STEM Starter Academy
Annual Evaluation Report – Year 3
March 2017

Prepared for the Massachusetts Department of Higher Education
Version 6: July 10, 2017

Acknowledgements

The UMass Donahue Institute extends its sincere appreciation to the many people who supported and collaborated with us on this evaluation. In particular, we want to thank personnel from the Massachusetts Department of Higher Education and all fifteen community colleges from around the state who have supported this project.

STEM Starter Academy
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Executive Summary

The STEM Starter Academy (SSA) is a Massachusetts Department of Higher Education (DHE) initiative to inform, engage, recruit, retain and graduate significantly more students through STEM Pathway programs that result in job placement or transfer to university STEM programs and careers. The initiative was launched system-wide at all 15 community colleges in January 2014. From its inception, the SSA initiative has focused on affecting system-level change through at-scale implementation.

SSA supports outreach to prospective students who previously may not have considered STEM careers, including: exploratory courses and activities that engage and inform students about career opportunities in STEM fields, summer-bridge programs that prepare incoming students for success in STEM coursework, and an array of services intended to support higher student retention rates and program completion. The STEM Starter Academy promotes the identification and replication of best practices from existing community college projects, fosters integration and alignment of existing STEM-student support services, and complements and extends curriculum pathway programs at each campus.
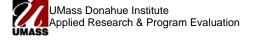
The UMass Donahue Institute (UMDI) has worked with DHE as an external evaluator of the SSA initiative since the inception of the program. This report presents findings from Year 3 and analyses of the impacts that SSA has had on students' progress toward targeted outcomes, including an analysis of the trajectories of the first cohort of SSA participants to have had the opportunity to complete two full academic years at their institutions.[1,2] This report serves multiple purposes: (1) to provide formative feedback to DHE and to the community colleges relevant to the continuous improvement of grant activities, (2) to provide initial quantitative and qualitative feedback about SSA student participation and impact, and (3) to provide technical assistance to support DHE's efforts to implement the initiative. Evaluation efforts focused on assessing the impacts of SSA on participation and outcome metrics that are relevant across all 15 campuses rather than assessing the impact of SSA on individual campuses. Therefore, system-level reporting is the primary function of this report. Some site-level data are provided but are not the primary focus of this evaluation (or this document). The evaluation findings in this report are based on data largely from SSA Years 1–3. Please see the Glossary of Terms in Appendix A for clarification of terms used throughout this report.

STEM Pipeline: Trends in SSA Participation

Key Finding: SSA programs have served a diverse population of over 19,000 people during Year 3 (including primary and secondary participants), and over 50,000 people since the inception of the initiative.

✓ **In Year 3, SSA-supported activities served 7,172 primary participants and 12,590 secondary participants.**[3] To date, SSA has served 17,622 primary participants and 33,947 secondary participants.[4]

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[1] For the purposes of this report, Year 1 includes Spring and Summer 2014, Year 2 includes Fall 2014 and Spring and Summer 2015, and Year 3 includes Fall 2015 and Spring and Summer 2016.

[2] Few students complete a community college degree or certificate in two years. For example, 4.6% of community college students that were first-time students (either full time or part time) in Massachusetts in Fall 2011 completed a degree or certificate by August 2013.

[3] Primary participants are community college students (i.e., participants who have an ID number assigned by their college) who have chosen to participate in at least one STEM Starter Academy grant-funded program/event/activity. Secondary participants are individuals who are not currently enrolled at a community college and participate in STEM Starter Academy grant-funded programs/events/activities (i.e., participants who do not have an ID number assigned by their college). Please see the Glossary of Terms in Appendix A for clarification of terms used throughout this report.

✓ **Primary participants reflect the diversity of the overall population of community college students.** For example, 18% of primary participants are Black or African American and 17% are Latino, while 13% of all community college students are Black or African American and 19% are Latino. Similarly, 48% of SSA participants and 57% of community college students are female.

Key Finding: There are some indications that SSA might be contributing to diversifying the STEM pipeline in terms of race/ethnicity and gender.
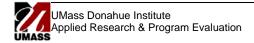
✓ Female SSA participants are more likely to enter their college in a STEM program than female non-SSA participants. Nearly twice the proportion of female SSA participants entered a STEM program (42%) compared to that proportion among female community college students as a whole (23%).

✓ SSA participants who were enrolled in a STEM program at admission have slightly higher proportions of students who identify as Black/African American (20% vs. 15%), Asian (8% vs. 6%), or Latino (20% vs. 19%), compared with all community college students who were enrolled in a STEM program at admission.

Key Finding: The proportion of SSA participants identified as enrolled in a STEM program at their time of admission increased between 2014 and 2016 and is higher than in the general community college population.

✓ **The proportion of SSA participants who are enrolled in a STEM program at their time of admission increased from 33% (764 participants) in Fall 2014 to 63% (1,293 participants) in Fall 2016.** This is higher than the community college statewide proportion of 24% (24,790 students) of students enrolled in a STEM program at admission in Fall 2014 and 26% (24,802 students) of students in Fall 2016. This is an important finding because our analyses indicate that students who are enrolled in a STEM program at admission are more likely to complete a STEM degree or certificate two years later than students who are not enrolled in a STEM program at admission.

✓ **Even as total enrollment at community colleges has declined, the STEM pipeline continues to grow. [5]** Across all sites, STEM enrollment at entry among all students remained steady from Fall 2014 (23,263 students) to Fall 2016 (23,521 students) even as overall enrollment at community colleges decreased from Fall 2014 (96,887) to Fall 2016 (87,527). Between 2010 and 2016, the proportion of students who were full-time or part-time STEM-enrolled at time of entry increased by 5 percentage points despite a decrease in the total number of students enrolled full or part time at community colleges across those years.

✓ **The proportion of the STEM pipeline participating in SSA (i.e., those who are STEM-enrolled at entry) increased from 3% (764 of 24,790) in Fall 2014 to 5% (1,293 of 24,802) in Fall 2016**. Many SSA primary participants do not enroll in a STEM program at time of entry, as SSA is intended to introduce STEM to students that may not be initially interested in pursuing a STEM degree. SSA serves a group of students with diverse levels of interest and engagement with STEM. Many SSA primary participants may have no (or very limited) interest in obtaining a STEM

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[4] These are counts of total participants across terms, which include duplicates.

[5] For the purposes of this report, the STEM pipeline data are assessed in two ways. First, we used HEIRS data to determine which students were enrolled in and/or were admitted to a STEM program at the time of entry. Second, we used HEIRS graduation data to determine which students completed a STEM degree or certificate. HEIRS data do not allow us to identify students that change programs after their initial entry into the college. That is, many students change their program of study after they have joined a community college, and HEIRS does not track these changes. HEIRS data can only be used to assess STEM program status at time of entry and at the point of completion/graduation. Throughout this report, we will refer to community college students who enrolled in and/or were admitted to a STEM program at the time of entry as "STEM-enrolled at time of entry." Complete student enrollment data is only available for fall terms, therefore only fall data are reported. SSA uses the same definition for STEM as DHE uses for the STEM Data Dashboard.

degree or certificate, but are counted as SSA primary participants because they benefit from an SSA service such as math or science tutoring. In other words, SSA participants are heterogeneous not only in their individual characteristics, but also in their exposure to SSA supports. However, a greater portion of SSA participants are enrolled in a STEM program at their time of admission than are individuals from the general student population.

Key Finding: **Regardless of SSA program participation status, students who joined a community college in Fall 2014 as first-time, full-time freshmen and were identified as STEM enrolled at their time of admission were far more likely (approximately 30 times as likely) to earn a STEM degree or certificate two years later than similar students who were not identified as STEM program participants at their time of admission. (Please see the Effectiveness of SSA section on page 40 for further discussion.)**

- ✓ SSA programs at all sites include activities aimed to foster early exploration and interest in STEM fields of study—at some sites, this included encouraging or advising students to enroll in STEM programs at admission. In Year 3, SSA Early College High School activities prioritized introducing STEM careers, fields of study, and coursework. Moving forward, Early College activities will be a topic of increased interest and focus for DHE, the community colleges, and the evaluation.

Patterns of Practice: SSA Model and Strategies

The SSA model provides a platform for the 15 community college campuses to align best practices and bring those practices to scale over time. The model is not—and is not intended to be—fixed or stagnant. Rather, the model is intended to reflect learnings that are accumulated from campuses through their efforts to support students and improve student outcomes. A description of the model is provided in the report on page 18.

Key Finding: Program implementations across sites show evidence of incorporating and integrating SSA model elements and lessons from inter- and intra-campus work. Campus visions for SSA have coalesced around the model even as individual practices continue to vary (by design of the program) across campuses.

- ✓ **The practices implemented by sites (see Figure 1) reflect the SSA model and also reflect inter-campus collaboration.** [6] Year 3 saw widespread implementation of college and STEM readiness programs, academic support, advising, and career and transfer exploration. Early College High School programs—implemented through SSA for the first time in 2016—showed a high degree of alignment with the SSA model as well as consistency across sites. Reports indicate continued variation across sites in their views of which practices were most promising or effective in meeting the needs of the local student population. Advising, collaboration, community building, academic support, and faculty involvement were among the practices noted by sites as promising or effective for reaching initiative goals.

- ✓ **The project has supported and facilitated an ongoing learning community with full participation by each of the 15 community college campuses.** This learning community reflects the system change focus of this initiative, and has supported the sharing of adaptations of SSA that are viewed locally as promising practices.

Key Finding: Community colleges benefit from SSA-supported integration and alignment of on- and off-campus endeavors to support STEM students.

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[6] A similar figure was presented in the SSA Year 2 Evaluation Report. This figure has been updated with findings from Year 3.

✓ **Sites report that the increased capacity—achieved through SSA investments—facilitated expanded partnerships**, including collaboration across departments on campus and with external partners such as local STEM industries, 4-year schools, and community agencies.

✓ **Campuses report that SSA has improved the visibility and reputation of community colleges as STEM destinations**.

✓ **SSA sites continue to value opportunities for coordination and collaboration.** Sites reported that on-campus coordination and collaboration allowed for more efficient outreach and recruiting, better integration of services provided to students, and more effective leveraging of total institutional funding.

Key Finding: Shifts in practice and use of funding suggest that SSA sites are building capacity and looking forward, but sustainability may be piecemeal.

✓ Most sites did not view the SSA programs on their campuses as sustainable, but many were pursuing options for sustaining some elements of the work that they perceive to be effective.

✓ Sites have shifted greater energy to tracking participant outcomes, and some sites attribute student engagement, participation, and academic achievement to elements of their SSA programs.

✓ Sites' increased attention to preparing students for post-graduation suggests a progression in implementation of the SSA model.

Figure 1: Common SSA Model Practices and Strategies Across Campuses, Year 3

Outcomes: Effectiveness of SSA Intervention

Key Finding: SSA has supported retention, full-time enrollment, and engagement with STEM.

✓ **SSA primary participants have had higher rates of full-time enrollment than the general community college population for all years of the initiative.** In Fall 2016, full-time enrollment was 12 percentage points higher among SSA primary participants than among the general community college student population. This is potentially a positive indication of SSA impact, as there is some evidence that students who remain enrolled full-time are more likely to be retained and to complete their program of study or transfer to a 4-year school than their part-time peers.[7]

✓ **The proportion of SSA participants who were both STEM-enrolled at time of entry and full-time students grew from 20% (452 participants) to 32% (650 participants) between Fall 2014 and Fall 2016**. This proportion among SSA participants exceeded that of the general community college population by 10 percentage points in Fall 2014 and by more than 20 percentage points in Fall 2016. In Fall 2016, 32% of SSA participants were full time and STEM-enrolled at time of entry compared to 11% of community college students.

✓ **About half of SSA primary participants who have—to date—earned degrees and certificates did so in STEM fields.** SSA programs include a diverse array o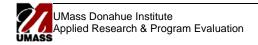f services and some students who receive SSA supports (e.g., mathematics support) do not pursue STEM programs of study. However, 49% of degrees and certificates completed by any SSA participant were in STEM fields. This is slightly higher than the statewide total of 45% of below-bachelor's certificates and degrees granted in STEM fields.[8]

✓ **Fall 2015 to Fall 2016 retention rates for SSA participants are similar to—but slightly higher than—the overall retention rate for all Massachusetts community college students:** 62% vs. 58% for full-time, first-time degree-seeking students and 59% for STEM-enrolled full-time, first-time degree-seeking students.

Key Finding: SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen were neither more nor less likely than similar non-participating students to graduate/complete (in any field), be retained, or transfer one or two years after joining SSA.

✓ SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen that received specific types of support (i.e., financial support, academic support, or counseling support) were neither more nor less likely than similar non-participating students to graduate/complete, be retained, or transfer one or two years after joining the program.

✓ SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen were less likely than similar non-participating students to earn a *STEM degree or certificate* two years after joining the program.

There are multiple plausible explanations for this pattern of findings, including a relatively small (and potentially unusual) sample of students who joined SSA in the fall of 2014 as first-time, full-time freshmen and variability in the intensity and character of SSA interventions both within and across sites. These are discussed in the Outcomes section of this report. It is also difficult to determine if the results

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[7] Crosta, P. M. (2014). Intensity and attachment: How the chaotic enrollment patterns of community college students relate to educational outcomes. Community College Review, 42(2), 118–142.

[8] This figure includes both public and private schools in 2013. *2015 Massachusetts STEM Data Dashboard*, http://www.mass.edu/stem/documents/2015%20STEM%20Data%20Dashboard%20FINAL.pdf
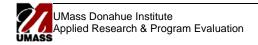
presented for students who entered SSA in Fall 2014 as first-time, full-time freshmen are indicative of outcomes of later cohorts of participants. It is clear that significant shifts in SSA recruitment practices and programming have occurred at many sites since the fall of 2014, as are discussed throughout this report. We will continue to monitor these outcomes closely over time, as more cohorts of SSA participants have the opportunity to complete one or two years of community college.

Strategic Considerations

After Year 3, DHE and the campuses are well positioned to continue to refine the SSA model and identify and scale promising practices and key strategies. The following are some strategic opportunities for consideration by DHE.

✓ **Refine the SSA program model to represent emergent consensus regarding what its core practices should be, and work with sites to move SSA activities into greater alignment with those practices.** Sites differ in their understanding of what constitutes a key component of SSA, and there continues to be substantial variation in institutional practice.

  o Campuses report positive outcomes, but system-level impacts have not been detected. If campuses believe that SSA is positively impacting student outcomes at some locations, then **campuses should consider sharing evidence-based best practices and implementing the practices that are having the greatest impact.** DHE and the campuses have established a strong network to share knowledge and identify and scale best practices.

  o **Facilitate additional opportunities to foster system-wide communication and resource sharing, particularly with regard to best practices and lessons learned.** Campuses have appreciated DHE leadership in facilitating cross-site collaboration and evidence-based learning (e.g., at initiative-wide bi-annual meetings with representatives from all 15 SSA campuses), and continued attention to these activities is warranted.

  o **Support sites in managing increased project demands**, potentially by encouraging sites to focus their limited resources on core or promising practices. Some campuses feel they have insufficient personnel capacity to manage the expansion of programmatic activity over the full range of student support needs—from college recruitment and STEM preparation, to job placement and transfer.

✓ **Expand the definition of "STEM" for SSA to include liberal arts programs with STEM concentrations.** Many community college students have enrolled in and/or completed liberal arts programs that may be considered "STEM" by the colleges and by the students. DHE has adopted a definition of "STEM" for SSA that is aligned with the definition used for the STEM Data Dashboard, and that definition excludes those enrolled in liberal arts programs. However, our analyses revealed that liberal arts programs include many STEM concentrations like mathematics, pre-engineering, biology, chemistry, and pre-nursing. Hundreds of students earn degrees or certificates from community colleges in these concentrations each year.[9]

✓ **Expand the collection of student-level SSA dosage data.** It is possible that SSA is differentially impacting students that receive varying dosage of intervention, and expanding the collection of

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[9] SSA uses the STEM subject/employment areas that are used for the Data Dashboard: (1) Agriculture, Conservation, and Natural Resources; (2) Architecture; (3) Biological and Biomedical Sciences; (4) Computer and Information Sciences; (5) Engineering and Engineering Technologies/Technicians; (6) Health Professions and Clinical Sciences; (7) Mathematics and Statistics; (8) Mechanic and Repair Technologies/Technicians; (9) Military Technologies/Technicians; (10) Physical Sciences; (11) Precision Production; and (12) Science Technologies/Technicians.

student-level dosage data will enhance DHE's ability to identify factors impacting student performance.[10]

✓ **Support the collection and sharing of data at the campus level.** SSA administrators with access to student data are better able to make programmatic decisions based on student performance and also to submit data to DHE in a timely manner. Several sites use some amount of SSA funding to recruit part-time help from their Institutional Research offices to support data management and reporting.

✓ **Work with sites to think through strategies for sustainability.** Campuses are seeking to diversify their funding and to enhance the sustainability and institutionalization of SSA program elements. This may be an area in which continued technical assistance and sharing is particularly important.

✓ **Explore, monitor, and assess the impact of early engagement in STEM certificate/degree programs.** SSA programs at all sites include activities aimed to foster early exploration and interest in STEM fields of study. UMDI observed that, over time, an increasing portion of SSA students who are first-time, full-time freshmen have entered their community colleges with a STEM degree/certificate focus. We also found that (regardless of SSA participation status) students who enter community college with a STEM degree/certificate focus are significantly more likely to complete a STEM program (i.e., earn a STEM degree or certificate) within two years than students who were not identified as STEM-enrolled at time of entry. If the number of SSA participants continues to grow and the proportion of first-time, full-time participants entering with a STEM degree/certificate focus continues to expand, then future analyses may detect increases in STEM completion rates for SSA participants, and possibly for the community college sector as a whole. Early College activities have become a topic of increased interest for DHE and the community colleges, and therefore, the SSA evaluation will continue to track the impact of early engagement in STEM certificate/degree programs.

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[10] See page 42 of this report for more discussion of dosage.

Introduction

The STEM Starter Academy (SSA) is a Massachusetts Department of Higher Education (DHE) initiative to inform, engage, recruit, retain and graduate significantly more students through STEM Pathway programs that result in job placement or transfer to university STEM programs and careers. The initiative was launched system-wide at all 15 community colleges in January 2014. From its inception, the SSA initiative has focused on affecting system-level change through at-scale implementation.

SSA supports outreach to prospective students who previously may not have considered STEM careers, including: exploratory courses and activities that engage and inform students about career opportunities in STEM fields, summer-bridge programs that prepare incoming students for success in STEM coursework, and an array of services intended to support higher student retention rates and program completion. The STEM Starter Academy promotes the identification and replication of best practices from existing community college projects, fosters integration and alignment of existing STEM-student support services, and complements and extends curriculum pathway programs at each campus.

The UMass Donahue Institute (UMDI) has worked with DHE as an external evaluator of the SSA initiative since the inception of the program. This report presents findings from Year 3 and analyses of the impacts that SSA has had on students' progress toward targeted outcomes, including an analysis of the trajectories of the first cohort of SSA participants to have had the opportunity to complete two full academic years at their institutions.[11,12] This report serves multiple purposes: (1) to provide formative feedback to DHE and to the community colleges relevant to the continuous improvement of grant activities, (2) to provide initial quantitative and qualitative feedback about SSA student participation and impact, and (3) to provide technical assistance to support DHE's efforts to implement the initiative. Evaluation efforts focused on assessing the impacts of SSA on participation and outcome metrics that are relevant across all 15 campuses rather than assessing the impact of SSA on individual campuses. Therefore, system-level reporting is the primary function of this report. Some site-level data are provided but are not the primary focus of this evaluation (or this document). The evaluation findings in this report are based on data from SSA Years 1–3. Please see the Glossary of Terms in Appendix A for clarification of terms used throughout this report.

This report is organized into three main sections: The first section presents findings from descriptive analyses that describe the population of students who participated in SSA, including their demographics, service profiles, and contribution to the community college STEM pipeline; the second section reviews the SSA model and summarizes trends in SSA program implementation as well as stakeholder reflections on the initiative; the third section presents findings from both descriptive and statistical analyses that assess initiative-level progress on SSA Model metrics and student-level outcomes.

Guiding Evaluation Questions

Evaluation of the STEM Starter Academy initiative continues to encompass data collection and analysis to facilitate both process and outcome evaluation. In Year 3, more resources were dedicated to addressing outcome-focused questions. Nevertheless, process questions remain relevant to

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[11] For the purposes of this report, Year 1 includes Spring and Summer 2014, Year 2 includes Fall 2014 and Spring and Summer 2015, and Year 3 includes Fall 2015 and Spring and Summer 2016.

[12] Few students complete a community college degree or certificate in two years. For example, 4.6% of community college students that were first-time students (either full time or part time) in Massachusetts in Fall 2011 completed a degree or certificate by August 2013.

understanding and explaining the contexts in which effective programs are developed and sustained. The evaluation questions outlined below guided the Year 3 evaluation.

Process Evaluation Questions

P1. What are the major challenges to and facilitators of successful program implementation that have been encountered by grantees? How have challenges been addressed or overcome?

P2. What are the major challenges to and facilitators of advancing SSA implementation and initiative development that have been encountered by DHE? How have challenges been addressed or overcome?

P3. How do key project stakeholders (e.g., SSA students, administrators, coordinators) rate and explain the quality, relevance, and effectiveness of major SSA model components and services?

P4. What infrastructure, systems, and processes are being put in place to aid program sustainability during and beyond the grant period? What are the greatest challenges to and facilitators of creating sustainability?

Outcome Evaluation Questions

O1. What progress is being made toward the goals of recruiting, preparing, retaining, and graduating/completing more students from STEM-pathway programs?

O2. Who is participating in SSA activities? Do observed changes in progress and outcomes differ across student characteristics such as gender and race/ethnicity?

O3. To what extent are observed changes in student outcomes attributable to initiative activities (including combinations of program activities) versus contextual variables or non-SSA interventions?[13]

O4. What differences in program features, implementation strategies, and contextual variables can be identified across institutions whose student progress or outcomes differ substantially?[14]

Report Evaluation Questions

Based on the guiding evaluation questions specified above, DHE and UMDI agreed that the following eight questions would be addressed in this report:

1. Who is participating in SSA (breakdown by race/ethnicity, gender, etc.)?

    a. How does this population differ from the community college STEM pipeline as a whole?

    b. How does this population differ from community college population as a whole?

2. What practices and strategies implemented through SSA are considered the most promising by key stakeholders in terms of contributing to the achievement of the initiative's goals?

3. What similarities and differences in program features, implementation strategies, and contextual variables can be identified across SSA institutions?

4. What key lessons have been learned about implementing and facilitating the SSA initiative?

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[13] Although direct attribution to SSA is difficult to validate, the evaluation seeks to improve stakeholders' understandings of the connection between SSA program activities and student outcomes.
[14] UMDI and DHE agree that addressing Outcome Question 4 is a long term goal which will not be fully addressed through evaluation analysis and reporting activities in Year 3. The evaluation team will continue to work with DHE to collect data that are relevant to this question.

5. How many students are completing STEM programs/degrees at community colleges?[15]

    a. How has this number and rate changed over time, both overall and by site?

6. Are SSA participants more or less likely than similar non-participants to complete a STEM program or degree?

7. Are SSA participants more or less likely than similar non-participants to have positive educational outcomes (retained, transferred, or completed/graduated) one year and two years after participation?

8. Are SSA participants who receive specific types of support (i.e., financial support, academic support, or counseling support) more or less likely to have positive educational outcomes than similar students who do not receive these services?

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[15] "STEM" and "STEM program" are defined in Appendix A.

STEM Pipeline: Trends in SSA Participation

This section presents findings from descriptive analyses that were completed to characterize the population of students who participated in SSA, including their demographics, service profiles, and contribution to the community college STEM pipeline. More specifically, this section addresses the following three questions:

- Who is participating in SSA (breakdown by race/ethnicity, gender, etc.)?

- How does this population differ from the community college STEM pipeline as a whole?

- How does this population differ from the community college population as a whole?

Summary of Key Findings

Key Finding: SSA programs have served a diverse population of over 19,000 people during Year 3 (including primary and secondary participants), and over 50,000 people since the inception of the initiative.

- ✓ **In Year 3, SSA-supported activities served 7,172 primary participants and 12,590 secondary participants.**[16] To date, SSA has served 17,622 primary participants and 33,947 secondary participants.[17]

- ✓ **Primary participants reflect the diversity of the overall population of community college students.** For example, 18% of SSA primary participants are Black or African American and 17% are Latino, while 13% of all community college students are Black or African American and 19% are Latino. Similarly, 48% of SSA participants and 57% of community college students are female.

Key Finding: There are some indications that SSA might be contributing to diversifying the STEM pipeline in terms of race/ethnicity and gender.

- ✓ Female SSA participants are more likely to enter their college in a STEM program than female non-SSA participants. Nearly twice the proportion of female SSA participants entered a STEM program (42%) compared to that proportion among female community college students as a whole (23%).

- ✓ SSA participants who were STEM-enrolled at time of entry have slightly higher proportions of students who identify as Black/African American (20% vs. 15%), Asian (8% vs. 6%), or Latino (20% vs. 19%), compared with all community college students who were STEM-enrolled at time of entry (see Table 8B in Appendix B).

Key Finding: The proportion of SSA participants identified as enrolled in a STEM program at their time of admission increased between 2014 and 2016 and is higher than in the general community college population.

- ✓ **The proportion of SSA participants who are enrolled in a STEM program at their time of**

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[16] "Primary Participant" and "Secondary Participant" are defined in Appendix A.

[17] These are counts of total participants across terms, which include duplicates. Duplicates and/or duplicated totals include students who may have participated in SSA for multiple terms and are included in total counts for each term of their participation. In other words, these are not counts of unique cases, but rather counts of total participation in the initiative.

admission increased from 33% (764 participants) in Fall 2014 to 63% (1,293 participants) in Fall 2016. This is higher than the community college statewide proportion of 24% (24,790 students) of students enrolled in a STEM program at admission in Fall 2014 and 26% (24,802 students) of students in Fall 2016. This is an important finding because our analyses indicate that students who are enrolled in a STEM program at admission are more likely to complete a STEM degree or certificate two years later than students who are not enrolled in a STEM program at admission.

✓ **Even as total enrollment at community colleges has declined, the STEM pipeline continues to grow. [18]** Across all sites, STEM enrollment at entry among all students remained steady from Fall 2014 (23,263 students) to Fall 2016 (23,521 students) even as overall enrollment at community colleges decreased from Fall 2014 (96,887) to Fall 2016 (87,527). Between 2010 and 2016, the proportion of students who were full-time or part-time STEM-enrolled at time of entry increased by 5 percentage points despite a decrease in the total number of students enrolled full or part time at community colleges across those years.

✓ **The proportion of the STEM pipeline participating in SSA (i.e., those who are STEM-enrolled at entry) increased from 3% (764 of 24,790) in Fall 2014 to 5% (1,293 of 24,802) in Fall 2016**. Many SSA primary participants do not enroll in a STEM program at time of entry, as SSA is intended to introduce STEM to students that may not be initially interested in pursuing a STEM degree. SSA serves a group of students with diverse levels of interest and engagement with STEM. Many SSA primary participants may have no (or very limited) interest in obtaining a STEM degree or certificate, but are counted as SSA primary participants because they benefit from an SSA service such as math or science tutoring. In other words, SSA participants are heterogeneous not only in their individual characteristics, but also in their exposure to SSA supports. However, a greater portion of SSA participants are enrolled in a STEM program at their time of admission than are individuals from the general student population.

I.   SSA Participants and the Community College STEM Pipeline

Characterizing the Community College STEM Pipeline

Massachusetts community colleges have seen a slight, steady increase of part-time and full-time students who were STEM-enrolled at time of entry since 2010.[19] In 2010, 9% of community college students were enrolled full time in STEM degree or certificate program at time of entry and 13% of all students were enrolled part time in a STEM degree or certificate program at entry. Despite a decrease in the total number of students enrolled full or part time at community colleges between 2010 and 2016 (from 100,480 students to 87,527 students), the proportion of students who were full-time STEM-

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[18] For the purposes of this report, the STEM pipeline data are assessed in two ways. First, we used HEIRS data to determine which students were enrolled in and/or were admitted to a STEM program at the time of entry. Second, we used HEIRS graduation data to determine which students completed a STEM degree or certificate. HEIRS data do not allow us to identify students that change programs after their initial entry into the college. That is, many students change their program of study after they have joined a community college, and HEIRS does not track these changes. HEIRS data can only be used to assess STEM program status at time of entry and at the point of completion/graduation. Throughout this report, we will refer to community college students who enrolled in and/or were admitted to a STEM program at the time of entry as "STEM-enrolled at time of entry." Complete student enrollment data is only available for fall terms, therefore only fall data are reported. SSA uses the same definition for STEM as DHE uses for the STEM Data Dashboard.

[19] "STEM-enrolled at entry" and "STEM pipeline" are defined in Appendix A.

enrolled at time of entry increased from 9% to 10%, and the proportion of part-time students who were STEM-enrolled at time of entry increased from 13% to 17%. See Table 1, below.

Over time, the number of STEM degrees and certificates steadily increased across all 15 community colleges from 2010 through 2015 (5,190 STEM degrees and certificates earned), with a slight decrease in 2016 (4,978 STEM degrees and certificates earned). For further details, please see Table 1A in Appendix B. The proportion of all degrees earned at community colleges that were STEM degrees and certificates decreased slightly from 41% in 2011 to 37% in 2016. For further details, please see Appendix B. For comparisons between the community college STEM pipeline and the SSA student population in terms of outcomes, please see the Completion and Retention subsection section of the Outcomes section of this report.

Table 1: STEM Status at Entry for Full- and Part-Time Students Across all Community Colleges, 2010–2016*							
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Full-time STEM at entry	8.7%	8.7%	8.7%	9.2%	9.0%	9.4%	10.2%
Part-time STEM at entry	13.0%	13.4%	13.7%	14.4%	15.1%	15.7%	16.7%
Full-time non-STEM at entry	34.1%	32.8%	31.7%	30.3%	29.4%	28.3%	27.0%
Part-time non-STEM at entry	44.1%	45.1%	45.9%	46.1%	46.6%	46.6%	46.2%
Total full-time and part-time students	100,480	100,442	100,798	99,786	96,887	92,671	87,527
Total STEM degrees and certificates earned	4,560	4,961	4,836	4,964	5,392	5,190	4,978

*Due to how enrollment data is collected, complete numbers are only available for fall terms. Counts only include students with valid HEIRS IDs who were enrolled in at least one credit hour.

Table 2 (next page) shows the number of full- and part-time students at each community college who were STEM-enrolled at time of entry during Fall 2014, Fall 2015, and Fall 2016. The table also shows the number of SSA primary participants at each institution during that term, and the number of SSA primary participants enrolled in STEM at entry during that term. Across all sites, STEM enrollment at entry remained steady from Fall 2014 (23,263 students) to Fall 2016 (23,521 students). This is notable because overall enrollment at the community colleges decreased from Fall 2014 (96,887) to Fall 2016 (87,527).

Table 2 (next page) also shows that many SSA primary participants do not enroll in a STEM program when they enter their colleges. This table reflects the reality that—across all sites—SSA serves a group of students with diverse levels of interest and engagement with STEM. Participation in many SSA-supported activities is open access and participants self-select. Many SSA primary participants may have no (or very limited) interest in obtaining a STEM degree or certificate, but are counted as SSA primary participants because they benefit from an SSA service such as math or science tutoring. Additionally, there are SSA participants that are interested in STEM and enrolled in a liberal arts program with a STEM focus, but are not currently counted as STEM. In other words, SSA participants are heterogeneous not only in their individual characteristics, but also in their exposure to SSA supports. For example, an SSA primary participant might be someone who participates in a 10-hour-per-week supervised research internship or someone who attends a single workshop on preparing for transfer in STEM fields. Student participation in and exposure to SSA support elements varies both within and across campuses. This is further explored in the Patterns of Practice section of this document.

Table 2: Number of Students in the Community College STEM Pipeline, Fall 2014–2016*								
	Fall 2014			Fall 2015			Fall 2016		
	# of students in the STEM pipeline**	SSA Primary Participants		# of students in the STEM pipeline**	SSA Primary Participants		# of students in the STEM pipeline**	SSA Primary Participants	
		Total #	# STEM at entry		Total #	# STEM at entry		Total #	# STEM at entry
Berkshire	805	67	12	770	66	33	767	60	28
Bristol	1,309	52	37	1,339	48	38	1,454	95	66
Bunker Hill	3,058	40	28	3,150	107	71	3,327	57	46
Cape Cod	1,098	296	92	956	345	88	969	360	124
Greenfield	455	4	1	432	10	0	438	0	0
Holyoke	957	149	26	1,525	0	0	1,637	11	2
Mass Bay	1,072	369	101	915	228	172	951	303	229
Massasoit	829	598	33	920	521	45	1,081	38	8
Middlesex	1,896	165	111	1,804	152	113	1,739	119	93
Mt. Wachusett	1,977	32	0	1,832	35	5	1,761	30	0
North Shore	2,409	1	0	2,080	275	154	1,961	197	123
Northern Essex	2,670	230	121	2,795	64	17	2,748	132	122
Quinsigamond	1,549	264	168	1,685	93	50	1,818	207	134
Roxbury	1,421	7	0	1,281	32	25	1,159	320	221
Springfield	1,758	39	34	1,729	71	50	1,711	129	97
Total across sites	**23,263**	**2,313**	**764**	**23,213**	**2,047**	**861**	**23,521**	**2,058**	**1,293**

*Only includes students with a valid HEIRS ID

**Students in the STEM pipeline includes students that are STEM enrolled at entry, have a valid HEIRS ID, and are enrolled full or part time during the fall term. See Glossary in Appendix A for definitions of terms.

SSA Participants in the Community College STEM Pipeline

Since Fall 2014, an increasing proportion of SSA primary participants have been STEM-enrolled at time of entry, while the proportion of these students in the general community college population has remained steady. In Fall 2014, 33% of SSA primary participants were STEM-enrolled at time of entry. This proportion rose to 42% in Fall 2015 and 63% in Fall 2016 (see Table 3, below). During the same time, fall enrollees who were STEM-enrolled at time of entry in the community college population as a whole grew more modestly—from 24% in 2014 to 26% in 2016. See Table 3, below, for further detail. This is an important difference, as analyses reported in the Outcomes section of this report suggest that students who are STEM-enrolled at time of entry are far more likely to earn a STEM degree or certificate two years after joining a community college than students who are not STEM-enrolled at time of entry.

		STEM at Entry		Not STEM at Entry	
Table 3: Fall Enrollment by STEM Status at Entry, SSA Primary Participants and all Community College Students, Fall 2014–2016*					
	Year	**#**	**%**	**#**	**%**
SSA Primary Participants	2014	764	33.1%	1,549	66.9%
	2015	861	42.1%	1,186	57.9%
	2016	1,293	62.8%	765	37.2%
All Community College Students	2014	24,790	23.9%	78,910	76.1%
	2015	24,555	24.6%	75,140	75.4%
	2016	24,802	26.3%	69,579	73.7%

* only includes students with a valid HEIRS ID, regardless of full- or part-time status

The proportion of SSA participants who were both enrolled in a STEM program at entry and full-time students grew from 20% to 32% between Fall 2014 and Fall 2016 (see Table 4 and Figure 2, next page). This proportion (of STEM-enrolled, full-time students) among SSA participants exceeded that of the general community college population by 10 percentage points in Fall 2014 and by more than 20 percentage points in Fall 2016. In Fall 2016, 32% of SSA participants were full time and STEM-enrolled at time of entry compared to 11% of community college students.

Although the total enrollment at community colleges has declined, the STEM pipeline continues to grow. The increase in the proportion of (full- or part-time) community college students who enrolled in a STEM program at time of entry—from 17% in 2014 to 20% in 2016—is in the context of a 10% decrease in total enrollment across all sites during that period (from 96,887 to 87,527 students). The proportion of the STEM pipeline participating in SSA (i.e., those who are STEM-enrolled at entry) increased from 3% (764 of 24,790) in Fall 2014 to 5% (1,293 of 24,802) in Fall 2016 (see Table 3, above). As noted earlier, many SSA primary participants do not enroll in a STEM program at time of entry, as SSA is intended to introduce STEM to students that may not be initially interested in pursuing a STEM degree.

Table 4 : Full-time and Part-time Status by STEM Status at Entry, SSA Primary Participants and all Community College Students, Fall 2014–2016*							
		Fall 2014		**Fall 2015**		**Fall 2016**	
		All Students	**SSA Participants**	All Students	**SSA Participants**	All Students	**SSA Participants**
STEM at Entry	Full-time	10%	20%	11%	27%	11%	32%
	Part-time	17%	13%	19%	19%	20%	31%
Not STEM at Entry	Full-time	28%	39%	27%	33%	26%	18%
	Part-time	44%	28%	43%	21%	43%	19%
Total full- and part-time students		**96,887**	**2,313**	**92,671**	**1,886**	**87,527**	**2,058**

*Numbers are only available for fall terms. Counts only include students with valid HEIRS IDs who were enrolled in at least one credit hour.

Figure 2: Percentage of Enrolled Students who are STEM-Enrolled at Entry SSA and All Community College Students, Fall 2014–Fall 2016

II.   Scale of Participation

To date, campuses report having served 17,622 primary SSA participants and 33,947 secondary SSA participants.[20] A summary of participation, by term, is provided in Table 5 (next page). Institution-level data can be found in Appendix B, Table 5A.

- ✓ 7,172 primary participants were supported by SSA in Year 3 with programs such as summer bridge and college readiness initiatives, developmental math preparation, additional tutoring and academic support, scholarships and tuition waivers, STEM career exploration and preparation, and academic advising.

- ✓ 12,590 secondary participants were engaged by SSA in Year 3 with activities that included recruitment events targeted to prospective students (e.g., presentations or visits at high schools, STEM exploration activities at the college campus, and meetings with prospective participants), after-school hands-on STEM workshops, guest speakers, and STEM career exploration events.

Differences in participation numbers across terms reflect general patterns of SSA implementation across sites. These patterns include spring recruitment activities with secondary participants, intensive summer programming with a focused group of primary participants, and ongoing academic year supports for primary participants. For example, at nearly all sites, the number of both primary and secondary participants was higher during the academic year than during the summer, reflecting different program activities and program intensities during these two periods (i.e., summer activities are typically more intensive than those that occur during the academic year).

The number of primary participants during the academic year remained fairly steady between Year 2 and Year 3—and the first term of Year 4 (Fall 2016). The number of primary participants over the summer nearly doubled between Summer 2015 and Summer 2016, likely due (in part) to the initiation of SSA Early College programming in Summer 2016. Engagement with secondary participants continues to be highest in the spring, when sites are recruiting for intensive summer programs. Differences in secondary participant numbers across years likely reflect two trends: 1) the recovery of secondary participant engagement after the 9c funding cuts in Year 2, and 2) the more established presence of SSA within campuses' surrounding communities in Year 3.

During Year 3, all sites served current community college students and high school seniors. Participant populations served by 14 of the 15 sites included high school freshmen, sophomores, and juniors. These data were reported in Year 3 Site Report Surveys (see full analysis in Appendix C). High school student participants in some SSA activities (e.g., summer bridge programs) received college IDs and are therefore reported in SSA Primary Participant counts, however they are not trackable in HEIRS since they return to their high school without enrolling in a degree program at the community college.

 In each term of Year 3, 69–78% of SSA primary participants were new to SSA. 5,224 primary participants engaged in SSA activities for the first time in Year 3. This suggests that SSA is regularly attracting and engaging new participants. It also suggests that a relatively small proportion (20–30%) of SSA primary participants remains engaged with SSA for more than one term. Sites have stressed the importance of ongoing engagement with students to build their connections with peers, staff and faculty, and the

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[20] This is a duplicated count. See Table 5 (next page) for further detail.

institution. These data suggest that most SSA primary participants are not engaging with SSA in this way. Future analyses may use these data to separately assess educational outcomes for SSA participants who have engaged with SSA for multiple terms and those who have engaged for only a single term.

Table 5: SSA Participants by Term and Year									
	Year 1 (Pilot)		**Year 2**			**Year 3**			**Year 4**	
	Spring 2014	**Summer 2014**	**Fall 2014**	**Spring 2015**	**Summer 2015**	**Fall 2015**	**Spring 2016**	**Summer 2016**	**Fall 2016**	**Totals**
Number of primary participants*	448	786	2,769	2,949	941	2,430	2,984	1,758	2,557	17,622
Number of secondary participants†	5,662	2,545	1,741	5,018	1,742	4,192	6,161	2,237	4,649	33,947

*Primary participants are community college students (i.e., participants who have an ID number assigned by their college) who participate in STEM Starter Academy grant funded programs/events/activities.
†Secondary participants are individuals who are not currently enrolled at a community college and participate in STEM Starter Academy grant funded programs/events/activities (i.e., participants who do not have an ID number assigned by their college).

Table 6 (next page) summarizes the student status of SSA primary participants who were first supported by SSA in Fall 2014, Fall 2015, and Fall 2016. Of all the participants who were new to SSA in these three terms, 32% were continuing students during the term they were first reported as a primary participant, 34% were first-time freshmen, 7% were transfer students, 3% were dually enrolled, 3% were readmitted or reactivated, and 2% were non-degree seekers.

In Table 6 (next page), 14% of students in Fall 2014, 17% of students in Fall 2015, and 27% of students in Fall 2016 have "indeterminate status." These students are unable to be tracked because they do not have valid HEIRS IDs or social security numbers and are not registered for a course. However, most of the students with "indeterminate status" were reported by Mt. Wachusett Community College (312 students in Fall 2014, 350 students in Fall 2015, and 446 in Fall 2016). These students likely participated in that institution's Math Modeling Program, in which several hundred high school seniors enrolled in the college's MAT092 developmental math course (but were not part of a dual-enrollment program and therefore did not have a status in the DHE's HEIRS data system). Institution-level data about SSA primary participant student status at point of entry are provided in Appendix B, Table 6A.

Table 6: Student Status at Point of Entry to SSA, Fall 2014, Fall 2015, and Fall 2016								
Student status at point of entry to SSA	**Fall 2014**		**Fall 2015**		**Fall 2016**		**Total**	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Continuing	1,037	40.9%	787	28.7%	699	40.3%	2,523	32.1%
First-time freshman	784	33.7%	507	38.1%	282	16.3%	1,543	34.0%
Transfer	111	4.5%	112	8.3%	146	8.4%	369	6.9%
Dually-enrolled	92	3.0%	49	2.8%	38	2.2%	178	2.8%
Readmitted/reactivated	67	2.6%	41	3.1%	69	4%	177	3.2%
Non-degree	33	1.3%	29	2.2%	32	1.8%	106	1.7%
Seeking another degree	3	0.1%	1	0.1%	0	0.0%	4	0.1%
Indeterminate status[†]	453	13.8%	372	16.8%	467	27%	1,292	19.3%
Total	2,580	100%	1,898	100%	1,733	100%	6,098	100%

[†]This includes those who do not have a SSN, and those who have been assigned a student ID number (for tracking *within* an institution) but have not registered for a course (e.g. high school participants that returned to high school) .

III.   Participant Demographics

There are some indications that SSA might be contributing to diversifying the STEM pipeline in terms of race/ethnicity and gender. Table 7 (page 14) summarizes the racial/ethnic composition of SSA participants across years.[21] SSA primary participants generally reflect the racial/ethnic diversity of the overall population of community college students, suggesting that SSA serves a representative cross-section of community college students. For example, 18% of SSA primary participants identify as Black or African American, 17% identify as Latino, and 45% identify as White, while 13% of all community college students identify as Black or African American, 19% identify as Latino and 56% identify as White.[22] When looking only at STEM-enrolled students, SSA participants are slightly more diverse in terms of race/ethnicity than the general community college population. SSA participants who were STEM-enrolled at time of entry have slightly higher proportions of students who identify as Black or African American (20% vs. 15%), Asian (8% vs. 6%), or Latino (20% vs. 19%), compared with all community college students who were STEM-enrolled at time of entry (see Table 8B in Appendix B).[23]

The racial/ethnic makeup of the SSA and general student populations varied by site, as did site's efforts to recruit under-represented populations.[24] The sites serving the highest proportion of Black or African American students were Roxbury, Massasoit, Bunker Hill and Springfield Technical. The sites serving the highest proportion of Latino or Hispanic students were Northern Essex, Holyoke, Roxbury, and Bunker

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[21] These are duplicated totals. For a summary of the racial composition of SSA students by site, please see Table 8B in Appendix B.
[22] Percentages are calculated out of the students who have race/ethnicity data included in HEIRS (including those whose race/ethnicity was reported as "unknown"). See Table 8B in Appendix B.
[23] These percentages are calculated out of the students who have race/ethnicity data included in HEIRS (including those whose race/ethnicity was reported as "unknown") during Fall 2014, Fall 2015, and Fall 2016. We only include fall enrollment data because fall is the only term where the submission of institutional data is mandatory.
[24] See the Patterns of Practice Section of this report for more information about SSA sites' recruitment efforts.

Hill. These differences generally mirrored the differences in the student populations at each site. That is, the racial/ethnic makeup of SSA participants at each institution generally mirrored the racial/ethnic makeup of the general student population at that institution. Institution-level data about SSA participant race/ethnicity are provided in Appendix B, Table 7A.
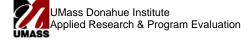
Table 8 (next page) summarizes the gender composition of SSA primary participants across years. A higher proportion of SSA primary participants are male than in the general community college population. 48% of SSA primary participants are female and 46% are male while 57% of community college students are female and 42% are male. There was some variation in gender composition by site. At nine sites, more than 50% of primary participants from all years were female (Berkshire, Cape Cod, Greenfield, Holyoke, Massasoit, Middlesex, North Shore, Northern Essex, and Roxbury). Institution level data about SSA participant gender are in Appendix B, Table 8A. In their Year 3 Site Report narratives, about half of SSA sites qualitatively reported engaging in targeted recruiting activities to attract under-represented groups to their SSA programs, but few of these explicitly aimed to attract female students.

Female SSA participants were more likely to be STEM-enrolled at time of entry than female non-SSA participants. Nearly twice the proportion of female SSA participants were STEM-enrolled at time of entry (42%) compared to that proportion among female community college students as a whole (23%).[25, 26] Advising incoming students about their options for an academic focus—and about STEM programs in particular—is one strategy used at many SSA sites that may contribute to these results. See Table 8B in Appendix B for further details about gender, race/ethnicity, and enrollment status for SSA participants and community college students.

Research on women's underrepresentation in STEM fields at community colleges suggests that the SSA participation numbers are a positive initial indicator.[27] At Massachusetts community colleges, as nationally, men have earned the majority of certificates and associates degrees in almost every STEM field (exceptions are health professions, science technologies, and biological and biomedical sciences). When health professions are excluded, 77% of STEM associates degrees and 80% of STEM certificates earned at Massachusetts community colleges are awarded to men.[28,29]

Nationally, the STEM workforce continues to see an under-representation of women, Blacks or African Americans, and Latinos. In 2015, women made up 47% of science professionals, 25% of computer and math professionals, and 15% of engineering and architecture professionals. More women were represented in biological sciences (55%). Black or African American individuals comprised 9% of computer and mathematical occupations and 6% of architecture and engineering, while Latinos comprised 7% of the computer and mathematical occupations and 8% of the architecture and engineering fields.[30,31]

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[25] See Table 8B in Appendix B. These percentages are calculated out of the students whose gender data is included in HEIRS (including those whose gender was reported as "unknown") during Fall 2014, Fall 2015, and Fall 2016. We only include fall enrollment data because fall is the only term where the submission of institutional data is mandatory.

[26] These counts include only students with a HEIRS ID that enrolled as a STEM major when they entered their institution during Fall 2014, Fall 2015, and Fall 2016. We only include fall enrollment data because fall is the only term where the submission of institutional data is mandatory.

[27] See, for example Gatta (2015). *A Review of the Current Research on Women in Community College STEM Programs*. Wider Opportunities for Women. http://www.wowonline.org/wp-content/uploads/2015/03/Women-in-CC-STEM-Programs-Brief-FINAL.pdf

[28] National Center for Education Statistics, Integrated Postsecondary Education Data System, 2008-2009.

[29] Note that SSA includes health professions among STEM fields, see footnote 9, above.

[30]AFLCIO Department for Professional Employment: dpeaflcio.org/programs-publications/issue-fact-sheets/the-stem-workforce-an-occupational-overview/#_edn22

[31] Liana Christin Landivar (2013), "Disparities in STEM Employment by Sex, Race, and Hispanic Origin," American Community Survey Reports, ACS-24, U.S. Census Bureau, Washington, DC.

Year	Term	Non-resident Alien	Black or African American	American Indian or Alaska Native	Asian or Pacific Islander	Hispanic or Latino (of any race)	White	Two or more races	Native Hawaiian or other Pacific Islander	Race and Ethnicity Reported Unknown	Race and Ethnicity not found in HEIRS
Table 7: Primary Participant* Race/Ethnicity by Term											
Year 1 (Pilot)	Spring 2014	6	33	1	25	89	221	14	0	57	2
	Summer 2014	5	113	1	48	139	394	23	0	56	7
Year 2	Fall 2014	12	485	11	117	468	1,327	75	2	266	6
	Spring 2015	33	546	9	139	467	1,342	86	2	313	12
	Summer 2015	14	101	0	74	196	426	21	0	103	6
Year 3	Fall 2015	34	431	9	125	389	1,195	61	1	175	10
	Spring 2016	55	735	10	149	452	1,354	75	1	112	41
	Summer 2016	34	277	4	89	312	760	45	5	89	143
Year 4	Fall 2016	38	471	7	121	408	954	56	3	362	137
	SSA Total	231	3,192	52	887	2,920	7,973	456	14	1,533	364
		1.3%	18.1%	0.3%	5.0%	16.6%	45.2%	2.6%	0.1%	8.7%	2.1%

*Primary participants are community college students (i.e., participants who have an ID number assigned by their college) who participate in STEM Starter Academy grant funded programs/events/activities.

Year	Term	Male #	Male %	Female #	Female %	Unknown #	Unknown %	Total Number of Primary Participants
Table 8: Primary Participant* Gender by Term								
Year 1 (Pilot)	Spring 2014	182	40.6%	209	46.7%	57	12.3%	448
	Summer 2014	380	48.3%	374	47.6%	32	4.1%	786
Year 2	Fall 2014	1,225	44.2%	1,374	49.6%	170	6.1%	2,769
	Spring 2015	1,367	46.2%	1,378	46.6%	204	7.2%	2,949
	Summer 2015	438	49.7%	427	48.4%	76	8.6%	941
Year 3	Fall 2015	1,158	47.7%	1,172	48.2%	100	4.1%	2,430
	Spring 2016	1,337	44.8%	1,583	53.0%	64	2.1%	2,984
	Summer 2016	884	50.3%	723	41.1%	151	9.6%	1,758
Year 4	Fall 2016	1,086	42.5%	1,183	46.3%	288	11.3%	2,557
	Total	8,057	45.7%	8,423	47.8%	1,152	6.5%	17,622

*Primary participants are community college students (i.e., participants who have an ID number assigned by their college) who participate in STEM Starter Academy grant funded programs/events/activities.

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IV.   Primary Participant Support Service Descriptions: Financial, Academic, and STEM Counseling

Table 9 (below) displays primary participant support service descriptions by year and term, and the number of primary participants who received three categories of services: direct financial support, extra or targeted supports (e.g., tutoring, peer mentoring), and targeted STEM pathway and/or STEM career counseling. The service categories are not mutually exclusive and individual primary participants could receive all three types of services in the same term.

The high percentage of total primary participants receiving each of these supports during summer (64–73%) compared with the academic year (33–63%) reflects an elevated intensity of service provision during summer programming.

Of the three tracked categories of services, extra or targeted supports—such as tutoring or peer mentoring—was most common category during the academic year. Over the summer, the distribution of students receiving each type of support is more even. The proportion of students receiving each type of support varied by year and term.

Table 9: Primary Participants' Service Descriptions by Term and Year*					
Year	**Term**	**Number of primary participants***	**Number of primary participants who received direct (SSA grant subsidized) financial support**	**Number of primary participants who received extra or targeted supports**	**Number of primary participants who received targeted STEM pathway and/or STEM career counseling**
Year 1 (Pilot)	Spring 2014	448	111	103	101
	Summer 2014	786	758	548	505
Year 2	Fall 2014	2,769	1,341	2,002	913
	Spring 2015	2,949	1,079	1,890	942
	Summer 2015	941	507	618	559
Year 3	Fall 2015	2,430	766	1,591	805
	Spring 2016	2,984	1,045	2,240	856
	Summer 2016	1,758	991	864	838
Year 4	Fall 2016	2,557	343	1,527	759
	Total	**17,622**	**6,941**	**11,383**	**6,278**

*Primary participants are community college students (i.e., participants who have an ID number assigned by their college) who participate in STEM Starter Academy grant funded programs/events/activities.

Patterns of Practice Across SSA Programs

Implementation of SSA has evolved over the course of the initiative, moving through phases of open-ended innovation and collaborative model development in the first two years and alignment of program implementation with the model in Year 3. DHE launched the SSA initiative at scale in 2014—with implementation across all 15 sites within months of distributing initial funding in January. During the first phase, DHE encouraged sites to innovate and tailor SSA activities and interventions to best meet the needs of their participants. This flexibility resulted in a wide range of practices and strategies being implemented by the campuses. During the second half of Year 2, DHE engaged campuses in a collaborative process to develop an implementation model based on campus practice and system-level data. Campuses subsequently worked to align their program implementation efforts with the SSA model's goals and metrics (outlined below) and these were used to guide site-level planning for Year3.

The SSA model was not meant to be entirely prescriptive, as DHE was clear that one of their intentions was to foster and support innovation at scale. In Year 3, SSA programs coalesced around common model elements even as practices within the different model components continue to vary across campuses. SSA sites also worked in Year 3 to integrate their more established SSA elements into their campuses and communities.

This section takes a cross-campus perspective to present emerging patterns in implementation. It focuses on Year 3, but also includes trends and insights that have emerged over time.

Specifically, this section addresses the following three evaluation questions:

- Which practices and strategies, implemented through SSA, are considered the most promising by key stakeholders in terms of contributing to the achievement of the initiative's goals?

- What similarities and differences in program features, implementation strategies, and contextual variables can be identified across SSA institutions?

- What key lessons have been learned about implementing and facilitating the SSA initiative?

This section includes the perspectives of multiple SSA stakeholders, including campus SSA coordinators and administrators, SSA participants, and DHE personnel.[32] Data presented in this section about SSA sites' practices and strategies have been synthesized primarily from campus-reported perspectives.

Differences between these perspectives and the findings presented elsewhere in this report may be due to a number of factors including: varying standards of evidence across sites, differences between the populations that are tracked at the initiative level and those of highest salience to SSA campus-implementers, and distinctions between campus definitions of evaluation metrics (e.g., which programs count as STEM) and those used by DHE.

After a summary of key findings, this section includes three parts: an overview/review of the SSA model, a summary of common SSA practices and strategies reported by sites in Year 3, and a synthesis of stakeholder reflections on SSA implementation.

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[32] Data sources for this section include four Year 3 data collections (each detailed in the methods section): interviews with administrators at each SSA site in spring 2016, Year 3 Site Report surveys, Year 3 Site Report narratives, and interviews with DHE administrators in winter and fall of 2016. These data are supplemented with highlights from the first (summer 2016) Student Experience Survey, fall 2016 site visits to six sites, and a winter 2017 DHE interview.

Summary of Key Findings

<u>Key Finding</u>: **Program implementations across sites show evidence of incorporating and integrating SSA model elements and lessons from inter- and intra-campus work. Campus visions for SSA have coalesced even as practices continue to vary across campuses.**

✓ **The practices implemented by sites (see Figure 4, next page) reflect the SSA model and also reflect inter-campus collaboration.**[33] Year 3 saw widespread implementation of college and STEM readiness programs, academic support, advising, and career and transfer exploration. Early College High School programs—implemented through SSA for the first time in 2016—showed a high degree of alignment with the SSA model and consistency across sites.

✓ **Campuses have developed increasingly consistent visions for supporting student access and success in STEM fields.** Campus reporting on the key or main components of their institution's SSA program (i.e., integrated supports, college and STEM readiness experiences) and their messages to stakeholders about SSA (i.e., as a springboard for entry into STEM and an engine of STEM support) showed more widespread agreement in Year 3 than in Year 2.

✓ Reports indicate continued variation across sites in their views of which practices were most promising or effective. Advising, collaboration, community-building, academic support, and faculty involvement were among the practices noted by sites as promising or effective for reaching initiative goals. Many sites engage in these practices and some consensus about implementation is emerging.

<u>Key Finding</u>: **Shifts in practice and funding suggest that SSA sites are building capacity and looking forward, but sustainability may be piecemeal.**

✓ **Sites' increasing attention to preparing students for post-graduation suggests a progression in implementation of the model.** An increased emphasis on and consistency of strategy, in Year 3, regarding activities designed to transition students beyond graduation (into jobs, careers, or transfer) suggests a progression through the model with increasing attention to completion.

✓ **Sites have shifted greater energy to tracking participant outcomes, and some sites attribute increased student engagement, participation, and academic achievement to elements of their SSA programs.** Two thirds of sites reported tracking indicators of students' academic progress—including GPA, progress in developmental math courses, retention, credit earning, and internship placements—in Year 3, as compared to about half of sites in Year 2. Also in Year 3, about half of sites reported that these indicators were positive for some of elements of their SSA programming.

✓ **Shifts in the use of SSA funding in Year 3 suggest that sites are building capacity that might continue beyond the life of the grant.** A few SSA elements saw consistent implementation from Year 2, but decreased use of SSA funding, suggesting possible institutionalization.

✓ M**ost sites did not see the SSA programs on their campuses (the aggregation of the smaller elements) as sustainable, but many were pursuing options for sustaining some of the pieces.**

<u>Key Finding</u>: **SSA institutions benefit from SSA-supported integration and alignment of on- and off-campus endeavors to support STEM students. Sites report that students benefit from service integration.**

✓ **Campuses report increased integration of SSA on their campus and in their community.** Sites report that SSA activities are well aligned with other campus endeavors or grant-funded initiatives. Academic support, career readiness, and admissions and recruiting were the most common areas of collaboration. Sites continue to value opportunities for coordination and collaboration.

✓ **Sites report that the increased capacity, achieved through SSA, facilitated expanded partnerships**, including collaboration across departments on campus and with external partners such as local STEM industries, 4-year schools, and community agencies.

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[33] A similar figure was presented in the SSA Year 2 Evaluation Report. This figure has been updated with findings from Year 3.

I.   SSA Model

The SSA model contains four major components—recruitment, readiness, retention, and completion—organized into two major goals, each with related metrics and supporting strategies.[34] See Figure 3 (below) for a summary of the model goals, metrics, and strategies.

Figure 3: SSA Model Goals and Metrics

Recruitment > Readiness > Retention > Completion

Goal: To increase the number of students entering STEM programs at the community colleges.

Goal: To increase the number of STEM graduates and certificate holders produced by the community colleges and transfer to a 4-year university or obtain STEM employment.

Metrics include:

STEM program enrollment

Program application and participation rates

Developmental math enrollment

Transfer rates into STEM programs of study

Changes in STEM interest following participation in SSA programs.

Metrics include:

Student retention rates

Completion indicators (e.g., STEM degrees and certificates earned, transfer rates to 4-year institutions, rates of obtaining STEM employment)

Measures of SSA impact on student experiences.

Figure 4: Common SSA Model Practices and Strategies Across Campuses, Year 3

Recruitment > Readiness > Retention > Completion

Relationship building

Summer programs

College skills

STEM Coursework and mathematics preparation

Classroom and laboratory infrastructure

STEM exploration

Intra-campus integration of support

Cultivating community and connection

STEM Advising

Academic support

Direct financial support

Experiential opportunities

Career preparation

Building connections to industry

Transfer programming and alignment

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[34] The SSA model is available from DHE upon request.

II. Overview of SSA Practices and Strategies in Year 3

Based on data from Year 3 site report narratives and surveys, practices and strategies at SSA sites remained fairly consistent from Year 2 to Year 3 and were well aligned with the SSA model. Site administrators report having established the outlines of their SSA program plans but are continuing to make adjustments and introducing elements of new programming. Notable changes include:

- Increased focus on high school populations in recruiting for Early College programs

- Common emphasis across sites on summer bridge programs, math and college readiness, academic support, advising, and community building

- Increased emphasis on completion activities

- Introduction of Early College programming consistent with SSA model practices

- Data and measurement practices that emphasized tracking student academic progress

Summer Bridge at Berkshire Community College

Recruitment: Consistent activities, new focus on Early College in Year 3

Site-reported data from Year 3 suggest that SSA campuses implemented recruitment strategies that were generally similar to Year 2, with an additional emphasis in Year 3 on recruiting high school participants to Early College programs. Recruitment strategies included: events at community college campuses; targeted contact through email, letters, or phone calls; outreach with community college faculty and students; visits to high schools; and events with high school faculty and staff.

Relationships key to recruitment

In their narratives, sites emphasized the importance of relationships in their recruitment strategies – both internal and external to their college. Externally, sites reported building relationships with particular institutions and individuals at those institutions. Internally, SSA administrators built campus-based collaborations to facilitate recruiting, such as partnerships with admissions offices and other programs targeting similar populations. Most sites reported engaging faculty in their recruitment efforts, both external and internal.

Peer-facilitated math tutoring at Bristol Community College

Half of campuses reported making targeted efforts to recruit under-represented populations

Efforts included partnering with campus programs or offices (e.g., LSAMP, Adult Basic Education) that serve these populations, recruiting from high schools with high proportions of under-represented groups, including students and staff from under-represented groups in recruiting materials and efforts, and working with community organizations. Many of the remaining campuses reported that their college populations were already diverse and therefore no additional efforts to target specific groups were necessary.

Readiness: Summer bridge and math preparation keys to readiness

SSA sites' strategies for readying students for college and STEM focused around college readiness programs or events, STEM exploration or coursework, and mathematics preparation or coursework. When asked about their most successful SSA-related strategies to ready students for college or STEM fields in Year 3, sites most commonly listed summer bridge programs and mathematics preparation/support, which overlapped at many sites. Nearly every SSA site offered summer programs that combined elements of STEM exploration, college readiness, and math preparation – often supported by tutoring and advising or coaching.

Every site offered math preparation programs (non-credit), coursework, or math-focused tutoring as part of their SSA programming for incoming and current students.

Every site offered math placement test refresher or bootcamp programs, two thirds with SSA funding. The number of sites offering accelerated or self-paced math courses increased slightly from 13 sites in Year 2 to 14 in Year 3; however, the proportion of sites using SSA funding to support these courses decreased from 10 of 13 sites (77%) in Year 2 to 8 of 14 sites (57%) in Year 3.

See the Outcomes section of this report for data on SSA students' participation and completion of developmental math.

Facilitated study group session
at Bunker Hill Community College

College readiness programs and college skills events were widespread at SSA campuses in Year 3.

Fourteen sites reported each activity, and the number of campuses implementing the latter increased slightly from Year 2. The majority of each of these types of programs were funded through SSA, and the proportion funded through SSA grew between Year 2 and Year 3 (for college readiness programs, from 57% to 71%; and for college skills events/speakers, from 67%—8 of 12, to 93%—13 of 14).

SSA funded coursework was common.

Twelve sites (80%) supported developmental math coursework, and 10 sites (67%) supported STEM introductory courses through SSA in Year 3 (all sites offered such courses). The proportion of sites funding both types of coursework with SSA funds increased from Year 2 to Year 3. Only a handful of sites (3) offered advanced STEM coursework with SSA funding in Year 3.

Peer tutors at Quinsigamond Community College's
Math Center

Efforts to improve courses through STEM faculty professional development, curriculum revision, or classroom/laboratory equipment were also widespread in Year 3.

More sites used SSA funding to support STEM faculty professional development or curriculum revision activities in Year 3 than had in Year 2. The proportion of sites using SSA funding for

professional development for faculty who teach STEM courses increased from 4 of 12 sites (33%) in Year 2 to 9 of 13 sites (69%) in Year 3.

In their narratives, sites described offering faculty professional development in co-requisite remediation for mathematics, course re-design to include more engaging student learning activities, curriculum revision to increase content rigor, and teaching with specific campus resources such as a Fab Lab or robotics technology.

> Roxbury Community College reported innovations in developmental math and science pedagogy in 2016-2017. Supported by SSA, the college piloted co-requisite remediation in Pre-Calculus, Statistics, and Biology I, and the college reports that preliminary results suggest higher retention rates with the co-requisite model.

SSA sites continued to invest in classroom technology or laboratory equipment in Year 3, mostly with SSA funding. More than two thirds of sites used SSA funding to support these investments (11 funded classroom technology and 12 funded laboratory equipment) and these numbers remained the same in both years. Two sites invested in each of these elements without SSA funding in Year 2. This decreased to one site in Year 3.

Retention: Academic support, advising, and community building

Academic support, advising, and community building continued to be the top three retention strategies reported in narratives across SSA sites. Direct financial support was also widely implemented in Year 3.

Academic support.

In narratives, nine sites described a variety of tutoring and academic support strategies, including peer tutoring, faculty facilitated study groups, staffed math spaces, embedded classroom support, and math boot camps. In the survey, peer and professional tutoring and supplemental instruction or facilitated study groups were fairly widespread in Year 3, implemented by 14 or 15 sites each. The majority of sites (80% or more) supported these activities with SSA funding in Year 3. For supplemental instruction/facilitated study groups, this marked an increase in the proportion of sites using SSA funding from Year 2 (from 69% - 9 of 13, to 86% - 12 of 14).

Advising.

Eight sites reported in their narratives a variety of models of STEM-specific advising among their retention strategies; these typically involved active progress checks and regular contact. STEM-specific advising and intrusive advising were each reported by 14 sites in the survey, and funded through SSA by 13 sites (93%) in Year 2 and 11 sites (79%) in Year 3.

Community building.

Nine sites reported in their narratives supporting student persistence through various forms of ongoing engagement or community building. These strategies included STEM clubs and informal community building activities, peer leadership, providing STEM-specific space, and requiring participation in activities tied to next-term scholarships. A few sites highlighted intensive engagement opportunities that involved leadership and building peer connections such as serving as a peer tutor, a research intern, or being on the college's robotics team.

Students at a "STEMnasium" open house event at Cape Cod Community College

Survey results indicate that these types of supports were widely implemented in Year 3 (by 2/3 or more sites) and included cohort meetings and activities, peer mentors, coaching or support from SSA coordinators, and STEM specific studying or gathering space. With the exception of studying or gathering space, the majority of implementing sites also used SSA funding to support these activities. Notable changes between Year 2 and Year 3 include an increase in the number of sites with peer mentors (from 11 to 13) and a decrease in the number of sites using SSA funding for studying or gathering space (from 9 to 6).

An SSA research intern at Massasoit Community College explains her work at a public poster session

Financial support.

Every SSA site offered some form of direct financial support in Year 3 (including scholarships, participation stipends, textbook lending, book vouchers, or paid internships), with half to two thirds of sites offering each, and the majority of sites using SSA funding for these supports. Between 10-12 sites offered scholarships, participation stipends, book vouchers, or textbook lending in Year 3. This is similar to Year 2. Seven sites offered paid internships in Year 3, while only four had offered such internships in Year 2; both years were entirely funded through SSA. Although the number of colleges that offered scholarships remained the same (12), the number of sites that used SSA funding for scholarships increased from 8 in Year 2 (67%) to 10 in Year 3 (83%). Several sites indicated pursuing other options for elements of this support (such as seeking scholarship funds from their foundations or from industry).

Northern Essex Community College reported saving SSA students $17,955 during the 2015/2016 academic year: 106 SSA students borrowed 175 books, workbooks, calculators, or access codes. Eighty (75.4%) of those students remained enrolled in a subsequent semester.

Completion: Building industry connections, transfer programming, and career exploration

Campus narrative reporting reflected greater attention to post-graduation and more coherence of strategy—focused around building both student and institutional connections to industry, offering transfer programming and engaging in transfer alignment, and offering career workshops or fairs (each reported by 10 or more sites)—in Year 3 than in Year 2. Two other strategies—support for placement in internships or research experiences and targeted STEM advising, coaching, or mentorship—were also commonly reported (by 8 or 9 sites each) in Year 3. Intensive experiential opportunities such as research internships and professional mentoring were also noted as important completion strategies.

Berkshire Community College SSA student with President Kennedy at commencement

Professional development opportunities for students were among the SSA elements that saw consistent implementation from Year 2, but decreased use of SSA funding—suggesting possible institutionalization. These opportunities included research experiences, professional mentorships, and professional development (such as attending conferences). The number of sites offering these opportunities remained steady or grew from Year 2 to Year 3, but the proportion of sites funding these opportunities

through SSA remained steady or decreased. The exception is internships, which were implemented by the same number of sites both years but saw a small increase in use of SSA funding in Year 3.

Building industry connections.

In their narratives, sites described two primary activities for building connections with industry: 1) student visits to local industries and/or industry representatives' visits to campus, and 2) cultivating relationships with employers through regular communication, course and skill alignment work, or advisory boards.

- **Most sites engaged industry speakers or instructors**, according to surveys, both in Year 2 (13 sites) and Year 3 (15 sites), with the majority of sites using SSA funding for these activities. The number of sites using SSA funding for these industry speakers or instructors remained stable, but the proportion decreased from Year 2 to Year 3 (from 85% to 73%), as more sites implemented these activities without SSA funding in Year 3.

> MassBay reported that the retention rate from Fall 2015 to Spring 2016 among participants in their STEM Mentor Program was 89%. In Year 3, they reported 31% of the mentees obtained a STEM-related job or internship and 24% transferred to a 4-year institution.

- **At least two thirds of sites offered other industry-engagement activities** (industry-aligned curriculum development, industry advisory boards, and industry-based internships), the majority without SSA funding. However, the number of sites using SSA funding to support each of these activities grew slightly between Year 2 and Year 3. Most notably, the number of sites supporting industry-based internships with SSA funding grew from 2 in Year 2 to 5 in Year 3.

Transfer programming.

In sites' narrative reporting, transfer programming was a bit more varied, and included campus visits to 4-year institutions, transfer workshops and fairs, transfer counseling/advising, and course alignment and degree transfer pathway development.

Surveys indicated that all sites offered some form of transfer-focused events, activities (including field trips), or speakers, and half or more used SSA funding to support these activities. This is similar to Year 2. In Year 2, every site offered transfer-specific advising for STEM fields. There was a slight decrease in Year 3 in the number of sites that offered this kind of advising as well as transfer-focused field trips. However, the proportion of sites using SSA funding to support transfer-specific advising for STEM fields increased from 60% (9 of 15) in Year 2 to 85% (11 of 13) in Year 3. This timing reflects an increased programmatic focus on transfer and job placement among SSA sites and coincides with the readiness of some more-senior SSA participants to engage with these topics.

Career exploration.

Targeted workshops (e.g., resume and cover letter development, interviewing skills) were the most common career-oriented activity reported in narratives, but a handful of sites also reported supporting or hosting STEM-focused career fairs (or a STEM-focused section at such a fair), and a few sites also offered targeted networking opportunities between students and STEM professionals.

Middlesex Community College Students at an interviewing skills workshop

Career exploration activities (including career advising, career exploration speakers or events, field trips, and internships) were widely implemented by SSA sites in Year 3, according to surveys.

- The number of sites offering each of these activities either remained stable or moderately increased between Year 2 and Year 3.

- With the exception of internships, the majority of sites funded these activities with SSA funding. The number of sites offering internships (13) remained stable between Year 2 and Year 3; however, there was a small increase in the number and proportion of sites using SSA funding to support these internships—from 4 of 13 (30%) in Year 2 to 6 of 13 (46%) in Year 3.

- The opposite was true for research opportunities, which were offered by 10 sites in both years, although use of SSA funding for these decreased from 8 sites (80%) in Year 2 to 5 sites (50%) in Year 3. More colleges offered professional mentorships in Year 3 (9) than in Year 2 (7), largely without SSA funding (7 without SSA funding in Year 3 and 4 in Year 2).

Early College: Campus implementation consistent with overall SSA programming

SSA Early College High School (ECHS) summer programs overwhelmingly reflected the same general pattern of activities that sites were implementing with their new-to-college or new-to-STEM populations. Sites offered 1-6 week programs that combined elements of hands-on STEM exploration, career awareness, math preparation, and college readiness. The exception to this pattern was industry engagement and transfer programming, which fewer sites incorporated as part of their SSA ECHS programs. The details of local implementation varied; however, there was a relatively high degree of similarity in what elements sites reported including in their ECHS programs.

In surveys, two thirds or more of sites reported offering each of these activities as part of their SSA ECHS endeavors, most with SSA funding:

- At least one form of **social support**, including cohort meetings or activities, peer mentors, coaching or support from an SSA coordinator, or studying or gathering space for students

- **STEM exploration** workshops

- **Career exploration** events or activities

- **College skills** events/speakers or **college success courses**

- At least one form of SSA-supported **direct financial assistance**, including scholarships, participation stipends, book vouchers, or textbook lending

Summer Bridge Students
at Springfield Technical Community College

- **Coursework**, including STEM introductory courses, developmental math courses, and advanced STEM courses (most of these were offered at the college campus, but some were offered at the high school)

- **Academic support**, including peer or professional tutoring, supplemental instruction, or facilitated study groups

- **Advising**

Data and Measurement: Continued interest in student-level outcomes and increased tracking of students' academic progress

Strong interest in site level student outcomes; widespread tracking of students' academic progress

- Many sites reported strong interest in the measurement of site-level student outcomes. SSA sites tracked a range of information about SSA participants for their *internal* purposes, including student participation in SSA activities, student experience data, and academic progress.

- Notably, two thirds of sites in Year 3 reported tracking indicators of students' academic progress, including GPA, progress in developmental math courses, retention, and internship placements. Only about half of sites reported tracking these types of indicators in Year 2.

> Mount Wachusett Community College reported strong credit accumulation among their summer 2016 Academy cohort (31 students), who completed 204 of 216 attempted credits. All 31 students also enrolled fall semester for 405 credits.

- Eight sites reported a variety of strategies to track student participation, including recording traffic via sign-in kiosks, gathering reports from service providers (tutors, career counselors, coaches), and developing attributes in campus-based databases.

- Seven sites reported gathering student experience data and program feedback for internal purposes. A few sites reported strategies for tracking impacts of SSA activities or students' plans/activities after leaving the program or community college.

- Two thirds of sites reported measurement priorities beyond the required statewide data collections. Most of these (8 sites) included student outcomes at the site level, including retention, academic progress, graduation and transfer rates, and job placements.

III.   Stakeholder Reflections: STEM integration, building community, increased visibility for community colleges

Overall, stakeholders find that SSA has contributed to integrating STEM efforts at institutions; building community among STEM students, faculty, and staff; and raising the visibility of community college STEM programs both on campus and in the community.

Reflections on SSA in Year 3 were gathered from campus administrators (SSA coordinators and deans), students, and DHE staff. Campus administrators from all sites were briefly interviewed over the phone in Spring 2016. Other campus perspectives come from Year 3 site report narratives. A Student Experience Survey instrument designed to capture student perspectives across institutions was first implemented in Summer 2016 and these preliminary data are summarized here. Finally, reflections from DHE staff on the initiative were gathered through a series of interviews in January and October of 2016 and February of 2017.

> Holyoke Community College reports that positive experiences with SSA have led former participants to serve as program ambassadors. Former SSA participants spoke highly of the program at division meetings, and serve as peer mentors as well as ambassadors for program recruitment.

A. Campus Perspectives

The bulk of the Year 3 site report narrative instrument focused on asking about SSA activities that took place in Year 3 (see Appendix D for instrument). However, a small section of the instrument asked sites to reflect on SSA at their institution over the first three years. This retrospective overview included questions about the key components of the institutions` SSA programs, sites' perspectives on the most

successful SSA strategies or practices, and sites' messaging about their SSA programs. This section on campus perspectives first presents these retrospective reflections and then captures campus reflections on Year 3 implementation.

Retrospective look at the first three years

Key Components: Building STEM community and readying students for college and STEM

Campuses' reporting on the key or main components of their institution's SSA program showed more widespread agreement in Year 3 than in Year 2. Year 3 site reports emphasized that building community around STEM and readying students for college and STEM fields were central to SSA programs across campuses.

- Two thirds of sites reported that the key components of SSA implementation at their site included variations on creating integrated, centralized, positive experiences that help build STEM community.

- College and STEM readiness experiences—including summer bridge programs, credit and non-credit mathematics, STEM exploration and college readiness courses and workshops—were also reported by two thirds of sites as key components of their SSA implementations.

Promising Practices: Varying views on which SSA practices and strategies contribute to the achievement of the initiative's goals

Sites varied in which SSA strategies they emphasized as most successful, overall, at their institutions; however, at least a third each named targeted advising, intra-campus collaboration, cultivating community, attending to outreach, providing academic support, and faculty involvement.

The following strategies and practices combine those most commonly highlighted by sites in their Year 3 interviews and Site Reports.

- Advising

- Intra-campus collaboration to provide integrated and articulated supports

- Relationship building with schools, community organizations, and faculty

- Cultivating community and group identity among students

- Providing academic support

- Summer bridge programs that include elements of STEM exploration, college readiness, and math preparation

- Building student and institutional connections to industry

- Transfer programming and pathways alignment

- Career workshops and fairs

- Experiential opportunities

> North Shore Community College reports preliminary positive results from Tutor Linked Courses (TLC). Withdrawal rates from CHE104 were 60% lower in sections with TLC leaders compared to those without. Sections with a TLC leader also had a 0% failure rate.

Messaging: SSA as a springboard and engine

Sites' messages to stakeholders about their SSA programs also showed convergence compared to Year 2 and focused on two related themes—SSA as a springboard for entry into STEM, and SSA as the engine of a centralized STEM student support network.

- Nine sites emphasized engaging, preparing, and promoting student entry into STEM fields, including expanding and diversifying this pipeline of students.

- Eight sites reported focusing on supporting students through a network of linked services that encourage persistence and connection.

- Other stakeholder messages included emphases on preparation for careers and transfer and increasing student engagement and connections to each other, to the college, and to STEM.

Reflections on Year 3 implementation

Year 3 Successes

- **Outreach and participation.** Two thirds of sites reported outreach and participation among their main successes of Year 3. Named successes included increased participation or enrollment, growing awareness of STEM fields or programs, and outreach by current and former SSA participants serving as leaders or program ambassadors.

- **Academic achievement.** Half of sites reported some SSA participants' academic achievement among Year 3 SSA successes, including rates of developmental math completion, retention, and credit earning or general progress toward completion. This focus on impacts reflects program development since Year 2, when reports of success focused on sites' ability to *offer* opportunities and support, but outcome data had not yet become widely available.

> At Greenfield Community College, SSA helped to increase Math Studio staffing and professional tutoring. They report summer bridge participants benefitting with a 100% class completion rate, 70% of participants earning a B or better, and 90% earning a C or better in their class.

  Most sites that tracked and reported outcomes did so for specific groups of students (e.g., a summer bridge cohort) or for specific activities (e.g., a course with an embedded peer tutor). Thus, these results differ from those reported in other sections of this report, which reflect outcomes for other groups of students (e.g., first-time, full-time fall enrollees) analyzed across sites at the initiative level.

- **STEM integration.** A third of sites each reported as successes various forms of STEM integration on campus; increased opportunities for experiential learning or career and transfer activities; and positive outcomes from experiential learning opportunities such as student placements, strong relationships, and student preparedness.

Benefits to Institutions: Expanded opportunities or supports for STEM students and improved college visibility and reputation

There was some coherence in sites' assessments of the benefits of SSA to their institutions, with nearly two thirds of sites reporting expanded opportunities or supports for STEM students as a major benefit to their institutions.

- **Improved or expanded opportunities or supports for STEM students.** Nine sites listed improved or expanded opportunities or supports for STEM students among the main benefits of SSA to their institutions. Improved or expanded opportunities included professional development, STEM career exposure, college success strategies, improved curriculum, and a hack-a-thon activity. Supports included professional mentorship, career services, STEM-specific advising, tutoring, and improved community and culture around STEM.

- **Improved visibility and reputation of the college.** Nine sites reported that SSA had improved the visibility and reputation of their college as a STEM destination or had increased or diversified enrollments in STEM.

- **Additional capacity to support STEM initiatives.** Seven sites reported additional capacity to support STEM initiatives as a key benefit to their institutions through SSA. Additional capacity included resources for pilot testing, innovative approaches to increasing student success and persistence, and staff to support STEM-focused programming. Sites also noted expanded partnerships, including collaboration across departments on campus and with external partners such as community agencies, as a benefit of increased capacity. For example, one site reported that SSA supported the development of a strategic vision for STEM education on campus. Another site reported leveraging SSA success to obtain additional grant funding.

Implementation Challenges in Year 3: Recruitment, resource limitations, and student data procedures

The main implementation challenges reported by sites in Year 3 were recruitment (8 sites), resource limitations and especially staffing (7 sites), and student tracking, data collection, and reporting (6 sites). Recruitment challenges included populating summer bridge or Early College programs and generating attendance at campus events and workshops (e.g., career-oriented activities). Of the sites that reported resource limitation challenges, four reported that the time-intensive nature of student support required more staff time than was available. A fifth had experienced turnover in program staff that had set them back. Two sites experienced higher levels of participation than in the past, and this created challenging resource demands.

- **Recruitment.** Program establishment has ameliorated some challenges to recruiting new participants to SSA bridge programs; however, recruiting students to on-campus events (especially career or industry-focused events) remained a challenge for many sites.

- **Resource limitations.** Many sites felt that the most promising practices for engaging, retaining, and graduating students were labor intensive, and this led to challenges related to limited staffing resources.

- **Funding uncertainty.** Unpredictability in funding from year to year made it more difficult to establish programs and recruit and retain qualified staff.

- **Data collection and reporting.** Managing student-level data is an ongoing challenge for sites, especially given resource limitations, but sites continue to be interested in making data-driven decisions and data collection efforts are beginning to pay off as sites are better able to document student progress and outcomes. Several sites sought technical assistance with data collection and measurement. A few sites used SSA funding to secure the support of a member of the Institutional Research staff.

- **Process and scope.** Site administrators reported pros and cons to the process of narrowing the scope of the initiative down to common metrics after initially providing flexibility. Several

advocated for the reverse process of starting with common metrics and allowing flexibility within those.

Sustainability: Some progress toward institutionalization, and anticipated piecemeal sustainability

- **SSA activities well aligned and integrated with other campus endeavors or grant-funded initiatives.** Asked about their progress on integrating SSA activities at their institutions, sites reported that SSA activities were well aligned with other campus endeavors or grant-funded initiatives. Academic support, career readiness, and admissions and recruiting were the most common areas of collaboration. Eight sites reported partnerships between SSA and either college academic support centers or other grant-funded initiatives to provide tutoring or academic coaching.

- **Sites strategize to sustain elements of SSA.** Many sites explained that sustaining the entirety of their SSA programs would be unlikely once grant funding ends. Instead, sites reported strategies to sustain particular SSA program elements: seven sites reported collaborating with campus programs and offices to support SSA elements, and six sites reported pursuing outside funding, including several that were developing or had submitted NSF grant proposals.

- **Sites reported mixed progress toward sustaining SSA initiative elements at their campuses.** Successes include seven sites where STEM student support staff (e.g., STEM advisor, STEM career specialist) have been or are anticipated to be institutionalized.

Initiative Facilitation: Productive coordination and collaboration, positive feedback on DHE leadership

- **Students benefit from cross-campus coordination and collaboration**. Sites reported that on-campus coordination and collaboration allowed for more efficient outreach and recruiting and better integration of services provided to students.

- **Site administrators had overwhelmingly positive feedback about DHE's organization and facilitation of the SSA initiative.** Feedback included appreciation of DHE's responsiveness, flexibility, guidance, and communication with legislators and higher-level administration. They also appreciated that DHE consistently solicited campus input.

B. Student Reflections: Gains in awareness, confidence, connections, and performance.

Student Experiences, Summer 2016. The Student Experience Survey, developed collaboratively by SSA sites, DHE, and UMDI, was designed to measure SSA participants' perceptions of their experiences and sense of self-efficacy as a result of participating in SSA programs and activities. It was administered at all sites for the first time in summer 2016.[35]

- **Instructors and mentors were the most commonly cited strength of SSA or STEM programs.** Among the students surveyed, this was followed by increased readiness for the fall semester, connections with other students, and career readiness. Advising, college readiness workshops or courses, and free textbooks or access codes were also highly rated by students in terms of

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[35] These results are preliminary and come from the first implementation of this instrument. The number of respondents, the supports they received, and the types of activities in which they participated vary substantially across sites.

helpfulness. Additionally, most respondents who rated STEM-related activities found them to be helpful. Figure 5, on the next page, captures these sentiments visually: a "word cloud" of student feedback about program strengths illustrates patterns in students' responses.

- **Student feedback regarding potential program improvements focused on having more opportunities similar to those that were already offered**, including more staff, more STEM programs overall, and more time—to understand concepts, to complete assignments, or to engage in activities and field trips.

- **A majority of students reported that participation in SSA has contributed to their academic success and equipped them to further their pursuit of STEM learning**. More than half of respondents agreed that SSA has provided each of the following benefits:

  o Gaining knowledge/awareness of available academic supports and resources on campus

  o Expanded knowledge of STEM majors and of transfer processes and options

  o Improved performance or achievement in courses

  o Improved STEM self-efficacy, including:

      ▪ understanding of content in STEM courses

      ▪ confidence in ability to use STEM-related knowledge and skills outside of school

      ▪ stronger connections with faculty and other students

Figure 5: Word Cloud of Student Experience Survey Open-ended Response Feedback on Program Strengths*
(Most commonly used words – size reflects frequency of use)

*Student open-ended responses regarding program strengths ranged from 1-5 words.

Student focus groups, Fall 2016. In focus groups at six sites visited by UMDI in Fall 2016, students expressed appreciation for the advising and guidance they received through SSA, their sense of community, belonging and connection, the academic head start they gained, and the introduction to STEM fields, careers, and professionalization. Figure 6 (below) presents a sampling of student quotes that illustrate these sentiments.

Figure 6: SSA Student Quotes from Fall 2016 Site Visits

"Being here with the math cluster was **the first time that I ever made any actual connections with people** … Now I have 3 other people from my math cluster in classes this semester … I have never had a school friend [before this]. It's really nice. I don't think I would have made relationships like that without being in [this program]."

Bunker Hill SSA Math Cluster Participant

"Coming into this environment [at the Pathways Center] … **makes me feel like I do have a place. … I'm not to be counted out** because I'm a minority, I come from an impoverished family, I'm a woman. I can study [science] if I want to. And I'll be successful … if I take advantage of the services that are here."

Middlesex Pathways Center Peer Mentor

"We are treated as professionals. We treat this as a job—as our future job. So, **we are held to high standards. I think that prepares us for our future career.**"

Massasoit Research Intern

"Before I met [the STEM advisor] I wasn't thinking science or math. I was just going in a general direction. I **didn't have a direction. I now I have something that I can say I want to do 20 years down the road.**"

Cape Cod Student

"I used to … as soon as my classes were done, I was like 'boom! I'm out'. And now that I am in this community, I spend time here. I'm doing research. I'm being in the building. **I'm being among scientists and really being involved.**"

Massasoit SSA Research Intern

"All the degree programs are set up for typical students… missing any link in that chain of classes … sets you back by at least a semester. So, for someone in an atypical spot like me … **being able to condense two semesters worth of math into a summer was absolutely invaluable.**"

Bunker Hill SSA Math Cluster Participant

"[The summer bridge] was really helpful. It gave me an idea of what is there in technology and science. So it's also helping me with my major and what I want to do. **It gives me a start – an idea of what I would need or what to work on.**"

QCC Student

"The field trips to industries are very helpful because they allow us to understand what the industry is expecting of us and **how we can shape ourselves to meet the requirements of the industry.**"

Bristol student

C. Reflections from Leadership: Campus participation, breaking down silos, embedded practice

UMDI conducted interviews with DHE personnel who guide the STEM Starter Academy Initiative at the statewide level on January 19, 2016, October 18, 2016, and February 14, 2017. The interviews were each one hour and included the Associate Commissioner for Economic and Workforce Development and the Executive Director of STEM. A comprehensive summary of the 2016 interviews can be found in Appendix E. The following brief summary highlights key elements of all three interviews.

Challenges

- **Varying levels of innovation and change across the sites.** DHE staff observed that differing levels of knowledge and/or "empowerment" to implement recommended changes, including best practices, may account for differing implementation across sites.

- **"Getting the message out" and "telling the story" of SSA**. DHE plans to engage with a broader audience, moving beyond a subset of campus representatives to presidents and additional

stakeholders in order to communicate the lessons and learnings that have emerged from the SSA initiative thus far.

Successes

- **The model and campuses' adoption of the model.** DHE personnel observed that campuses' Year 3 and Year 4 plans reflected movement toward the program model that was developed in Year 2. SSA sites placed greater emphasis on strategies to help place students into jobs, expose them to careers, and help them transfer to 4-year schools—strategies which had previously received less attention as campuses focused on recruiting, enrolling, and supporting students.

- **Evidence of breaking down silos.** DHE found over the course of Year 3 that work to connect SSA to other programs was helping to demonstrate the relationships between efforts such as developmental math, transfer planning, and Early College programs. Noting that other groups are now interested in partnering through SSA, one speaker commented in the 2017 interview, "It's become this community where we can make sure that community colleges are plugged into resources that help further SSA's goals…" Integration of SSA activities with other institutional STEM endeavors and cross-site collaboration to develop best practices indicate progress toward the goal of establishing a system-wide network for STEM engagement and support.

- **Increased STEM pipeline.** A major goal of the SSA initiative is to increase the number of students interested in STEM. A substantial number of students are now in that pipeline, showing a marked increase over the past three years.

Factors that contributed to success

- **Campus participation in the initiative.** DHE involved the campuses in planning and implementation, seeking input and demonstrating responsiveness to feedback. The speakers cite working groups and extensive campus participation over the first three years as strategies that they will carry forward.

- **The evaluation.** DHE appreciates a collaborative relationship with the evaluation team, a thoughtful approach to evaluation, and campus participation in data collection.

Looking forward

- **Sustainability.** In the 2017 interview, DHE commented that, overall, the strategies and practices developed under SSA are increasingly "embedded," and that there is a growing "normalization" of those strategies and practices ("a sense that 'this is how you do the work'"). Speakers anticipate that while the "banner" of SSA may not be carried forward beyond the term of direct SSA funding, the language and practices developed through SSA will likely endure and continue to influence campuses and programs.

Outcomes

This section presents findings related to the outcomes of SSA implementation in two parts. The first subsection presents findings from descriptive analyses that were completed to assess progress toward the metrics laid out in the SSA model. The second subsection presents findings from statistical analyses that compared the outcomes of SSA participants with similar students who did not participate in the intervention.

I.   Progress Toward Model Metrics

This subsection presents findings from descriptive analyses that were completed to assess progress toward the metrics laid out in the SSA model. Findings relevant to completion and retention metrics (SSA Model primary goal) are presented first, followed by findings relevant to recruitment and readiness metrics (SSA Model secondary goal). Two report evaluation questions related to completion were addressed, in part, in the STEM Pipeline section of this report and are further addressed—as they relate to SSA participants—in the Completion and Retention metrics section below:

- How many students are completing STEM programs/degrees at community colleges?

- How has this number and rate changed over time, both overall and by site?

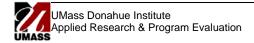## Completion and Retention Metrics

SSA Model Goal: To increase the number of STEM graduates and certificate holders produced by the community colleges and transfer to a 4-year university or obtain STEM employment.

Summary of Key Findings

Key Finding: SSA has supported retention, full-time enrollment, and engagement with STEM

- ✓ **About half of SSA primary participants who have—to date—earned degrees and certificates did so in STEM fields.** Overall, 49% of degrees and certificates completed by SSA participants were in STEM fields. This is slightly higher than the statewide total of 45% of below-bachelor's certificates and degrees granted in STEM fields.[36]

- ✓ **Fall 2015 to Fall 2016 retention rates for SSA participants are similar to—but slightly higher than—the overall retention rate for all Massachusetts community college students:** 62% vs 58% for full-time, first-time degree seeking students and 59% for full-time, first-time degree seeking students enrolled in a STEM program

- ✓ **SSA primary participants have had higher rates of full-time enrollment than the general community college population for all years of the initiative.** In Fall 2016, full-time enrollment was 12 percentage points higher among SSA primary participants than among the general community college student population. This is potentially a positive indication of SSA impact, as students who remain enrolled full-time are more likely to be retained, complete, or transfer than their part-time peers.[37]

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[36] This figure includes both public and private schools in 2013. *2015 Massachusetts STEM Data Dashboard*, http://www.mass.edu/stem/documents/2015%20STEM%20Data%20Dashboard%20FINAL.pdf
[37] Crosta, P. M. (2014). Intensity and attachment: How the chaotic enrollment patterns of community college students relate to educational outcomes. Community College Review, 42(2), 118–142.

Descriptive analysis of data from Year 3 indicates that SSA participants have slightly higher retention, full-time enrollment, and engagement with STEM than the general Massachusetts community college population. The observed trends in program completion, transfer, and indeterminate status rates (which are higher for older cohorts and lower for newer cohorts) were as anticipated, as was the trend for rates of student retention (which was lower for older cohorts and higher for newer cohorts). See Table 10 (next page), which summarizes these trends for all SSA participants by SSA starting term regardless of their full-time, part-time, or new student status.

The indicators presented below reflect metrics outlined in the SSA model for student success outcomes. They highlight findings that are detailed in Tables 10–12. For more detailed data, including institution-specific findings, please see Appendix B.

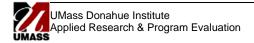## Completion (Degree, Certificate, or Transfer)

These descriptive analyses include outcomes for the first cohort of SSA participants to have had the opportunity to complete two full academic years at their institutions. However, few community college students complete a degree or certificate in two years and UMDI will track these indicators as SSA participants continue through their programs.[38]

- As of Fall 2016, 1,248 degrees and certificates had been awarded to SSA students, and of these 49% were in STEM fields (see Table 11, next page). According to the Massachusetts STEM Data Dashboard, 45% of below-bachelor's certificates and degrees are granted in STEM fields statewide.[39]

- In total, 52% of primary participants from Year 1, 56% of primary participants from Year 2, and 75% of primary participants from Year 3 have completed a degree or certificate, been retained to Fall 2016, or transferred to another Massachusetts public higher education institution (see Table 11, next page).

- As of Fall 2016, 6% of SSA primary participants had transferred to a 4-year school (see Table 10, next page).

- One year after enrolling at their institutions for the first time transfer rates of SSA students who had full-time, first-time degree seeking status in Fall 2015 were slightly lower than for all community college students (5% vs. 8%, see Table 12, page 37). Some of this difference is likely due to the higher rate of fall-to-fall retention among this group of SSA students compared to all community college students. It is currently not clear whether this is a positive or negative indicator. UMDI will continue to monitor this rate as an indicator of student success.

Retention

- SSA Primary participants were more likely to be enrolled full-time at their colleges than the general community college population. In Fall 2015 57% of SSA primary participants were enrolled full-time compared to 38% of the overall community college population. In Fall 2016, 44% of SSA primary participants were enrolled full time, compared to 37% of the overall community college population. For details, please see Table 4 (page 9) in the STEM Pipeline section of this report.

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[38] For example, 4.6% of community college students that were first-time students (either full time or part time) in Massachusetts in Fall 2011 completed a degree or certificate by August 2013

[39] This figure includes both public and private schools in 2013. *2015 Massachusetts STEM Data Dashboard*, http://www.mass.edu/stem/documents/2015%20STEM%20Data%20Dashboard%20FINAL.pdf

Notably, the differential between SSA and the community college population in overall full-time status (regardless of STEM enrollment) has decreased over the years. This reflects growth in both part-time and full-time STEM at entry status among SSA participants and concomitant decreases in non-STEM at entry (both full time and part time) among this group, while the proportion of all students who are full-time non-STEM at entry has remained approximately level.

- 82% of SSA primary participants (892 participants) who were new to SSA in Summer 2016 continued at their community college in Fall 2016 (see Table 10, below).

- 53% of SSA primary participants (862 participants) who were new to SSA in Fall 2015 remained enrolled at their college in Fall 2016 (see Table 10, below).

- When considering full-time, first-time degree seeking students, Fall 2015 to Fall 2016 retention rates for SSA participants are similar to—but slightly higher than—the overall retention rate for all Massachusetts community college students (62% vs. 58%). See Table 12 (next page).

Table 10: Fall 2016 Progress and Completion Rates for SSA Primary Participants, by SSA Starting Term										
	Year 1 (Pilot)		Year 2			Year 3			Year 4	
	Spring 2014	Summer 2014	Fall 2014	Spring 2015	Summer 2015	Fall 2015	Spring 2016	Summer 2016	Fall 2016	Total
Completed*	22.4%	16.8%	13.4%	14.9%	11.9%	8.5%	6.5%	0.2%	0.0%	9.4%
Retained to Fall 2016*	18.5%	29.1%	30.7%	34.2%	47.3%	52.9%	64.9%	81.9%	99.2%	52.7%
Transferred*	6.2%	8.7%	9.6%	6.7%	7.4%	6.4%	3.7%	2.5%	0.0%	5.8%
Indeterminate status*	52.9%	45.4%	46.3%	44.2%	33.3%	32.2%	24.9%	15.4%	0.8%	32.1%
Trackable total†	**340**	**643**	**2,275**	**1,690**	**564**	**1,630**	**1,908**	**1,089**	**1,199**	**11,338**

*Completed indicates students who earned a certificate or degree prior to July 1, 2016. Retained indicates students who were retained to Fall 2016 at the same institution. Transferred indicates students who enrolled at another in institution of higher education in Fall 2016. Indeterminate Status indicates students who had not earned a certificate or degree by July 1, 2016, nor were retained to Fall 2016 in a public institution of higher education.

†Some primary participants are not trackable (i.e., are not found in HEIRS). This includes those who do not have a SSN, and those who have been assigned a student ID number (for tracking within an institution) but have not registered for a course (e.g. high school participants that returned to high school).

Table 11: Number of SSA Students Earning Degrees and Certificates by Year of SSA Participation					
Year	Total SSA Students	Students earning degrees		Students earning certificates	
		All	STEM	All	STEM
Year 1 (Pilot)	1,234	172	70	38	29
Year 2	6,659	604	267	129	107
Year 3	7,172	258	106	47	35
Year 4 (Fall only)	2,557	-	-	-	-
Total	**17,622**	1,034	443	214	171

Table 12: Fall to Fall Retention of Full-Time, First-Time Degree Seeking Students SSA Students and Community College Students					
	Number of full-time, first-time degree seeking students	Retained to following fall at institution		Transferred to another institution within 2 years of starting	
		#	%	#	%
Fall 2014 to Fall 2015					
SSA Students	568	325	57.2%	49	8.6%
All Students	11,325	6,550	57.8%	845	7.5%
Fall 2015 to Fall 2016					
SSA Students	331	206	62.2%	15	4.5%
All Students	10,363	6,039	58.3%	783	7.6%

Recruitment and Readiness Metrics

SSA Model Goal: To increase the number of students entering STEM programs at the community colleges.

Summary of Key Findings

Key Finding: SSA continues to attract new participants.

✓ SSA programs continued to attract new participants in Year 3. Over the course of SSA Year 3, 5,224 (73%) primary participants were supported by SSA for the first time.

Key Finding: SSA participants who complete developmental math move on to college-level math classes at promising rates.
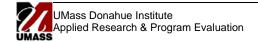
✓ Of the 418 SSA primary participants who engaged in a developmental math intervention (e.g., courses, workshops, and bootcamps) in Summer 2016, 160 (38%) fulfilled all developmental math requirements for their institution by the end of that term and 87 (54%) of those subsequently *enrolled* in a college-level math class for Fall 2016. Although not directly comparable (enrollment vs. completion), statewide data indicate that 20% of community college students who complete developmental math coursework go on to *complete* a college level math course within two years.[40]

The indicators presented below reflect the recruitment and readiness metrics outlined in the SSA model. They summarize findings that are detailed in Tables 13–15. For more detailed data, including institution-specific findings, please see Appendix B.

Recruitment

- 12,590 secondary participants were reached in Year 3 through activities and events such as open houses, STEM career and college events, visits to high schools, and hands-on career exploration days. 363 total events were held in Year 3. The average number of participants per event was similar in Year 2 and Year 3 (34 in Year 2 and 35 in Year 3). See Table 13 (next page).

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[40] Vision Project, *Final Report from the Task Force on Transforming Developmental Math Education*, October 2013

- Across all sites and terms, 1,302 primary participants were reported as former secondary participants. These represent 4% of all secondary participants (through Summer 2016) and 9% of all primary participants. Sites have commented on the difficulty of identifying former secondary participants (about whom individual data is often impractical to collect) when they first receive SSA supports as primary participants and thus these numbers likely underestimate the rate of "conversion" between secondary and primary participants. See Table 18 in Appendix B for further details.

- Between Fall 2014 and Fall 2015, there was a sharp increase in the number of secondary participants and the number of events and activities available to these students. The number of secondary participants in Fall 2016 increased slightly from Fall 2015 (4,649 in Fall 2016 compared to 4,192 in Fall 2015), but the number of activities decreased 44% (See Table 13, below). Sites' ability to reach as many students with fewer events might suggest more effective outreach or more established relationships with recruitment partners.

Table 13: Secondary Participant and Event Count by Term and Year			
Year	**Term**	**Number of secondary participants***	**Number of events and activities**
Year 1 (Pilot)	Spring 2014	5662	173
	Summer 2014	2545	49
Year 2	Fall 2014	1741	56
	Spring 2015	5018	156
	Summer 2015	1742	40
Year 3	Fall 2015	4192	100
	Spring 2016	6161	187
	Summer 2016	2237	76
Year 4	Fall 2016	4649	56
	Total	**33,947**	**893**

*Secondary participants are individuals who are not currently enrolled at a community college and participate in STEM Starter Academy grant funded programs/events/activities (i.e., participants who do not have an ID number assigned by their college).

Readiness

- In Summer and Fall 2016, 1,142 SSA primary participants took part in an SSA-sponsored developmental math intervention (including coursework and workshop or booster programs). Overall, 25% of those intervention participants fulfilled all developmental math requirements for their institution in the same term (see Table 14, next page).

- 24% (418) of Summer 2016 primary participants participated in an SSA-sponsored developmental math intervention that term. 38% (160) of those intervention participants fulfilled all developmental math requirements for their institution during that term. Similar percentages (although twice in number) of primary participants took part in an SSA-sponsored developmental math intervention in Summer 2016 as compared to Summer 2015. However, in 2016, a lower percentage of the participants who had fulfilled their developmental math requirements that term subsequently enrolled in a college-credit level math course (67% in 2015 and 54% in 2016). See Table 14 (next page).

- In Fall 2015, 48% (1,063) of SSA primary participants engaged in an SSA developmental math intervention and 22% (238) of those students fulfilled all developmental math requirements for their institution by the end of the term. This number decreased in Fall 2016 when 28% (724) of SSA primary participants engaged in an SSA developmental math intervention and 17% of those students fulfilled all developmental math requirements for their institution by the end of the term (see Table 14, below).

- Among freshmen first-time enrollees in Fall 2015, new SSA participants had rates of enrollment in developmental math that were much higher than for Massachusetts community college students more generally (70% vs. 44%). However SSA participants had similar rates of current-term developmental math course completion as the general community college population (see Table 15, below). Notably, 71% of SSA participants enrolled in developmental math courses were at one site (Massasoit). Thus, the figures in Table 14 (below) are more representative of SSA, more broadly (see the previous bullets in this section).
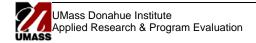
Table 14: SSA Primary Participants' Mathematics Participation and Outcomes, 2016								
Term	**Total number of primary participants***	**Primary participants who participated in a SSA-sponsored developmental math intervention** …		… and **fulfilled all developmental math requirements** for their institution by the end of the term		Primary participants who completed developmental math and **subsequently enrolled in a college-credit-level math course**[**]	
		#	%	#	%	#	%
Summer 2015	941	201	21.4%	81	8.1%	54	5.7%
Fall 2015	2,430	1,056	43.5%	237	9.8%	107	4.4%
Spring 2016	2,984	1,080	36.2%	236	7.9%	83	2.8%
Summer 2016	1,758	418	23.8%	160	9.1%	87	4.9%
Fall 2016	2,557	724	28.3%	122	4.8%	70	2.7%
Total	**9,729**	**3,278**	**33.7%**	**836**	**8.6%**	**401**	**4.1%**

[*]Primary participants are community college students who participate in STEM Starter Academy grant funded programs/events/activities (i.e., participants who have an ID number assigned by their college).
[**] Full enrollment data are only available for fall terms and thus, rates of subsequent-term enrollment are likely underestimates for terms other than summer (when fall would be the subsequent term).

Table 15: Freshmen, First-Time Enrollees' Progress in Developmental Mathematics Coursework					
	Number of freshmen, first-time enrollees	**Students *enrolled* in a developmental math course during current term**		**Students *completing* a developmental math course during the current term**	
		#	%	#	%
Fall 2014					
SSA Primary Participants*	784	688	87.8%	454	65.6%
Full College	18,911	8,644	45.7%	5,776	66.8%
Fall 2015					
SSA Primary Participants*	507	353	69.9%	214	60.6%
Full College	17,141	7,471	43.6%	4,772	63.9%

[*]Primary participants are community college students who participate in STEM Starter Academy grant funded programs/events/activities (i.e., participants who have an ID number assigned by their college).

II.   **Effectiveness of SSA Intervention**

This section presents findings from statistical analyses that compared the outcomes of SSA participants with similar students who did not participate in the intervention. We used rigorous, quasi-experimental, matched-comparison-group designs to draw strong conclusions about the effectiveness of the intervention.[41,42] Technical descriptions of statistical methods are presented in Appendix F. This section addresses the following questions:

- Are SSA participants more or less likely than similar non-participants to have positive educational outcomes (retained, transferred, or completed/graduated) one year and two years after initial participation?

- Are SSA participants who receive specific types of support (financial support, academic support, or counseling support) more or less likely to have positive educational outcomes than similar students who do not receive these services?

- Are SSA participants more or less likely than similar non-participants to complete a STEM program or degree?
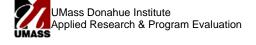
Summary of Key Findings

Key Finding: SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen were neither more nor less likely than similar non-participating students to graduate/complete (in any field), be retained, or transfer one or two years after joining SSA.[43, 44]

- ✓ SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen that received specific types of support (i.e., financial support, academic support, or counseling support) were neither more nor less likely than similar non-participating students to graduate/complete, be retained, or transfer one or two years after joining the program.

- ✓ SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen were less likely than similar non-participating students to earn a *STEM degree or certificate* two years after joining the program.[45]

- ✓ Quantitative findings generally indicate that SSA had a positive impact on student graduation, retention, and transfer status one and two years after participation, but the differences between SSA participants and similar non-participants were not large enough to be deemed statistically significant (i.e., likely attributable to something other than chance).

Key Finding: Regardless of SSA program participation status, student who joined a community college in Fall 2014 as first-time, full-time freshmen and were identified as STEM program participants at their time of admission were far more likely (approximately 30 times as likely) to complete a STEM program (i.e., earn a STEM degree or certificate) as students who were not identified as STEM program participants at their time of admission.

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[41] Treatment and comparison groups were matched on gender, race/ethnicity, college math-ready status, and STEM-at-admission status.
[42] Cook, Thomas D., and Donald T. Campbell. (1979). *Quasi-experimentation: Design & analysis issues for field settings.* Boston: Houghton Mifflin.
[43] "First-time, full time freshman" is defined in Appendix A.
[44] Possible explanations for these findings are described later in this section.
[45] HEIRS data do not allow us to identify students that change programs after their initial entry into the college. That is, many students change their program of study after they have joined a community college, and HEIRS does not track these changes. HEIRS data can only be used to assess STEM program status at time of entry and at the point of completion/graduation.

> ✓ SSA programs at all sites include activities aimed to foster early exploration and interest in STEM fields of study—at some sites, this included encouraging or advising students to enroll in STEM programs at admission. In Year 3, SSA Early College High School activities prioritized introducing STEM careers, fields of study, and coursework. Moving forward, Early College activities will be a topic of increased interest and focus for DHE, the community colleges, and the evaluation.

Description of Samples and Outcomes

Effects of SSA participation were assessed one year after initial participation and two years after initial participation. Depending on the time period and outcome indicator, different groups of students were included in the analyses. Specifically:

1. Graduation, retention at same institution, and transfer were assessed one and two years after initial entry into SSA. Outcomes for students who joined SSA in the fall of 2014 or the fall of 2015 as first-time, full-time freshman were compared to outcomes for similar students who did not participate in the intervention. Only students who joined SSA as first-time, full-time freshmen in the fall of 2014 were included in the sample used to determine outcomes two years after joining SSA.

2. The STEM program or degree-completion status of students who joined SSA in the fall of 2014 as first-time, full-time freshmen was assessed two years after their initial entry into the intervention. We compared outcomes of SSA participants to outcomes for similar non-participants who joined a community college as first-time, full-time freshmen during the fall of 2014.

Analyses included 568 students from 9 institutions who joined SSA as first-time, full-time freshmen in the fall of 2014, and 331 students from 13 institutions who joined SSA as first-time, full-time freshmen in the fall of 2015. The comparison sample included all 16,389 students who were first-time, full-time freshmen at the same institutions during the fall of 2014 and fall of 2015 that did not participate in SSA.

Each site applied their own recruitment and selection criteria to identify students for participation in SSA: in other words, students were not randomly assigned. To minimize any differences that may have existed between the treatment and comparison groups prior to the intervention, rigorous propensity-score-weighting procedures were used to weight each of the comparison students according to their similarities with the treatment group.[46]

Findings

Compared with students who did not participate in SSA, SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen were neither more nor less likely to graduate/complete, be retained, or transfer one or two years after joining SSA.

SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen that received specific types of support (i.e., financial support, academic support, or counseling support) were neither more nor less

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[46] Rubin, Donald B. (2001). Using propensity scores to help design observational studies: Application to the tobacco litigation. *Health Services & Outcomes Research Methodology 2* (3), 169–188.

likely than similar non-participating students to graduate/complete, be retained, or transfer one or two years after joining the program.

SSA participants who joined SSA in Fall 2014 as first-time, full-time freshmen were less likely than similar non-participating students to earn a STEM degree or certificate two years after joining the program.

Results for all models are provided in Table 16, below. The table provides odds ratios, indicating the degree of impact of the intervention.[47] An odds ratio greater than one indicates that the outcome was more likely for participants than non-participants, while an odds ratio less than one indicates that the outcome was less likely for participants than non-participants. For example, an odds ratio of 1.3 for positive outcome means that participants were 1.3 times as likely as non-participants to have a positive educational outcome two years after joining SSA. An odds ratio of 0.7 for STEM graduate means that participants were 0.7 times as likely as non-participants to earn a STEM degree two years after joining SSA.
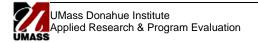
The table also provides a 95 percent confidence interval (CI), recognizing that the sample of students in the study might be somewhat different from the full population from which they were drawn. The confidence interval provides a range that has a 95 percent chance of including the true value of the odds ratio for that population. The statistically significant difference ($p < 0.05$) is noted with an asterisk.

Most of the findings reported in the table below are positive, but not statistically significant. That is, the reported odds ratios generally indicate that SSA had a positive impact on student graduation, retention, and transfer status one and two years after participation, but the differences between SSA participants and similar non-participants were not large enough to be deemed statistically significant (i.e., likely attributable to something other than chance).

Table 16: Outcomes – SSA Participants vs. Non-Participants			
Outcome	**Student Group**	**Odds Ratio**	**95% CI**
Graduation, retention, or transfer one year after participation	All SSA participants	1.12	[0.85, 1.49]
	SSA participants who received aid	1.00	[0.85, 1.18]
	SSA participants who received counseling support	1.22	[0.85, 1.75]
	SSA participants who received extra support	1.11	[0.85, 1.46]
Graduation, retention, or transfer two years after participation	All SSA participants	1.12	[0.92, 1.36]
	SSA participants who received aid	1.01	[0.88, 1.16]
	SSA participants who received counseling support	1.32	[0.83, 2.11]
	SSA participants who received extra support	1.10	[0.90, 1.33]
STEM graduate/completer two years after participation	All SSA participants	0.26*	[0.09, 0.80]

*$p < 0.05$

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[47] Researchers seeking effect sizes can calculate them directly from the reported odds ratios by subtracting one (1).

Analyses produced one additional finding of note: regardless of SSA program participation status, students who were identified as STEM-enrolled at time of entry were far more likely (approximately 30 times as likely) to complete a STEM program (i.e., earn a STEM degree or certificate) than students who were not identified as STEM-enrolled at time of entry. This finding suggests that early recruitment/identification and support of STEM students may enhance their likelihood of completing a STEM degree or certificate.

Discussion

This report presents initial indicators of SSA initiative impacts. These analyses primarily present findings for the first cohort of SSA participants that has had the opportunity to complete (at least) two full years of courses and started as first-time, full-time freshmen in a fall term. As discussed above, data that enable matched comparisons are only available for fall-enrolled students who were first-time, full-time freshman.

STEM Starter Academy interventions generally had a positive effect on SSA participants' odds of graduating/completing, being retained at the same institution, or transferring to another institution one or two years after joining SSA, but the effects were not large enough to be deemed statistically significant. SSA participants were less likely than similar non-participating students to earn a STEM degree or certificate two years after joining the program.

Possible explanations

There are multiple plausible explanations for this pattern of findings. All of the hypotheses presented below would require confirmation through additional research. For all findings, it is important to keep in mind that this was a quasi-experimental study, not an experimental study. In other words, students were not randomly assigned to treatment or comparison conditions. Despite rigorous (and very successful) efforts to balance the treatment and comparison samples on many relevant variables, it is possible that differences between these samples existed prior to treatment on variables that were not included in analytic models.

Small sample and unusual circumstances. Results assessing program impacts two years after initial entry are based upon the relatively small sample of students that joined SSA in the fall of 2014 as first-time, full-time freshmen (n = 568 students). Also, this cohort was impacted by circum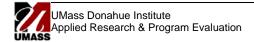stances that are now considered unusual for SSA. These students began their participation in the intervention at a time when the SSA model had not yet been defined. An important development that occurred after the fall of 2014 was the specification of a program model for SSA. After the development of the model was completed, UMDI and DHE have subsequently collaborated with sites to align

> **Possible Explanations for Observed Pattern of Findings:**
>
> **Small sample and unusual circumstances**
> Results assessing program impacts two years after initial entry are based upon the relatively small sample of students that joined SSA in the fall of 2014 as first-time, full-time freshmen (n = 568 students). Also, this cohort was impacted by circumstances that are now considered unusual for SSA.
>
> **Variations in exposure to intervention**
> The intensity and character of SSA interventions varied both across sites and within sites. Thus, SSA participants included in this analysis did not have uniform exposure to strategies or activities designed to improve their educational outcomes.
>
> **Initiative evolution**
> It is difficult to determine if the results presented here for students who entered SSA in Fall 2014 as first-time, full-time freshmen are indicative of outcomes of later cohorts of participants. It is clear that significant shifts in SSA recruitment practices and programming have occurred at many sites since the fall of 2014.

measurement activities with the key outcomes and metrics outlined in the model. The model's goals and metrics were used to guide planning for SSA after many participants from Fall 2014 had already exited the program.

Also, each site was given additional funds to spend during the fall of 2014—$47,000—with a relatively short window of time in which to spend those funds. Many sites used those funds to support students in taking developmental math courses. Results assessing program impacts for participants one year after initial program entry combine students from the fall of 2014 with those from the fall of 2015 (to generate the largest possible sample). That is, the cohort of students that joined SSA in the fall of 2014 may differ from other cohorts of SSA participants in ways that were not captured in our data.

Variations in exposure to intervention. The intensity and character of SSA interventions varied both across sites and within sites. Thus, SSA participants included in this analysis did not have uniform exposure to strategies or activities designed to improve their educational outcomes. For example, SSA participants in this analysis included—and did not distinguish between—students whose exposure to SSA is encompassed by attendance at a 1-hour workshop on study skills and those who spent the semester working as an SSA-sponsored research intern with ongoing faculty advising and professional development. Exposure to SSA activities across semesters also varied. As noted in the descriptive subsection above, 69–78% of SSA primary participants in any given term were exposed to SSA activities for the first time, suggesting that only 20–30% of SSA participants remain engaged with SSA from semester to semester.

"Dosage" or duration of exposure was not captured in data available for this analysis, but may contribute to distinguishing students who ultimately have different educational outcomes. A new measure that captures SSA participants' duration of exposure was designed in Year 3—by DHE in collaboration with SSA sites and UMDI—and pilot-tested by four sites in Fall 2016. This new measure asks sites to identify low-dose participants—defined as those SSA participants with fewer than 6 hours of participation in SSA-related activities—and data from all sites will be collected in Spring 2017.

Initiative evolution. It is also difficult to determine if the results presented above for students who entered SSA in Fall 2014 as first-time, full-time freshmen are indicative of outcomes of later cohorts of participants. It is clear that significant shifts in SSA recruitment practices and programming have occurred at many sites since the fall of 2014. For example, in Fall 2014 only 27.7% of new SSA students who were first-time, full-time freshmen were identified as being admitted to a STEM program when they entered their community college. By Fall 2016, 63.3% of SSA participants who were first-time, full-time freshmen were admitted to their community college as STEM program participants. Further descriptions of shifts in SSA programming over time are described in the Patterns of Practice section of this report.

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Strategic Considerations

After Year 3, DHE and the campuses are well positioned to continue to refine the SSA model and identify and scale promising practices and key strategies. The following are some strategic opportunities for consideration by DHE.

✓ **Refine the SSA program model to represent emergent consensus regarding what its core practices should be, and work with sites to move SSA activities into greater alignment with those practices.** Sites differ in their understanding of what constitutes a key component of SSA, and there continues to be substantial variation in practice.

- o Campuses report positive outcomes, but system-level impacts have not been detected. If campuses believe that SSA is positively impacting student outcomes at some locations, then **campuses should consider sharing best practices and implementing the practices that they believe are having the greatest impact.**

- o **Facilitate additional opportunities to foster system-wide communication and resource sharing, particularly in regard to best practices and lessons learned.** Campuses have appreciated DHE leadership in facilitating cross-site collaboration and learning, and continued attention to these activities is warranted.

- o **Support sites in managing increased project demands**, potentially by encouraging sites to focus on core or promising practices. Some campuses feel they have insufficient personnel capacity to manage the expansion of programmatic activity over the full range of student support needs—from college recruitment and STEM preparation, to job placement and transfer.

✓ **Expand the definition of "STEM" for SSA to include liberal arts programs with STEM concentrations.** Many community college students have enrolled in and/or completed liberal arts programs that may be considered "STEM" by the colleges and by the students. DHE has adopted a definition of "STEM" for SSA that is aligned with the definition used for the STEM Data Dashboard, and that definition excludes those enrolled in liberal arts programs. However, our analyses revealed that liberal arts programs include many STEM concentrations like mathematics, pre-engineering, biology, chemistry, and pre-nursing. Hundreds of students earn degrees or certificates from community colleges in these concentrations each year.

✓ **Expand the collection of student-level SSA dosage data.** It is possible that SSA is differentially impacting students that receive varying dosage of intervention, and collecting student-level dosage data will enhance DHE's ability to identify factors impacting student performance.

✓ **Support the collection and sharing of data at the campus level.** SSA administrators with access to student data are better able to make programmatic decisions based on student performance and also to submit data to DHE in a timely manner. Several sites use some amount of SSA funding to recruit part-time help from their Institutional Research offices to support data management and reporting.

✓ **Work with sites to think through strategies for sustainability.** Campuses are seeking to diversify their funding and to enhance the sustainability and institutionalization of SSA program elements. This may be an area in which continued technical assistance and sharing is particularly important.

✓ **Explore, monitor, and assess the impact of early engagement in STEM certificate/degree programs.** SSA programs at all sites include activities aimed to foster early exploration and

interest in STEM fields of study. UMDI observed that, over time, an increasing portion of SSA students who are first-time, full-time freshmen have entered their community colleges with a STEM degree/certificate focus. We also found that (regardless of SSA participation status) students who enter community college with a STEM degree/certificate focus are significantly more likely to complete a STEM program (i.e., earn a STEM degree or certificate) within two years than students who were not identified as STEM-enrolled at time of entry. If the number of SSA participants continues to grow and the proportion of first-time, full-time participants entering with a STEM degree/certificate focus continues to expand, then future analyses may detect increases in STEM completion rates for SSA participants, and possibly for the community college sector as a whole. Early College activities have become a topic of increased interest for DHE and the community colleges, and therefore, the SSA evaluation will continue to track the impact of early engagement in STEM certificate/degree programs.

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Methods

This report includes information collected through the data collection activities described below.

SSA Participant Data

At the conclusion of each term (Fall 2015, Spring 2016, Summer 2016, and Fall 2016), UMDI collected data about SSA participants from all grantees through a supplemental student data request, submitted through DHE. Each collection was in two parts: one for primary participants and one for secondary participants. Primary participants were defined as community college students who participated in programs, events, or activities funded by the STEM Starter Academy grant (i.e., participants who have an ID number assigned by the college). Secondary participants were defined as individuals who were not enrolled at a community college and participated in SSA-funded programs, events, or activities (i.e., participants who do not have an ID number assigned by the college).

Primary and Secondary data collection instruments were designed in consultation with DHE and can be found in Appendix G and Appendix H. Data about secondary participants were collected in the aggregate. The instrument collected a count of SSA events and event participants. For primary participants, the collection included student identification number, campus, and term; an indicator of whether or not the participant had been previously reported as a secondary participant; and indicators of each participant's receipt of SSA-funded financial support, targeted support (such as tutoring or peer mentoring), and counseling about STEM pathways and careers.

Two additional fields related to developmental mathematics were included in the primary participant collections beginning with Summer 2015. These fields were designed in consultation with DHE and grantees. One field indicates whether or not the student participated in an SSA-sponsored developmental mathematics intervention (e.g., developmental mathematics course, non-credit workshop) during the current reporting period. A second field indicates whether or not the student was a developmental mathematics intervention participant during the current reporting period and also fulfilled all developmental mathematics requirements for the institution by the end of the current reporting period.

A new "Low-Dose Participant" field was introduced in the Fall 2016 primary participant collection, but was only required of four SSA sites who had helped to design and agreed to pilot the measure. The field indicates whether or not the student participated in fewer than 6 hours of SSA-related activities during the current reporting period. The field will be required of all SSA sites in the Spring 2016 data collection.

Primary participant data were submitted by grantees directly to DHE. Through a data sharing agreement, DHE granted UMDI access to primary participant data as well as individual-level student data regularly submitted to DHE by each college through HEIRS (Higher Education Information Resource System).

Statistical analyses were used to compare the outcomes of SSA participants with similar students who did not participate in the intervention. We used rigorous, quasi-experimental, matched-comparison-

group designs to draw strong conclusions about the effectiveness of the intervention (Cook and Campbell 1979).[48] Technical descriptions of statistical methods are presented in Appendix F.

Phone Interviews – Spring 2016

UMDI conducted 30-minute telephone interviews with one or two individuals at 14 sites in Spring 2016 (one site did not participate). Interviews were typically conducted with the primary SSA administrator and often also included an SSA coordinator (where such a position existed). The interview protocol was developed in collaboration with DHE and focused on capturing site administrators' reflections on their institution's most promising SSA practices, as well as their feedback on implementation challenges and the facilitation of the initiative by DHE (see Appendix I for the complete protocol). Interviews were digitally recorded with permission, summarized, and analyzed in NVivo. Analysis of these interviews was included in the September 2016 Report Supplement and can be found in Appendix J.

Student Experience Survey – Summer 2016

The Student Experience Survey, developed in Year 3 by UMDI in consultation with DHE and SSA campuses, provides a student perspective on SSA programs and initiatives that is comparable across campuses. Data from this instrument were collected by sites for the first time in Summer 2016. The instrument asks SSA primary participants for feedback on how SSA participation impacted them as students. Topics include students' self-efficacy and knowledge of STEM topics, their feelings of connection to peers and faculty, their perceptions of the helpfulness of SSA supports and activities, and their thoughts about program strengths and weaknesses. Sites collected and organized data from their own SSA participants and reported aggregate data to UMDI. The Summer 2016 instrument can be found in Appendix K and analysis of the data is in Appendix L.
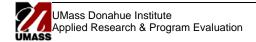
Participant Exit Survey

The purpose of the exit survey is to gather information from outgoing or former SSA participants relevant to key metrics of the SSA initiative (e.g., job placement, transfer status, STEM engagement). In Year 3, UMDI worked with DHE and SSA sites to develop an instrument and protocol for gathering data from primary SSA participants who have left their professional or degree programs for any reason, including dropout, transfer, completion, and job placement (see Appendix M for instrument). Campuses collect and organize data from their own exiting program participants and submit these data via DHE's HEIRS system. The first Participant Exit Survey data collection was from Summer 2016 primary participants who did not return to their institutions in Fall 2016 (submitted with the Fall 2016 data collection). Analysis of preliminary Exit Survey data can be found in Appendix N.

Year 3 Site Reports

In Fall 2016, all 15 SSA sites completed Year 3 Site Reports, which included two components: an online survey and a narrative template. These instruments were developed by UMDI in collaboration with DHE and are included in Appendices O and D. Summarized data from the survey are available in Appendix C

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[48] Treatment and comparison groups were matched on gender, race/ethnicity, college math-ready status, and STEM major at time of admission status.

and from the Narratives in Appendix P. Compiled narrative portions of the reports submitted by sites are available from DHE upon request.

Both instruments were distributed in September 2016 and were due in November 2016. Representatives from each site received a link to a single campus copy of the online survey. PDF copies were provided for ease of collaboration and sharing. The narrative template was distributed as a Word document.

Online survey – The purpose of the online survey was to catalog and assess site-specific components of SSA implementation as they relate to the core elements of the SSA model. The survey focused on topics that were of greatest interest to DHE and was comprised of close-ended items. Sites were asked to indicate which activities took place at their institution during the academic year and the summer, and whether or not these activities were at least partially supported with SSA funds. All survey items from Year 2 were included in the Year 3 survey to facilitate comparison across years. An additional set of questions asking sites to indicate elements that were part of their SSA-related Early College programming was added in Year 3. As in Year 2, all 15 sites responded to the survey for Year 3.

Narrative – The purpose of the narrative template was to gather qualitative details from each site about SSA activities, successes and challenges, and student experiences. It gave sites the opportunity to describe their programs, explain the details of activities contained in the closed-ended survey responses, and provide descriptive elements that add depth to programmatic and evaluative reporting. In Year 3, a section asking sites to reflect on SSA implementation overall was added, which included the key or main components of SSA programs at their institution and the practices and strategies that most contributed to success overall. Narratives were thematically analyzed in NVivo.

Selected Site Visits – Fall 2016

UMDI team members conducted site visits at six SSA grantee sites during October and November 2016: Cape Cod, Middlesex, Quinsigamond, Bristol, Bunker Hill, and Massasoit. These visits took place at the beginning of SSA Year 4, but some preliminary data that reflect on Year 3 practices are included in this report. UMDI will visit all 15 sites over the course of Year 4, and a thorough analysis of these data will be included in the Year 4 annual report, as feasible.

Sites were selected for a fall visit based on several criteria and goals. Given resource limitations, evaluators aimed to visit six sites in the fall so that nine visits would remain for the following summer. Sites that reported sufficient observable SSA activity in the fall for a productive site visit were initially selected. Evaluators then aimed to give sites that had previously been visited in the fall an opportunity to be visited in the summer instead (since much SSA programming concentrates in the summer). Finally, a few sites initially selected for a fall visit requested the option to switch based on administrative factors such as staff transitions.

Site visits typically lasted about four hours and included three primary data collection activities: interviews with key program administrators and staff, observation of program activities, and brief focus groups with program participants. Observed activities included a course with an embedded peer tutor, a faculty-facilitated study session, a STEM community building open house event, career or transfer workshops, an industry panel, and a student research presentation. Evaluators also took photos, with students' permission. Data collection instruments (interview, focus group, and observation protocols) were developed in collaboration with DHE and aimed to capture data about SSA sites' strategies and

practices at a time of full-initiative implementation (see Appendix Q, Appendix R, and Appendix S for protocols).

Evaluators drafted field notes from the observations following each visit. Interviews and focus groups were digitally recorded, with permission, and these recordings were later transcribed. These data were analyzed in NVivo. For brief "snapshots" of each of the sites visited in Fall 2016, please see Appendix T.

Interviews with DHE – January and October 2016

On January 19, and again on October 18, 2016, the UMDI project manager conducted hour-long telephone interviews with the two DHE personnel who guide the STEM Starter Academy Initiative at the statewide level: the Associate Commissioner for Economic and Workforce Development and the Executive Director of STEM. The first interview took place about a third of the way into Year 3. It explored the interviewees' perspectives on the implementation of SSA during Year 3 and their vision for the initiative moving forward. The interview also included some closing reflections on Year 2 that were summarized in the Year 2 Evaluation Report. A summary of this interview was provided in the September 2016 Evaluation Report Supplement. The second interview took place at the start of Year 4 and captured additional reflections on the project to date as well as considerations moving forward. The interview protocols are provided in Appendix U. The interviews were digitally recorded with the administrators' permission. The recordings were transcribed, analyzed, and summarized.

Participation in Technical Assistance Meetings

DHE convened technical assistance meetings for SSA grantees on October 30, 2015 and April 8, 2016. UMDI took notes (which were shared with DHE and sites) and observed at both meetings. For the October meeting, UMDI facilitated a discussion of new evaluation instruments and offered facilitation assistance with breakout groups. At the April meeting, UMDI presented a summary of the Year 2 Evaluation Report.

Participation in Monthly Grantee Phone Meetings and Working Group Meetings

DHE hosted approximately-monthly phone meetings with SSA grantee representatives. UMDI evaluators attended each call as observers and generated notes from each meeting for DHE to share with grantees. See the Technical Assistance section of this report for a list of topics from each call.

UMDI evaluators also participated in the meetings of the Measurement Working Group and the High-Low Participation Working Group—contributing technical assistance and taking notes. UMDI observed the Model and Programming Working Group's meetings.

Technical Assistance

In Year 3, UMDI provided technical assistance to DHE and SSA sites including instrument development, assistance to sites with data collection efforts, participation in DHE planning and review meetings, participation and note-taking at SSA grantee and working group meetings, and participation and material development for a presentation of the SSA Year 2 Evaluation Report to the Board of Higher Education.

Instrument Development

In Year 3, UMDI worked with DHE and SSA grantee sites to finalize the design of two new instruments: the Student Experience Survey and Participant Exit Survey.

The Student Experience Survey provides a student perspective on SSA programs and initiatives that is comparable across campuses. It was disseminated in Spring 2016 and the first round of data were collected in Summer 2016. See Appendix K for a copy of the instrument.

The Participant Exit Survey gathers information from outgoing or former SSA participants relevant to key metrics of the SSA initiative related to students' trajectories after SSA (e.g., job placement, transfer status, STEM engagement). The instrument was disseminated in Spring 2016. The first round of data was collected from participants in Summer 2016 and were submitted with the Fall 2016 data collection (when students' non-enrollment in the fall term had been confirmed). See Appendix M for a copy of the instrument.

As in previous years, UMDI worked with DHE to adapt site report instruments to reflect SSA implementations in Year 3 and DHE's reporting goals. These Year 3 Site Report instruments included an online survey and narrative template (see Appendices D and O for copies of these instruments).
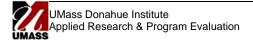
Support for Data Submission

UMDI worked with DHE and site representatives to facilitate data submission in Year 3. As in previous years, UMDI drafted instructions and documentation to clarify data collection procedures and provided ongoing technical assistance to individual sites regarding data submission. In Year 3, this technical assistance included helping sites to adapt, disseminate, and collect data from the Student Experience Survey and Participant Exit Survey. UMDI also assisted DHE in developing and collecting data on a new "Low-Dose Participant" measure for primary participants, including soliciting and compiling feedback from sites who pilot tested the measure.

Participation in Grantee Meetings

Grantee phone meetings

SSA grantees participated in 7 hour-long conference calls between October 2015 and September 2016 (see Table 17, below, for a list of topics by meeting). Calls were facilitated by DHE's Executive Director of STEM, Allison Little. Agenda items included updates from each of the working groups, discussions of measurement and evaluation findings, implementation updates from grantees, conversations about budgeting and planning, and discussions of the FY17 Early College RFP. UMDI evaluators attended the

calls to observe and offer technical assistance and generated notes from each meeting for DHE to share with grantees.

Grantees were also invited to an optional call on August 4, 2016, to discuss and ask questions about FY17 planning. UMDI evaluators attended this call as observers and to offer technical assistance.

Technical assistance meetings or "retreats"

DHE convened technical assistance meetings for SSA grantees on October 30, 2015, and April 8, 2016. UMDI took notes (which were shared with DHE and sites) and observed at both meetings. For the October meeting, UMDI facilitated a discussion of new evaluation instruments and offered facilitation assistance with breakout groups. At the April meeting, UMDI presented a summary of the Year 2 Evaluation Report. Evaluators also provided technical assistance to SSA working groups as they prepared to facilitate conversations during the meeting about elements of the Year 2 Evaluation Report.
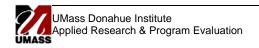
Working group meetings

In the fall and spring of Year 3 (FY16), DHE convened four working groups: Measurement, Model, Post-SSA, and Sustainability. UMDI evaluators participated in the meetings of the Measurement Working Group and provided technical assistance to the Model and Sustainability Working Groups.

In the summer of 2016, DHE convened three working groups: High-Low SSA Participation Pilot Group, Industry Partners and Career Pathways, and Transfer and 4-Year Partnerships. UMDI evaluators participated and offered technical assistance to the High-Low SSA Participation Pilot Group.

Table 17: SSA Grantee Monthly Phone Meetings Summary - Year 3		
Date	Topics Discussed	Notes

10-30-2015	• Working group report-outs
	     o Measurement and metrics
	     o Sustainability
	     o Model and Programming
	 • Planning for FY17
	 • GPSTEM and SSA Alignment
	 • Developing completion and transfer phase of SSA
		In-person Fall Retreat

11-19-2015	Review Exit Survey and Student Experience Survey • Feedback on survey items and implementation	Draft instruments had been disseminated at 10/30/16 retreat

12-17-2015	• Update on working group roles
	     o Model
	     o Post-SSA Transfer
	     o Sustainability
	     o Measurement
	 • State university retention and completion project
	 • Updates from SSA campuses
	 • Fall supplemental data reminder
	 • Timing for spring SSA retreat	

2-25-2016	• Early College High School RFP • Year 2 Evaluation Report overview • Working group updates	
3-17-2016	• DHE review and feedback on Early College proposals	Discussion of pros and

Table 17: SSA Grantee Monthly Phone Meetings Summary - Year 3		
Date	Topics Discussed	Notes
	• Retreat overview and preparation • Introduction of High-Low working group idea	cons of college credit for high school students.
4-8-2016	• Using data to communicate a common message about SSA – "one pagers" • Best practice examples based on Year 2 Evaluation report – panel (advising and career support, summer-to-fall retention, fall-to-fall retention) • Post-SSA transfer/career: data highlights, successes and challenges discussion • SSA Sustainability – STEM Centers • Early College check in • Year 4 planning	In-person spring retreat
5-19-2016	• Participant Exit Survey and Student Experience Survey – dissemination and administration • SSA "one pagers" update • Early College check in • Report back on Board of Higher Education meeting	

6-16-2016	• Primary and Secondary Data guidance
	 • STEM Transfer Pathways Initiative
	 • Launch of working groups
	    o Industry – potential establishment of a credential to signal skills to employers
	    o Transfer pathways – ways to strengthen connections between 2 and 4-year institutions
	    o High-Low Participation – possible data collection to differentiate low dose and high dose SSA participants.
	 • Year 4 materials – forwarded to sites
	 • Possible 2-year + 4-year meeting in fall
		Primary and Secondary data collections are intended to capture SSA-related activity.

8-4-2016	• DHE guidance for Year 4 of SSA implementation • DHE support/advocacy regarding SSA to campus leadership	Optional call to discuss SSA Year 4 plans

9-8-2016	• Year 4 planning
	 • Planning for October retreat
	 • Working group updates
	    o High-low participation group: definition of "low dose" as fewer than 6 hours of participation per semester
	    o Industry partner group: identification of skills to be identified with SSA
	 • Site summer Share Out
	 • SSA Early College 2016-17: will be competitive, interest from Executive Office of Education, criteria and RFP are being developed.
	 • Evaluation: upcoming data collections, fall site visits, Year 3 site report materials disseminated, Student Experience Survey and Exit Survey check in.	

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Appendices