools co-located at a former comprehensive school campus in West Roxbury had been condensed into two themed schools. The health science themed-school had been merged into USA. USA shared the library, gym, pool, and cafeteria with a business-themed school that had been formed by combining the other two small schools at the site. Classroom wings were separate with no cross-over. The library technology and librarian were funded by BPS, and the library was shared by both schools at this site. Thus, the four small high schools had been converted from small schools to medium-sized schools by doubling the size of the student bodies.

4.9.1.2. USA as a BPS School
USA, as a public high school in the Boston Public School district (BPS), was subject to BPS policies including those related to teacher hiring, professional development, and work environment. USA relied on the district for its funding.

4.9.1.3. School Administration
The leadership team was comprised of the Headmaster and two Assistant Headmasters. The headmaster was mainly responsible for administrative, fiscal, and policy interactions with BPS. USA also had three Deans who managed discipline, which was not unusual for BPS, a large urban school district. USA also had a Family and Community Engagement Specialist who had two roles: to facilitate communication with students and parents so they had a voice in school activities; and to conduct outreach to business and industry partners, including for academic experiences and extra funding resources for initiatives such as paying for all students to take AP exams. In addition, USA had its own dedicated technology support for its teachers and students. Two technology specialists taught two technology classes during the school day, and students from those classes could also request to participate in additional hours during the school day under their supervision, to respond to teacher requests for computer support or work on the school’s website. As already noted, the librarian and library technology were funded by BPS since the library was shared with the co-located other stand-alone magnet school.

4.9.2. Implementation of Administrative Functions
The implementation of the administrative structure design emphasized family and community outreach, providing a safe learning environment, and maintaining a qualified teaching staff.

4.9.2.1. Family and Community Outreach
USA emphasized family and community outreach. The Family and Community Engagement Specialist described the USA approach focused on working closely with parents, students, and partners:

USA welcomes families and knows the importance of families being involved; it is important to the Headmaster to have parents at the table. It includes both academic partnerships and social-emotional partnerships. The idea is not to always be in the position of speaking for parents, but to encourage parents to learn how to do that for themselves and learn how to be active in their child’s education and know that it’s important for them to do that. I help connect them with a lot of resources to do that—school parent council, “parent university” which consists of three events that provide workshops for parents in various supports they need, such as individual education plans, getting in touch with the school and understanding acronyms, college workshops. We even have workshops around depression, supporting students. We also do satellite sessions throughout the years for parents.

4.9.2.2. Providing a Safe Learning Environment
It was critically important to administrators, teachers, and students at USA that all students would experience a safe and supportive learning environment. In order to achieve this goal, USA employed three Deans to keep the school safe and to ensure students were where they were supposed to be. A Special Education teacher described the Deans’ relationships with the students:
The students who are getting in trouble, they really like these people [the deans]. They need that tough love. Most of the students in time respond. And we empower the kids—that is a big difference from other schools—we are going to show you how it is supposed to be.

4.9.2.3. Maintaining a Qualified Teaching Staff

The state of Massachusetts is a union state, and the teacher union had a major impact on the school’s administrative functions related to teacher hiring, evaluation, and working conditions. The Headmaster did not have autonomy in hiring staff, especially from outside the BPS system, due to contract provisions. Adhering to the union contract had major implications when BPS merged another co-located magnet high school with USA. The USA leadership team observed teachers from both schools before the merger, and interviewed them for the open positions. The leadership team was committed to ensuring that these teachers were fully informed of the curriculum and instructional strategies and sought to ensure that teachers embraced those strategies. During the recession precipitated by the 2008 fiscal crisis, urban school districts were particularly hard hit, resulting in extensive layoffs of teaching staff. Because BPS had a unionized teaching staff, filling vacant positions was subject to the seniority provisions of the union contract. According to the leadership team, this, coupled with low teacher turnover, impacted USA’s ability to recruit highly qualified STEM teachers who were amenable to USA’s academic approach, including team teaching.

4.9.3. Summary

USA was an urban science-themed magnet school in the BPS system and received its funding from BPS. The administrative staff included a Headmaster, two Assistant Headmasters, three deans responsible for student behavior, and a Family and Community Engagement Specialist. There were also two technology specialists who taught classes and maintained the school’s technology, including the infrastructure and classroom technology. Two factors had major impacts on the administrative structure: the merger with a similarly sized magnet school which doubled the student body, and the requirements of the Boston Teachers Union, which played a large role in the conditions under which teachers were hired and worked. Despite these challenges, USA had been able to successfully implement the co-teaching model and develop a collaborative curriculum planning model after the merger, as described in the section titled Well-Prepared Teaching Staff (CC7).

4.10. SUPPORTS FOR STUDENTS UNDER-REPRESENTED IN STEM FIELDS (CC10)

Supports such as bridge programs, tutoring programs, extended school day, extended school year, or looping exist to strengthen student transitions to STEM careers. Altered, improved opportunity structures, i.e., students are positioned for STEM college majors, careers, and jobs.

4.10.1. Design

Urban Science Academy capitalized on its small school culture to support students from groups underrepresented in STEM college majors and careers. It served a student body of almost 600 students in which 75% were low income, 51% African American, and 30% Hispanic. Thus, the
majority of their students were from such groups. The design and implementation of supports for both learning rigorous content and going to college are included in this section.

4.10.1.1. Learning Supports
Afterschool on Mondays, Wednesdays, and Thursdays from 2:00-3:30pm, students could meet with teachers for academic tutoring. Students were required to be in a class working with a teacher. During this time, students could get tutoring, extra help, or could be doing homework. Most teachers volunteered at least once per week to be in the afterschool program as part of their supervision time. If a teacher was not able to make it, they typically found a colleague within that content area to stay with the students.

Summer bridge programs were built into the design of AP courses to prepare students for specific AP courses. These summer bridge programs were required for enrollment in these specific AP courses.

Co-teaching was also a learning support that was part of USA’s design. The school received a $100,000 grant to support special education, and when developing this program, USA staff members visited schools across the state to look for innovative ideas for a comprehensive co-teaching model before putting its current model in place. The Assistant Headmaster explained why they chose the co-teaching model:

*I think the co-teacher model really supports all kids—particularly those with special needs and the kids come up through that and when they get to a certain point they need less support or at least we are trying to wean them from that support so that they can manage themselves in the real world.*

4.10.1.2. College-Going Supports
USA had a partnership with JFY Network to provide a program of individualized assessment and instruction designed to help students pass the College Board Accuplacer tests and enter college at the credit-earning level without having to take non-credit developmental courses.

USA also had grade level programs such as assemblies with speakers from different career fields, field trips to colleges, and college application support. To inspire and position students receiving B-C grades, USA offered the College Board AVID program (Advancement Via Individual Determination) designed to support students by strengthening their self-efficacy of learning, developing academic habits of mind, which encouraged student pursuit of post-graduate studies.

4.10.1.3 Parent Support.
The school effectively communicated with parents through a parent council, parent portal, and the Family and Community Engagement Specialist. The school was required to set up a Parent Council as part of its school structure. USA held special events such as Parent Nights to educate parents about the college admissions process including the FAFSA required to receive financial aid for college.
4.10.2. Implementation

Broadly, USA provided support for their students through developing relationships with students and parents and reaching out and engaging with community partners in order to help students develop the knowledge and skills to self-advocate. The staff and other students at USA worked to create a college-going culture that incoming students “buy-into” during their ninth grade year.

4.10.2.1. Self-advocacy

Students at Urban Science Academy were taught by the staff to advocate for themselves. This building of self-advocacy skills was seen by the staff at USA as a crucial skill to managing oneself and attaining success in high school and beyond. Evidence of the drive to help students be self-advocates could be seen in quotes across many stakeholders at USA. According to an Assistant Headmaster, “Everyone has a voice and I think we promote that and the teachers promote it.” According to a Special Education Teacher, “They practice that skill [self-advocacy]. I ask at first if they want me to go and talk to the teacher with them, but little by little they are expected to be more independent.” According to the Family and Community Engagement Specialist,

“We work with the ninth and tenth graders, but as they progress we cut the cord and there isn’t as much hand holding. It’s a process. They resist that a lot. In the end, they’re thankful for it. The teachers really incorporate that into the curriculum. I think the fact that we have co-teaching at the grade 9 and grade 10 levels is a really big help. Those are new kids: the 9th graders are coming from middle school and the 10th graders just finished their first year of high school. They often deal with transitional issues. I think having those classes at those two grade levels being co-taught makes a huge different in how our kids succeed.

4.10.2.2. Student Buy-in

Teachers and administrators reported that one of the reasons students were so successful at USA was due to the fact that students buy-in to the college-going culture of the school. This was due to the value that USA staff placed on students to be college and career ready, teachers caring and supporting their students, and students buying into this culture. The school staff was heavily invested into getting the students college ready, with preparation beginning in ninth grade. The Assistant Headmaster reported, “It starts in grade nine. We have weekly check-ins with the ninth graders and they look back at their eighth grade transcripts and decipher that and already know what their GPA is and what that means and how that affects them.” Another Assistant Headmaster at USA explained the level of teacher buy-in, “It’s a goal where almost, I would say close to, 100% of our graduating seniors have a tangible post-secondary plan, college acceptance or locked in with money.” The Family and Community Engagement Specialist spoke from her own experience when she was a student,

“For myself, I was a part of many of these programs and understand the support they provide. With my parents having now gone to college, I had a variety of supports, so I understand why it is important for them to get these different supports and to understand what they need and encourage them.

4.10.2.3. Grade Level Support
Support structures were in place at every grade level to help students stay on track to graduate and go to college. A file was on record of each student called their “roadmap”. A student’s “roadmap” was each student’s record and personal guide of activities they needed to complete before the end of high school. This “roadmap” followed students every year through high school and the activities got more involved as students progressed through each grade. This roadmap helped to guide students through their personal journey of high school and into a college or career.

Students received additional supports through their advisory period, a speaker series, and their academic classes. In ninth grade, during the students’ advisory period, they analyzed their eighth grade transcripts to determine their GPA. During this exercise, their advisory teachers would discuss the purpose of their GPA and how it affected them.

In tenth grade advisory, students attended workshops to develop resume writing and interviewing skills in conjunction with the Private Industry Council. The Headmaster explained, “We literally sit kids down and do the SAT registration with them. And literally drag them to the guy that does the financial aid stuff. Everyone does the common application.” They also attended a series of speakers on various careers and took field trips to colleges during tenth grade advisory. The students in eleventh grade advisory continued with workshops that became developmentally more challenging, and in twelfth grade, students worked on a tangible post-graduation plan. Also as part of the Humanities IV curriculum, the twelfth graders wrote a college essay early in the year.

As noted in the section on the Well-Prepared Teaching Staff (CC7), the teachers at USA had articulated common skills that they felt were important across grade levels. In addition they had developed a common language for learning as they taught students across all grade levels basic skills, such as designing experiments and writing lab reports and hypotheses. The result was that by senior year, teachers did not have to teach use of such basic skills.

4.10.2.4. Guidance Support
The Guidance department at Urban Science Academy connected with many of the community partners and coordinated an array of programs to help students, both academically and socially. This support was further strengthened through the hiring of six graduate interns to help coordinate, manage, and implement many of the programs at the school. The Headmaster explained, “The interns get real life experience because we need them. They really do some awesome things.” A USA Special Education Teacher confirmed the high level of graduate student, guidance intern involvement: “These young energetic people do things like start a homework club. Teachers are making it mandatory [for USA students] to attend at least one day of homework help.”

In addition to the guidance interns, USA supported its students through a Good to Go Group, funded by a grant through Race to the Top, which focused on peer mentoring. In the Good to Go Group, 18 seniors visited 9th and 10th graders and talked about their journey to becoming a senior. The idea behind the Good to Go Group was that senior students would work with younger students with the goal of being a role model to 9th and 10th grade students.
4.10.2.5. AP/College Support – Bridge Programs
The Bridge Programs for particular AP courses were usually structured as intensive two-week summer courses focused on giving students additional knowledge and skills to be successful in certain AP courses. These programs were typically offered in the last week of June and the last week of August. The bridge programs occurred at University of Massachusetts at Boston using their facilities. The summer bridge programs were initiated because USA started the school year after Labor Day, and in contrast to other states where students may start classes a month earlier, this put BPS students behind in the academic school year for preparation for the AP exams. The Assistant Headmaster reported that USA students appreciated the Bridge Programs and felt pride in being part of it.

Despite bridge programs at USA having been effective and well-received, funding constraints have been shortening these bridge programs in the recent years. In 2009, USA got a $50,000 grant from College Board to expand AP offerings from one course to seven course offerings. USA also cobbled together grant funding to pay for all of the AP exam fees for students. USA administrators realized that not all students were going to get a high enough score on the AP exam to get college credit, but at the very least the USA students were getting the experience of taking the AP exam. During the school visit, the administration announced that they had lost another funding source and were considering options to pay for the exams.

4.10.2.6. Classroom Supports
Urban Science Academy implemented a unique co-teaching model in the 9th and 10th grades that helps to support their ninth and tenth grade students as they learn to self-advocate and become more independent. The philosophy of the school is to support students more heavily in the earlier grade levels to develop self-advocacy and independence. As students graduate into the 11th and 12th grades, the philosophy is that these students are more independent and need less support.

Students enrolled in the special education department were also supported through the co-teaching model as they and the Special Education Teachers were “pushed into” general education classrooms. However, there were still resource rooms with study skills classes for special education students.

Another Assistant Headmaster explained how the teachers accepted the co-teaching model, “I think the piece that helped shift the culture [to teacher collaboration] was when we transitioned into a co-teaching model and restructured the schedule so that there could be common planning time.”

A mathematics teacher who was involved in the co-teaching model explained her role: My job is to help students with the skills they lack. My job is sometimes after school, to pull them out, identify, and give them the extra skills they need so they don’t fall behind in class. This is one of the benefits of co-teaching because you can help students and give them the skills they lack.
A Special Education Teacher at USA explained how this model was different from most high schools in Boston, “This school is not typical for Boston Public Schools. In most schools, you have math class and everyone in that small group, they have an IEP. USA does a very good job of putting the appropriate supports in place.”

Some students that were in the B-C grade range were supported through an AVID (Advancement Via Individual Determination) class to help develop college readiness skills. AVID is a college readiness program through College Board, offered for students in grades 9-12. The rationale for AVID is that students in the “middle” often are overlooked in favor of gifted or special education students, and by supporting students who attain grades of Bs and Cs, they are more likely to attend college.

After school supports offered by USA included a free SAT preparation class, MCAS review sessions, which began 8 weeks before the test and was offered twice a week, and after school academic tutoring from teachers as well as a variety of other clubs and sport teams.

4.10.2.7. Partnership Supports
Urban Science Academy had many partners (see the dedicated section on Partnerships, CC5). Two partnerships that specifically supported the development of students from groups underrepresented in STEM were through JFY NetWorks and Technology Goes Home. The programs offered by High Square Task Force, Let’s Get Ready, YMCA, YWCA, Boy’s and Girls Club, and Bottom Line all helped support children of BPS become college ready, and USA students were eligible for these programs.

Urban Science Academy partnered with JFY NetWorks, a school-based blended-learning program, as part of their college readiness initiative. JFY NetWorks was a program of individualized assessment and instruction designed to help students pass the College Board Accuplacer tests and enter college at the credit-earning level without having to take non-credit developmental courses. A representative from JFY NetWorks explained the need for the Accuplacer Program at USA,

*Developmental courses increase the length of time that students have to stay in college; they increase the cost of going to college. Students that place into them statistically do not graduate or earn a degree. It was not enough for their students to get into college. They want their students to graduate from college.*

Technology Goes Home is a nonprofit program offered through the Boston city government. The program is both school based and community based. The families take a class to learn to use Microsoft word, create an email account, create a financial account, learn about safety, and learn how to research information. Families can get a netbook (in 2013 it will be an iPad) for $50 and the families can also get reduced internet for $10 a month. Any low-income families qualify, but if they don’t qualify on that characteristic, people with children in Boston schools get at least a substantial discount. For families where English is not spoken, members get a free copy of Rosetta Stone for English if they take the class. The representative from Technology Goes Home explained the impact of the program on families from USA,
It’s really exciting to see how people’s skills change from the beginning of the program to the end. We taught one of the seniors from Urban Science Academy how to use online banking, and the parent, and he and his mom set him up with an account for when he goes off to college. They also spent time using the online application, one called Mint, that he will use when he’s away at college.

4.10.2.8. Supports for Parents
Urban Science Academy helped to support the parents of their students. They saw their parents as an integral part of the education of their students. The school effectively communicated with parents through an online parent portal, and the Family and Community Engagement Specialist. The school also educated parents about the college admissions process through events like Parent Night. In addition, the school was required to set up a Parent Council as part of its school structure. The Parent Council consisted of parents of USA students and was self-governing. The headmaster did not normally attend the monthly meetings, but there was a liaison on-site that informed the headmaster of pertinent information that came from the meetings. Priorities of the parent council shifted from year to year and ranged from fundraising to networking to setting up car pools.

Another support for parents was through the Parent Portal which was part of an electronic software package utilized throughout Boston Public Schools called APSEN. Using this portal, parents had access to their child’s grades, and teachers and parents were able to communicate with each other regarding the academic progress of a student. When parents needed to meet with their child’s teacher, parents knew to contact the Family and Community Engagement specialist, another supporter for parents who organized rally meetings so that parents could come in and meet with one teacher or the entire team of teachers that a student had over the course of the day. USA organized this type of event so that parents could meet with all the teachers of their child at one time instead of just one teacher in one class, which was time consuming especially for parents who worked during school hours. The Assistant Headmaster explained the rationale for the rally meetings, “It is [collaborative], let’s all get together since you are here now and try to meet and problem-solve so that we can support your child the best we can.”

USA also hosted a parent event called FAFSA Night, FAFSA being the application for financial support for college. This event brought the parents on board with the college-going culture of the school. Many of the students of USA were first generation college-bound students, and parents were often unfamiliar with the process of applying for college funding. An important part of the college application process was including the parents in the process, as many were intimidated by this process as it was new to them and they were afraid of how much college will cost.

4.10.2.9. Challenges
At the time of our visit in spring of 2013, USA was experiencing several challenges in supporting their underrepresented students: limited funding resources, transportation issues which caused absenteeism, and the implementation of a new homework policy that students were still adjusting to. As noted in the section titled Administrative Structure (CC9), BPS has had to forgo the originally small school structure by merging two schools to consolidate budgets.
Sustaining funding for programs was a growing issue for USA and at the time of our visit, the school had just lost funding for the AP tests.

The school’s geographic location outside the city was also a challenge for many students to arrive on time to school and resulted in high rates of absenteeism within the school. The school was not near the city center, and as a result, most students had over an hour commute because most students lived near the center of the city. Most students took a city bus to one of the main subway stations and there were school buses that picked up the students from the main subway stations and brought them to the school for a very early arrival time at 6:50AM. Every student that did not live within walking distance or receive special needs door-to-door transportation, received a T-Pass that paid their MBTA fare (subway and bus). If a student missed a bus, they could get a there via a MBTA bus, but that took a minimum of 1.5 hours. Because transportation was not well-synced with the school schedule, absenteeism was a big issue at Urban Science Academy, particularly in first period classes. A teacher explained the effect that transportation had on absenteeism,

*If you look at teachers and classes, most struggle with their block A [first class period] more than any other class in terms of their grades and it is a clear indication that attendance is a huge issue with understanding the material because if they are not there or late, they miss a lot.*

Some teachers had started using Edmodo to help combat some of the effects of absenteeism. A teacher explains why they are using this electronic format to help students attend first period remotely or at a later date, “I am not saying attendance is irrelevant, but if technology was on our side, if students has access all the time, missing 3 or 4 classes wouldn’t be an issue if they could catch up or catch onto a subject they missed.”

In addition to the funding and transportation challenges, the new homework policy that encouraged mastery learning continued to pose challenges to USA. Teachers had to adapt to the new system that allowed only performance evaluation, which was a paradigm and pedagogical shift, and students had to learn over time that although homework was not graded, it was necessary for success on the performance assessments. The Assistant Headmaster explained the impact of this policy, “Currently the way it is set up, the kids think that homework doesn’t count. [We want to] send the message that learning doesn’t have to take place in a fixed amount of time and that the important thing is that learning is taking place.”

4.10.3. Summary
Urban Science Academy capitalized on its small school culture to support underrepresented students through developing relationships with students and parents and reaching out and engaging with community partners in order to help students develop the knowledge and skills to self-advocate. Entering students were expected to buy into the school college preparatory culture and this was facilitated through a variety of school supports including: grade level supports, guidance department supports, classroom supports, and supports through local partnerships. These school supports were implemented to build the skills and knowledge necessary to navigate life after high school and prepare students for college. Additionally, there were supports for
students and their parents or guardians to guide them through the college selection and application process.

4.11. EMERGENT THEMES

The OSPrI research project began with a set of 10 critical components (See Table 1) that a review of the literature suggested would be found in ISHSs and that would likely contribute to their success as productive, inclusive STEM-focused high schools. These components would help build opportunity structures that, when purposefully designed and implemented, would contribute to students’ success in STEM. However, the OSPrI research team did not expect that the list of 10 hypothesized critical components was likely to be exhaustive, nor was every component likely to be “critical” in every school studied.

With this in mind, when we analyzed our data from USA, we also looked for themes that stood out as important to understanding the workings of the school, but that were not necessarily included in the initial set of critical components. We identified two themes as emergent at USA: school culture and data-driven decision making. Each will be described below in terms of their prominence.

4.11.1. School Culture

Hinde (n.d.) notes that school culture can positively or negatively influence all aspects of a school. A positive school culture provides an encouraging and supportive place where students and staff like to be. Peterson and Deal (1998) noted that positive school culture includes norms of collegiality, improvement and hard work, and a shared sense of purpose. There are rituals and traditions that celebrate student accomplishment, teacher innovation and parental commitment. An informal network of storytellers and heroes provide a social web of information, support, and history, and a shared ethos of caring, concern, and commitment to helping students learn. In a recent study that contrasts characteristics of effective high schools, Rutledge, Cohen-Vogel, and Osborne-Lampkin (2012) found that effective high schools take part in a strong culture of learning and professional behavior. There is a shared focus on high expectations for students and emphasis on students’ academic needs among all of the staff. Students internalize these cultural values and take responsibility for their learning, working together toward clear learning goals. Further, effective cultures of learning are collaborative, with individuals across organizational levels working together to meet the school mission.

4.11.1.1. Design

There is an overlap between the “school culture” emergent theme and other critical components. However, this emergent theme is about the larger picture of USA’s unique culture, the driving and empowering force for the positive school climate.

The data suggested that the design behind the school culture within USA started when the school was still a small school when it first opened in 2005. A teacher said, “The genesis [of the strength of the school] was a very small school with maybe thirty-five instructors.” He said, “Everyone wanted to play on that tightly knit team” and added, “The people who are not here any longer, maybe for some reason, may not have wanted to make the investment.” What the
teacher was describing was an initial dichotomy between teachers that bought into the mission of the school and those that did not. An administrator supported this sentiment and pointed to the high teacher attrition rate that USA had in the first two years after it opened. However, by the third year of its existence, USA had turned over much of the initial staff that did not buy into the culture of the school which gave them an opportunity to hire people that would buy into the school culture. Since this time, USA has used a system of evaluation to maintain consistency in the implementation of the culture of the school.

In addition to the school culture that was cultivated within the school by the administration and school staff, there was also the student and family element that came from the choice of choosing to attend to USA which required a conscious choice on behalf of the parent and student to select to attend the school. It is worth noting that parents and students chose to attend a STEM-focused school with other students who had made the same decision. Parents were aware of the science-focused curriculum when choosing the school as well as the school’s past reputation for success and being a safe learning environment. One parent said, “We were considering the private sector mainly because of safety. We noticed at USA that students were free to express their individuality and there was no bullying.” For many parents it was the reputation of USA, an alternative, smaller, safer, and more nurturing environment that made USA an attractive option for many families.

4.11.1.2. Implementation

Our data suggested the implementation of the school culture emergent theme can be traced back to when the West Roxbury Education Complex was first broken down into the four individual schools. During this time, the school relied on a small staff and was looking after a small student body of around 300 students. One teacher explained,

_You either fit in and you contribute a lot and then you meet that corporate culture, of being a volunteer, willing to stay afternoons, join this club, and join this leadership committee. It’s kind of contagious. Please recognize this, not that it’s required but that it’s encouraged. The people, who are not here any longer, maybe for some reason, may not have wanted to make that investment. Everyone wants to play on that tightly knit team._

This culture of a tightly knit team when the school was much smaller, was described by the headmaster as having “a family feel” with teachers really wanting to work together.” She said, “We have teachers that lead the charge for grade level common planning time, and we can see the emails go back and forth.” But what was even more significant she added, “They make adjustments to have that meeting time because that time has become so sacred.” When we asked the administrators how this school culture of collaboration and family feel started, she said, “I think the culture that we envision and in some ways created has been one of just people who are professionals who are trying to do their best as a group.” The headmaster attributed some of the success in having had the opportunity to hire people who fit a certain mold, but did make clear that it wasn’t a single person and that it was the collaborative nature of the staff that had created this community at the school.
Since USA opened, the administrators had used a system of evaluation to drive the culture of the school. One administrator said they used this system of evaluation because some teachers “do not want to buy into your culture and give up the formal ways of past schools.” The evaluations were seen by administrators as an act of kindness to give teachers feedback to improve their practice. One administrator said:

*Feedback is kind. And when you think about these folks that in some cases haven’t really got quality feedback in some cases 5, 10, 15, 20 years and then all of a sudden they are being told you are not meeting the standard. That can be hard to take and at that point it is really hard to do a 180 and in many cases it is unfair to them, but it does speak to that notion that feedback truly is kind, both positive feedback and probably even more importantly constructive feedback.*

Since the merger there had been a large increase in teaching staff and the administrators had been very busy conducting evaluations to encourage teachers to adopt the collaborative spirit that existed before the merger. One administrator said USA was “at their peak” two years ago before the merger and they hoped to get back to where they were. To do this, administrators had used evaluations to reach that goal. One administrator said, “we spent the last year and still parts of this year trying to evaluate people because that is the only way to get things moving.” Two years after the merger, USA had continued to evaluate teachers and push for more collaboration between teachers.

**4.11.1.2.2. Sense of Community.** Outside the administrative evaluations and teacher/administrator interactions, our team also observed a professional climate between teacher and student. This interaction seemed to be one of accountability, support, and respect for each other. One teacher said, “There is a high expectation and you [students] are held accountable” and that, “students can begin to advocate for themselves because in high school there is less involvement naturally.” This self-advocacy should not be conflated with a lack of support for the student, but rather what our team observed was a teaching of independence and responsibility. A teacher at the school said,

*There is an expectation but there is also how we show you how to do it. We aren’t throwing you in the deep end and you have to learn how to swim. We will support you and you will have to work to be a proficient swimmer. The students know; you can tell when a student has been here and they know this place is different and they are glad for it.*

The staff at USA worked to empower their students and they did this mainly through setting high expectations and holding students accountable. One teacher said, “Maybe because it is the first time that an adult has held them accountable because they care. They need that tough love.” What our team observed was a real sense of mutual respect between teacher and student. Students were taught to be accountable and to self-advocate for their own interests.

In addition to the community between teacher and student, USA also actively worked to incorporate the parents into the culture of the school. USA had a Family and Community engagement specialist and she acted as the main point of contact for parents at the school. Her role served as the go-between when parents had concerns or needed someone to advocate on
their behalf. She connected parents with resources and also helped parents with the college application process. The Family and Community Engagement Specialist said,

*The idea is not to always be in the position of speaking for the parents, but to encourage parents to learn how to do that for themselves and learn how to be active in their child’s education and know that it’s important for them to do that.*

For parents this meant attending “parent university” and taking part in associated events that gave parents the information and resources they need regarding individual education plans, getting in touch with the school, and understanding school acronyms. In addition the school put on workshops on getting into college and on how to fill out college applications and financial aid forms. The Family and Community Engagement Specialist said:

*Overall, our school community reaches out, we don’t keep parents out. Sometimes parents feel that in other schools. USA welcomes families. They know the importance of families being involved.*

Parents at USA reported feeling well supported and much of this could likely be attributed to the school making a concerted effort to include parents in the education process. The position of a Family and Community Engagement Specialist gave parents a sole contact at the school to reach out to for any educational concerns or supports they needed. In addition, with regular workshops at the school to engage and educate parents in the school and college admissions process, parents were able to better support their children.

**4.11.1.3. Summary**

The school culture at USA could be observed at all levels: between administrator and teacher, teacher and student, and school and parents. The administration described utilizing an evaluation process with the purpose of driving a desired culture within the school. These evaluations provided feedback to teachers on how to improve their practice and were aimed at realizing the vision of the school.

The teachers at USA reported working with students to set high expectations and accountability standards. In addition, students were taught to self-advocate from their supportive teachers. The data our team collected suggests that these high standards coupled with the support from teachers helped to create the caring and trusting environment between student and teacher.

USA also worked extensively with parents to involve them in the education process. USA created a key contact person, the Family and Community Engagement Specialist, as a point person for parents to reach out to when they needed to contact the school. In addition, the school sponsored many workshops throughout the year. These workshops aimed to educate and empower parents to take an active role in their child’s education at USA and in preparing the family for the college application process.
4.11.2. Data Driven Decision Making
Our team observed that USA used data to affect school curriculum, school instruction, and collaboration with community partners. One student said, “One thing that makes this school what it is, is that the school is adaptive. It is able to, with problems that come up, adapt to the problem and change.” We suggest that this culture of data driven decision making at USA played an important role in the success of USA. This theme will discuss how staff and students at USA used information and data to form key decisions.

4.11.2.1. Design
The design of this emergent theme came from several sources: the partnerships that USA and BPS made with local organizations to better support their students, the innovative units where students were collecting data and making decisions, and the Massachusetts science standards that stressed inquiry teaching which drove a curriculum of data collection and subsequent analysis.

4.11.2.2. Implementation
USA used student level data to identify areas where students needed additional supports. With this data, the school created partnerships with Boston area businesses to provide supports to their students. Additionally, teachers and students used data to make informed decisions in the classroom.

4.11.2.2.1. Partnerships. USA and BPS had formed several partnerships with neighboring organizations (see Partnerships CC5) to help remedy several challenges that the school faced. The partnerships were formed based on data of specific supports students were lacking and these organizations relied on student level data to address the challenges of individual students. For example, one challenge for many students at USA was access to technology, an issue that one teacher pointed out, “is a big issue.” Many students at USA did not have access to technology or internet at home, so BPS had partnered with Technology Goes Home to address this issue. In addition to using this data to identify students who needed this extra support, math teachers had collectively decided to add additional support. One math teacher said, “We try to provide help at least one day a week after school if technology is a problem.” This is just one example of how USA used data to adapt to the needs of their students at school and through partnerships with other organizations.

In another example, USA and BPS had partnered with JFY NetWorks, an organization that specialized in providing academic remediation in mathematics for schools. The coordinator explained that through the college readiness program JFY NetWorks implemented at USA, the program:

*prepares students to take the Accuplacer assessments, which is what Massachusetts colleges use to determine whether or not students need to take developmental [math] courses. This organization gives students a math diagnostic tests that highlights particular areas of weakness and then uses that data to give students individualized learning plans and activities to shore up their math skills so that they will be ready to take credit-baring courses in college.*
4.11.2.2. **Innovative data-driven units and science standards.** When observing the students at USA, we noticed data driven decision making was also a theme that was carried down all the way to the student level. In a science teacher focus group, a teacher cited that “the curriculum in Boston Public is designed from elementary through high school to develop inquiry.” For students this translated into collecting data and making data-driven decisions in their science courses. The vision and philosophy of science for BPS states, 

*Overall, the key criterion of science is that it provide a clear, rational, and succinct account of a pattern in nature. This account must be based on data gathering and analysis and other evidence obtained through direct observations or experiments, reflect inferences that are broadly shared and communicated, and be accompanied by a model that offers a naturalistic explanation expressed in conceptual, mathematical, and/or mechanical terms.*

In addition to making data driven decisions in their science courses, this theme of data-driven decision-making is a large part of the interdisciplinary units carried out in the 10th grade. While visiting the school, one teacher was discussing an upcoming interdisciplinary unit that would explore teenage dating violence where students would be required to, “gather data and design a public service announcement.” In these projects, students would take on varying roles and gather data surrounding the problem, and present these projects to their peers. In another project, a math teacher discussed how in the 9th grade, they carried out data-driven units in their math class:

*In the beginning of the school year, we talk about data and by the end of the first term their ending project is a project on data. And what they have to do is we pick some data that they have to analyze and when I say analyze, I mean they have to find mean, median, range, mode, Q1, and they have to create a presentation on Powerpoint.*

The goal of this type of teaching was described by one math teacher as being, “*more than numbers and [that math] is also presentation, making predictions, and understanding data better.*” These types of projects gave students a context and meaning to the schoolwork they did and helped them learn how to better use data in decision making.

4.11.2.3. **Summary**

At USA, data were not only collected, but our observations suggest they were also utilized to affect curriculum, instruction, and collaboration with community partners. Our team interviewed teachers and community partners who worked with individual student data to personalize instructional supports and we met with teachers who discussed how students learned to collect and use data in innovative units. This pattern of data driven decision-making helped the school to adapt quickly to change, and aided each student in reaching his or her maximum learning potential.

5.0 **EXPLORING THE OUTCOMES DIMENSION**

Having explored the design and implementation dimensions in the above sections, the study now examines the student outcomes produced at USA. There is overall agreement that ISHSs should
improve underrepresented students’ preparation in STEM in ways that inspire and provide requisite background knowledge and skills, instilling confidence and desire to seek more STEM education, jobs, and careers (Means et al., 2008; NRC, 2004). To capture this student outcome information for USA, OSPri compiled near-term outcome data such as student demographic data, attendance rates, discipline data, and student scores on state and national assessments. The study also gathered information on longer-term outcomes such as high school cohort graduation rates, post-high school intentions, and postsecondary-related outcomes.

In order to properly contextualize USA’s student outcomes, it is important to consider the recent history and changes that the school has faced. As described in various sections this case study, USA received a $100,000 grant for the 2006-2007 school year to train their teachers in a co-teaching model. Teacher union mandates that a teacher had to agree to be a co-teacher prior to being assigned as one required significant shifts within USA’s faculty structure as a result. For example, some teachers had to shift to different grades, and others left the school altogether. By 2011, then, USA was a school of approximately 300 students with a very particular teaching staff structure.

When they merged in 2011 with another school, not only was their student body doubled to approximately 600 students, but a new group of teachers was incorporated into the teaching staff and into their particular co-teaching model. Some of these teachers integrated easily, whereas others did not, and the overall school culture and structure underwent a major shift during that 2011 school year, according to the Headmaster and Assistant Headmasters at USA. In an attempt to more comprehensively capture this context and its effects, if any, on USA’s student outcomes, 4- or 5-year trends in several categories of the data are provided to complement the most recent snapshots of outcomes.

5.1. INCLUSIVE DEMOGRAPHICS: WHO ARE THE STUDENTS THAT USA IS SERVING?

Table 6 presents the demographic data from the 2012-2013 school year for USA, the Boston public school district, and the state of Massachusetts. Additionally, the Massachusetts Department of Education (DOE) website develops a list of ten “comparable schools” for each school through its “District Analysis and Review Tools (DART)” functionality (http://profiles.doe.mass.edu). According to the website, these comparable schools are determined to be most similar to the selected school in terms of grade span served, total enrollment numbers, and percentages of the student body classified as Low Income, Special Education, and English Language Learner students. Out of the ten schools selected for USA by Massachusetts DOE, Boston Excel High School (Excel) was highlighted as the “highest performing of the other 10 schools in 2011 and 2012” (http://profiles.doe.mass.edu). As a result, data for Excel is also provided in Table 6 and throughout this outcomes section as a comparison point from a comprehensive high school to USA.

USA’s student body was predominantly African American and Hispanic, more so than at the comprehensive high school, district, or state, although Boston Public Schools overall enrolls a nearly identical percentage of Hispanic students. Looking at the special populations, USA
serves essentially the same proportions of low-income students, students with disabilities, and students with “high needs” as the comprehensive school and the district, all at relatively high proportions. However, USA does serve substantially lower proportions of English language learners than Excel and the district.

Table 6

2012-2013 Demographics Comparing USA, Comprehensive High School, District, and State

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<td>Asian (%)</td>
<td>1.4</td>
<td>19.2</td>
<td>8.6</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>Hispanic (%)</td>
<td>38.9</td>
<td>24.6</td>
<td>39.9</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>Native American (%)</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>White (%)</td>
<td>6.8</td>
<td>13.9</td>
<td>13.2</td>
<td>66.0</td>
<td></td>
</tr>
<tr>
<td>Native Hawaiian/Pacific Islander (%)</td>
<td>0.3</td>
<td>0.0</td>
<td>0.2</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Multi-Race, Non-Hispanic (%)</td>
<td>1.0</td>
<td>2.0</td>
<td>2.2</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>54.3</td>
<td>57.5</td>
<td>51.9</td>
<td>51.2</td>
<td></td>
</tr>
<tr>
<td>Female (%)</td>
<td>45.7</td>
<td>42.5</td>
<td>48.1</td>
<td>48.8</td>
<td></td>
</tr>
<tr>
<td>Low-income (%) *</td>
<td>74.8</td>
<td>72.8</td>
<td>71.7</td>
<td>37.0</td>
<td></td>
</tr>
<tr>
<td>English Language Learner (%)</td>
<td>9.4</td>
<td>24.1</td>
<td>30.7</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>Students with Disabilities (%)</td>
<td>21.9</td>
<td>25.4</td>
<td>19.2</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>High Needs (%) **</td>
<td>83.2</td>
<td>81.7</td>
<td>82.3</td>
<td>47.9</td>
<td></td>
</tr>
</tbody>
</table>

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

* “Low-income” students defined by Massachusetts as “The percent of enrollment who meet ANY ONE of the following definitions of Low-income: The student is eligible for free or reduced price lunch; or The student receives Transitional Aid to Families benefits; or The student is eligible for food stamps.” (http://profiles.doe.mass.edu/help/data.aspx)

** “High Needs” students defined by Massachusetts as “A student is high needs if he or she is designated as either low income, or ELL, or former ELL, or a student with disabilities.” (http://profiles.doe.mass.edu/help/data.aspx)

The DOE website reports on several “student indicators,” presented in Table 7. These indicators are published on a schedule that is one year later than demographics and assessment outcomes, and so the table covers 2011-2012 school year data. For that year, USA appears to have experienced high absentee rates. Their attendance rates were substantially lower than the comparison points, and the average number of days absent for their students was relatively high.
compared to the comprehensive school, district, and state. Additionally, over 66% of their students had more than 9 unexcused absences. There were also indicators of possible disciplinary issues, with a relatively high percentage of their students receiving out-of-school suspensions. It is perhaps not surprising that USA’s retention rates also superseded those of the district and state. On the other hand, USA’s dropout rates were lower than the comprehensive school and were comparable to the district rate.

**Table 7**

2011-2012 Student Indicators Comparing USA, Comprehensive High School, District, and State

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>Excel High School</th>
<th>Boston Schools</th>
<th>Public Schools</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students Served</td>
<td>576</td>
<td>635</td>
<td>55,114</td>
<td>954,773</td>
<td></td>
</tr>
<tr>
<td>Grade Levels</td>
<td>9-12</td>
<td>9-12</td>
<td>PK-12</td>
<td>PK-12</td>
<td></td>
</tr>
<tr>
<td>Grade 9-12 Dropout Rate (%)</td>
<td>8.7</td>
<td>13.3</td>
<td>7.0</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Attendance Rate (%)</td>
<td>81.5</td>
<td>87.4</td>
<td>92.3</td>
<td>94.9</td>
<td></td>
</tr>
<tr>
<td>Average # of Days Absent</td>
<td>30.8</td>
<td>19.9</td>
<td>13.0</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>In-School Suspension Rate (%)</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Out-of-School Suspension Rate (%)</td>
<td>8.3</td>
<td>0.2</td>
<td>4.0</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Retention Rate (%) *</td>
<td>14.7</td>
<td>18.0</td>
<td>5.5</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Unexcused Absences &gt; 9 (%)</td>
<td>66.1</td>
<td>41.8</td>
<td>31.2</td>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.*

* “Retention Rate” defined by Massachusetts as “The percentage of enrolled students in grades 1-12 who were repeating the grade in which they were enrolled the previous year.” (http://profiles.doe.mass.edu/help/data.aspx)

Figure 1 examines the attendance rates of USA and the comparison entities over a span of four years, 2009-2012. There was a notable decrease in attendance rates over the last four school years for USA, while the rates for the state and district remained consistent and even increased very slightly over that same period.
Figure 1

4-Year Trends in Attendance Rates Comparing USA, Comprehensive High School, District, and State

![Graph of attendance rates]

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

Figure 2 similarly displays the dropout rates for USA and the comparables across the last four years of available data, 2009-2012. While USA’s rate for 2012 was lower than in 2011, overall there is an upward trend from 2009, while the district and state remained relatively constant or even decreased slightly.
**Figure 2**
4-Year Trends in Dropout Rates Comparing USA, Comprehensive High School, District, and State

![4-Year Trends in Dropout Rates Comparing USA, Comprehensive High School, District, and State](image)

*Note.* Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

Figure 3 completes the data by showing the retention rates for USA and the comparables over the same 2009-2012 span. Consistent with the indicators described above, increasing percentages of students at USA were required to repeat their previous grade level the following year over this time period, at a time when the same rates for the district and state remained constant or decreased slightly. Overall, the four-year trends for these student data points may be an indication that USA was continuing to adjust to the effects of their school merger.
Figure 3
4-Year Trends in Retention Rates Comparing USA, Comprehensive High School, District, and State

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

5.2 ASSESSMENT SCORES: HOW ARE USA STUDENTS PROGRESSING AND ACHIEVING ACADEMICALLY?

MCAS: Background Information. The Massachusetts Comprehensive Assessment System (MCAS) is the state-mandated assessment for all public school students in Massachusetts, including students with disabilities and English Language Learner students (http://www.doe.mass.edu/mcas/overview.htm). This assessment measures student performance based on the Massachusetts Curriculum Framework learning standards, and the MCAS program is also used to hold schools and districts accountable to the Annual Yearly Progress requirements of the No Child Left Behind Act (NCLB).

The MCAS tests three subjects: English Language Arts (ELA), Mathematics, and Science and Technology/Engineering. In order to earn a high school diploma, students must pass the grade 10 tests in ELA, Mathematics, and one of the four Science and Technology/Engineering tests (Biology, Chemistry, Introductory Physics, or Technology/Engineering), in addition to fulfilling the other graduation requirements. For these grade 10 tests, student results are reported along four achievement levels: Advanced, Proficient, Needs Improvement, and Failing. Massachusetts defines the achievement levels as:
Advanced: Students at this level demonstrate a comprehensive and in-depth understanding of rigorous subject matter, and provide sophisticated solutions to complex problems.

Proficient: Students at this level demonstrate a solid understanding of challenging subject matter and solve a wide variety of problems.

Needs Improvement: Students at this level demonstrate a partial understanding of subject matter and solve some simple problems.

Failing: Students at this level demonstrate a minimal understanding of subject matter and do not solve simple problems.

(http://www.doe.mass.edu/mcas/tdd/pld/)

MCAS Student Outcomes. Figure 4 displays the Spring 2013 MCAS results for the grade 10 administration of all three subject matter assessments. The percentages represent the proportion of the students tested that “passed” by achieving at or above the “proficient” level. For the ELA and Mathematics assessments, higher percentages of USA students attained a passing level than at the comprehensive high school, and USA matched the outcomes of the district. However, it is notable than for the Science assessments, USA’s outcomes lagged behind those of the comprehensive high school, district, and state.

Figure 4
Spring 2013 MCAS Results for USA, Comprehensive High School, District, and State (Percent Proficient OR Advanced, for Grade 10 administration)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.
Some may argue that “academic excellence” reflects more than achieving at “proficient” levels, instead defining such excellence as performing at an “advanced” level, as described by the Massachusetts DOE. Figure 5 accordingly presents the percentages of students achieving specifically at the “advanced” level on the Spring 2013 MCAS administration. It is notable again that according to this indicator, USA students lagged behind the comprehensive high school, district, and state for the Science assessments, with none of their students achieving at the “advanced” level.

**Figure 5**

*Spring 2013 MCAS Results for USA, Comprehensive High School, District, and State (Percent Advanced ONLY, for Grade 10 administration)*

![Bar chart showing MCAS results for USA, Excel, District, and State for English Language Arts, Mathematics, and Science and Tech/Eng in Spring 2013.](chart.png)

**Note.** Data retrieved from School Profile for USA and WRA, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 8, 2013.

Figures 6 and 7 break down the Spring 2013 MCAS results for the Science and Mathematics assessments respectively, providing percentages of students achieving at or above the “proficient” level on those assessments, disaggregated by student demographic factors. Specifically, six demographic groups are presented, representing student groups that have been traditionally underrepresented in STEM majors and fields: African American, Hispanic, female, students with disabilities, English language learners, and low-income students. For the Science assessments, USA had lower percentages of students attaining the passing level than the district or state across each of the demographic groups. However, for the Mathematics assessment, USA compared relatively well to the comparison points, essentially matching the percentages for the district and exceeding them for their Hispanic student group. It should be noted that the numbers of students taking each assessment for the four comparable entities are significantly different. For the Science assessments, a total of 72 students from USA took the tests in 2013, compared to 100 at Excel, 3,043 for the district, and 66,693 for the state. For the Mathematics assessments, a
A total of 92 students from USA took the tests, compared to 119 at Excel, 3,341 from the district, and 68,821 from the state.

**Figure 6**

*Spring 2013 MCAS Results in Science and Technology/Engineering for USA, Comprehensive High School, District, and State, disaggregated by Student Demographics (Percent Proficient OR Advanced, for Grade 10 administration)*

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>Hispanic</th>
<th>Female</th>
<th>Disabilities</th>
<th>ELL</th>
<th>Low Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>24</td>
<td>40</td>
<td>26</td>
<td>8</td>
<td>17</td>
<td>27</td>
</tr>
<tr>
<td>Excel</td>
<td>44</td>
<td>38</td>
<td>41</td>
<td>16</td>
<td>23</td>
<td>43</td>
</tr>
<tr>
<td>District</td>
<td>47</td>
<td>41</td>
<td>71</td>
<td>0</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>State</td>
<td>37</td>
<td>33</td>
<td>33</td>
<td>0</td>
<td>17</td>
<td>37</td>
</tr>
</tbody>
</table>

**Note.** Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.
Figure 7

Spring 2013 MCAS Results in Mathematics for USA, Comprehensive High School, District, and State, disaggregated by Student Demographics (Percent Proficient OR Advanced, for Grade 10 administration)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

Figures 8 and 9 provide a look at the last five years of outcomes on the Science and Mathematics assessments respectively, covering the 2009-2013 school years. These graphs show the percentages of students achieving at or above the “proficient” level for each assessment. For the Science assessment, in 2010, USA had nearly identical percentages of students attaining a passing score as the district and comprehensive high school, even slightly outperforming them for that year. However, the merger may have had a significant effect on the school, as for 2011-2013, USA was substantially lower than the comparables in the percentages of students passing those tests. Notably, however, USA has had a slight upward trend in their results over those three years.

The trends are more pronounced for the Mathematics assessment. In 2010, USA not only exceeded the district and the comprehensive high school, but they also matched the outcomes for the state overall. There was a significant drop in their outcomes for 2011, after the merger, although as with the Science assessment, there are signs of some improvement from 2011 to 2013.
Figure 8

5-Year Trends in MCAS Results in Science for USA, Comprehensive High School, District, and State for All Students (Percent Proficient or Advanced)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.
Figure 9

5-Year Trends in MCAS Results in Mathematics for USA, Comprehensive High School, District, and State for All Students (Percent Proficient or Advanced)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

Figures 10, 11, 12, and 13 examine the Science assessment outcomes in more detail, disaggregating the results for four student groups traditionally underrepresented in STEM: Low-income students, African American students, Hispanic students, and females. Each of the graphs, with the exception of the Hispanic students, shows the same trend for USA’s assessment outcomes: a peak in 2010, followed by a sharp decrease for 2011, then an upward trend through 2013. Each of these figures support the notion that USA was deeply affected by their school merger and has been adapting to the new structure, culture, and student body ever since. Interestingly, USA’s outcomes for their Hispanic students remained relatively stable across the five years, comparing well with the district and the state.
Figure 10

5-Year Trends in MCAS Results in Science for USA, Comprehensive High School, District, and State, Disaggregated by Low-income Students (Percent Proficient or Advanced)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.
Figure 11

5-Year Trends in MCAS Results in Science for USA, Comprehensive High School, District, and State, Disaggregated by African-American Students (Percent Proficient or Advanced)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.
Figure 12

5-Year Trends in MCAS Results in Science for USA, Comprehensive High School, District, and State, Disaggregated by Hispanic Students (Percent Proficient or Advanced)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.
5-Year Trends in MCAS Results in Science for USA, Comprehensive High School, District, and State, Disaggregated by Female Students (Percent Proficient or Advanced)

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

Advanced Placement (AP) Exam and SAT Outcomes. As described in the Early College Coursework and Supports for Underrepresented students sections of the case study, USA encouraged their students to take AP level courses and the corresponding exams. Table 8 displays the 2011-2012 AP exam results for USA, the comprehensive high school, district, and state for the STEM-related AP subjects that USA students completed. USA students also took the English Literature/Composition, US Government, and Psychology exams. For each assessment and across all subjects, over 90% of USA’s students scored in the 1 to 2 range, higher percentages than in the comparable entities.
Table 8
2011-2012 Advanced Placement Test Student Outcomes Comparing USA, Comprehensive High School, District, and State

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>Excel High School</th>
<th>Boston Public Schools</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests Taken in All Subjects</td>
<td>119</td>
<td>83</td>
<td>3,993</td>
<td>67,429</td>
</tr>
<tr>
<td>Score 1-2 (%)</td>
<td>92.4</td>
<td>74.7</td>
<td>50.7</td>
<td>30.1</td>
</tr>
<tr>
<td>Score 3-5 (%)</td>
<td>7.6</td>
<td>25.3</td>
<td>49.3</td>
<td>69.9</td>
</tr>
<tr>
<td>Tests Taken in Calculus AB</td>
<td>18</td>
<td>17</td>
<td>309</td>
<td>6,009</td>
</tr>
<tr>
<td>Score 1-2 (%)</td>
<td>94.4</td>
<td>41.2</td>
<td>59.5</td>
<td>31.9</td>
</tr>
<tr>
<td>Score 3-5 (%)</td>
<td>5.6</td>
<td>58.8</td>
<td>40.5</td>
<td>68.1</td>
</tr>
<tr>
<td>Tests Taken in Statistics</td>
<td>15</td>
<td>0</td>
<td>204</td>
<td>4,164</td>
</tr>
<tr>
<td>Score 1-2 (%)</td>
<td>100</td>
<td>n/a</td>
<td>64.7</td>
<td>33.3</td>
</tr>
<tr>
<td>Score 3-5 (%)</td>
<td>0.0</td>
<td>n/a</td>
<td>35.3</td>
<td>66.7</td>
</tr>
<tr>
<td>Tests Taken in Biology</td>
<td>16</td>
<td>17</td>
<td>267</td>
<td>5,778</td>
</tr>
<tr>
<td>Score 1-2 (%)</td>
<td>100</td>
<td>82.4</td>
<td>67.4</td>
<td>40.0</td>
</tr>
<tr>
<td>Score 3-5 (%)</td>
<td>0.0</td>
<td>17.6</td>
<td>32.6</td>
<td>60.0</td>
</tr>
<tr>
<td>Tests Taken in Chemistry</td>
<td>21</td>
<td>0</td>
<td>179</td>
<td>3,363</td>
</tr>
<tr>
<td>Score 1-2 (%)</td>
<td>90.5</td>
<td>n/a</td>
<td>55.9</td>
<td>33.6</td>
</tr>
<tr>
<td>Score 3-5 (%)</td>
<td>9.5</td>
<td>n/a</td>
<td>44.1</td>
<td>66.4</td>
</tr>
</tbody>
</table>

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

Table 9 displays the SAT outcomes for USA’s students, compared with the comprehensive high school, district, and state. Additionally, the table disaggregates the data for five traditionally underrepresented student groups: low-income students, special education students, females, African American students, and Hispanic students. Across the demographics and overall, USA compared well with the comprehensive high school, and matched the district in some areas. However, USA’s average scores on the Mathematics portions lagged behind those of the comprehensive high school, district, and state, which is not surprising given that USA encourages all students to take the exam for the exposure.
**Table 9**  
2011-2012 SAT Student Outcomes Comparing USA, Comprehensive High School, District, and State

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>Excel School</th>
<th>Boston Schools</th>
<th>Public Schools</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # of Students</td>
<td>85</td>
<td>117</td>
<td>2,532</td>
<td>48,611</td>
<td>506</td>
</tr>
<tr>
<td>Reading</td>
<td>394</td>
<td>370</td>
<td>431</td>
<td>500</td>
<td>10,704</td>
</tr>
<tr>
<td>Writing</td>
<td>382</td>
<td>367</td>
<td>427</td>
<td>500</td>
<td>426</td>
</tr>
<tr>
<td>Mathematics</td>
<td>410</td>
<td>433</td>
<td>464</td>
<td>524</td>
<td></td>
</tr>
<tr>
<td># of Low Income Students</td>
<td>57</td>
<td>103</td>
<td>1,601</td>
<td>10,704</td>
<td>2,515</td>
</tr>
<tr>
<td>Reading</td>
<td>384</td>
<td>367</td>
<td>403</td>
<td>434</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>378</td>
<td>363</td>
<td>401</td>
<td>426</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>401</td>
<td>434</td>
<td>446</td>
<td>458</td>
<td></td>
</tr>
<tr>
<td># of Special Education Students</td>
<td>11</td>
<td>13</td>
<td>202</td>
<td>3,515</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>353</td>
<td>362</td>
<td>354</td>
<td>424</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>344</td>
<td>322</td>
<td>338</td>
<td>409</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>348</td>
<td>335</td>
<td>363</td>
<td>427</td>
<td></td>
</tr>
<tr>
<td># of Female Students</td>
<td>51</td>
<td>54</td>
<td>1,415</td>
<td>26,113</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>394</td>
<td>383</td>
<td>434</td>
<td>503</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>382</td>
<td>385</td>
<td>437</td>
<td>507</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>399</td>
<td>429</td>
<td>455</td>
<td>509</td>
<td></td>
</tr>
<tr>
<td># of Black/Afr. Am. Students</td>
<td>42</td>
<td>38</td>
<td>952</td>
<td>3,755</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>393</td>
<td>378</td>
<td>395</td>
<td>415</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>377</td>
<td>377</td>
<td>392</td>
<td>409</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>405</td>
<td>397</td>
<td>419</td>
<td>429</td>
<td></td>
</tr>
<tr>
<td># of Hispanic Students</td>
<td>37</td>
<td>20</td>
<td>760</td>
<td>4,130</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>401</td>
<td>392</td>
<td>405</td>
<td>427</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>392</td>
<td>377</td>
<td>397</td>
<td>418</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>419</td>
<td>386</td>
<td>426</td>
<td>443</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

### 5.3 Longer-Term Outcomes: Cohort Graduation Rates and Postsecondary Outcomes

Massachusetts defines their four-year high school graduation rate as the “percentage of students who graduate with a regular high school diploma within 4 years” (http://profiles.doe.mass.edu/help/data.aspx). For each cohort, then, the full formula used to determine the four-year cohort graduation rate is: (Number of students in the cohort who graduate within 4 years of entering 9th grade) divided by [(Number of students entering 9th grade for the first time 4 years earlier) + (Number of transfers in)] – (Number of transfers out).
Table 10 presents the four-year graduation rates for USA, the comprehensive high school, district, and state, for the Class of 2012. USA’s graduation rates for the student groups traditionally underrepresented in STEM were actually strong when compared to the comprehensive high school, district, and state. In particular, the rates for their Hispanic students, African American students, English language learners, low-income students, students with disabilities, and female students compared very well across the comparables. This relative strength, when compared to the indicators and test scores described above, may be the result of these seniors having been at USA during their 2009-2010 school year as sophomores, prior to the school’s merger.

Table 10

<table>
<thead>
<tr>
<th>4-Year Graduation Rate for Class of 2012, for USA, Comprehensive High School, District, and State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>All Students (%)</td>
</tr>
<tr>
<td>Females (%)</td>
</tr>
<tr>
<td>Males (%)</td>
</tr>
<tr>
<td>Asian (%)</td>
</tr>
<tr>
<td>Hispanic (%)</td>
</tr>
<tr>
<td>African American (%)</td>
</tr>
<tr>
<td>White (%)</td>
</tr>
<tr>
<td>Multi-Race, Non-Hispanic (%)</td>
</tr>
<tr>
<td>English Language Learners (%)</td>
</tr>
<tr>
<td>Low-income (%) *</td>
</tr>
<tr>
<td>Students with Disabilities (%)</td>
</tr>
<tr>
<td>High Needs (%) **</td>
</tr>
</tbody>
</table>

Note. Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

* “Low-income” students defined by Massachusetts as “The percent of enrollment who meet ANY ONE of the following definitions of Low-income: The student is eligible for free or reduced price lunch; or The student receives Transitional Aid to Families benefits; or The student is eligible for food stamps.” (http://profiles.doe.mass.edu/help/data.aspx)

** “High Needs” students defined by Massachusetts as “A student is high needs if he or she is designated as either low income, or ELL, or former ELL, or a student with disabilities.” (http://profiles.doe.mass.edu/help/data.aspx)

Figure 14 shows the graduation rates for USA and the comparable entities across the last four years of available data, 2009-2012. Similar to the other data points, USA appears to have reached
a peak in 2010, prior to the merger. However, USA’s 2011 and 2012 data still compares well to the district and to the comprehensive high school.

**Figure 14**
4-Year Trends in Four-Year Cohort Graduation Rates Comparing USA, Comprehensive High School, District, and State

![Graph showing graduation rates for USA, Excel, District, and State from 2009 to 2012.](image)

*Note.* Data retrieved from School Profile for USA and Excel High School, from Massachusetts Department of Elementary and Secondary Education website (http://profiles.doe.mass.edu) on October 24, 2013.

Table 11 displays the percentages of students in the Class of 2011 from USA, comprehensive high school, district, and state continuing on to attend “institutions of higher education,” covering all colleges and universities, including 2-year institutions, 4-year institutions, and community colleges. While USA’s overall rates were slightly below the district and state, their outcomes for certain traditionally underrepresented student groups compared well with each of the comparables.
Table 11  
Graduates Attending Institutions of Higher Education (All Colleges and Universities) for Class of 2011, for USA, Comprehensive High School, District, and State

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>Excel High School</th>
<th>High School</th>
<th>Boston Public Schools</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Students (%)</td>
<td>61.5</td>
<td>63.2</td>
<td>66.2</td>
<td>74.3</td>
<td></td>
</tr>
<tr>
<td>Females (%)</td>
<td>73.7</td>
<td>65.0</td>
<td>71.3</td>
<td>79.3</td>
<td></td>
</tr>
<tr>
<td>Males (%)</td>
<td>50.0</td>
<td>61.7</td>
<td>60.6</td>
<td>69.2</td>
<td></td>
</tr>
<tr>
<td>Hispanic (%)</td>
<td>63.9</td>
<td>56.4</td>
<td>59.5</td>
<td>60.7</td>
<td></td>
</tr>
<tr>
<td>Black (%)</td>
<td>59.4</td>
<td>69.2</td>
<td>63.5</td>
<td>70.9</td>
<td></td>
</tr>
<tr>
<td>English Language Learners (%)</td>
<td>n/a</td>
<td>65.5</td>
<td>56.8</td>
<td>57.7</td>
<td></td>
</tr>
<tr>
<td>Low-income (%) *</td>
<td>66.2</td>
<td>65.4</td>
<td>63.6</td>
<td>62.2</td>
<td></td>
</tr>
<tr>
<td>Students with Disabilities (%)</td>
<td>52.6</td>
<td>n/a</td>
<td>49.3</td>
<td>55.7</td>
<td></td>
</tr>
</tbody>
</table>

* “Low-income” students defined by Massachusetts as “The percent of enrollment who meet ANY ONE of the following definitions of Low-income: The student is eligible for free or reduced price lunch; or The student receives Transitional Aid to Families benefits; or The student is eligible for food stamps.” (http://profiles.doe.mass.edu/help/data.aspx)

5.4 SUMMARY

Given the challenges of being a public school in an urban school district and merging with a similarly small themed school with a different theme and mission, thus doubling their student body and teaching staff, USA may have experienced some decreases in measures. However, an examination of their progress from startup in 2005 to 2011, just before the merger, demonstrated USA’s ability to address the needs of all of their students, particularly their students with Individualized Education Plans. The administration, staff, partners and students at USA were working together to find creative solutions to address the needs of students in preparing for their future careers and for college.

6.0 DISCUSSION AND IMPLICATIONS

USA faced many of the challenges that are typical of an urban school such as funding and technology limitations. However, USA stood out as a successful inclusive STEM high school because it organizes the curriculum to move students to increased rigor, accepted students who may not have had an outstanding academic record and supports the students in a variety of ways. The faculty and administration had high expectations for the students and were aware of the supports that were needed to help students succeed. For example, students were encouraged to take at least one AP course before they graduate, and USA supported students’ engagement in rigorous classes by offering entry-level classes with co-teachers, effectively cutting the teacher-
student ratio in half, particularly in mathematics and sciences, and by teaching the courses through guided inquiry so that students have more and more experience in taking responsibility for their own learning. Students who receive average scores in their courses take the AVID program, which built their self-efficacy for and awareness of necessary preparations required for attending college.

The data-driven decisions that USA stakeholders made were instrumental in the relevance of supports offered to students. Decisions to initiate new programs of support for students were in response to evidence of student needs. For example, the guidance department recognized that merely filling out the applications for college did not address the financial needs that the students had for attending college. The awareness of USA’s faculty and administration regarding student needs was key in initiating new programs that help students succeed, such as school-wide funding for the SAT, technology club, changes in the school schedule, and supports for science fair ideas through the Cloud Foundation. When faculty and administration saw a need that was not met within the school system, they partnered with universities, non-profits and businesses to provide enriched opportunities to students. At USA there was a constant vigilance of student needs by the faculty, and the administration was driven to continuously improve educational experiences for the students.

An extension of the tangible supports that USA provided was a caring school culture. Students and parents were aware that USA expected students to be high performing and to take risks, and there was a core group of teachers who worked beyond expectations to support students. The collective experience of the school system and the teachers working to support students, and students working to get themselves to a higher level of learning demonstrated that there was value in the endeavor of learning. USA demonstrated their ethic of caring by reaching out to various partners in order to provide relevant, quality experience for their students, although their funding resources were strained. Students and parents viewed schooling as an opportunity to improve situations academically, economically, and for a higher standard of living.
7.0 REFERENCES


President’s Council of Advisors on Science and Technology (PCAST). (2010). *Prepare and inspire: K-12 education in science, technology, engineering, and math (stem) for America’s future*. Washington, DC: Author.
