Improving High Schools through STEM Early College Strategies

The Impact Evaluation of the STEM Early College Expansion Partnership (SECEP)—Summary Report

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Introduction

The changing U.S. economy means that jobs that pay a living wage are more likely to require some form of postsecondary education, particularly in fields related to science, technology, engineering, or mathematics (known as STEM for short)[1]. Yet, concerns remain that too few students are successfully earning postsecondary credentials, particularly in STEM areas. The problem is particularly acute for certain populations of students, including low-income students, students who are the first in their family to go to college, and students who are members of racial and ethnic groups underrepresented in college. In response to these concerns, educators and policymakers have been exploring a variety of efforts at the high school level to increase students' interest and skills in STEM and to increase their likelihood of enrolling and succeeding in postsecondary education.

This brief provides a summary of key findings from the impact study of the STEM Early College Expansion Partnership. More detail on project implementation can be found in two accompanying briefs that focus on the STEM Early College Model and on the supports provided to the districts and schools. More information on the impact study—including the methodology and detailed impact findings—can be found in the accompanying technical report.

One of the most successful efforts to increase students' enrollment and success in postsecondary education has been the Early College. As originally conceptualized, Early Colleges are small schools focused purposefully on college readiness for all students. Frequently located on college campuses, Early Colleges target students who might face challenges in postsecondary education. Early Colleges serve students starting in 9th grade; the goal is to have students graduate in four or five years, either with a high school diploma and a postsecondary credential (usually an associate degree) or two years of transferable college credit. Two rigorous experimental studies have found that this model had positive impacts on a variety of outcomes, including staying in school, progressing in college preparatory courses, graduating from high school, and enrolling in and graduating from college.[2]

As implemented, the Early College was not necessarily required to have a focus on STEM, although some Early Colleges did structure themselves around STEM themes. There is little research, however, on how STEM can be successfully integrated into the Early College Model. Additionally, there is little research that indicates whether and how the small Early College Model can be scaled to comprehensive high schools. Two previous studies have found that comprehensive high schools can make some changes, although it is challenging work.[3] The

[1] Carnevale & Desrochers, 2003; Carnevale, Smith, & Strohl, 2010

[2] Berger et al., 2013; Edmunds, Bernstein, Unlu, Glennie, & Smith, 2013; Edmunds et al., 2012; Edmunds, Unlu, et al., 2017; Edmunds, Willse, Arshavsky, & Dallas, 2013

[3] Edmunds, Klopfenstein, Lewis, & Hutchins, 2018; Edmunds, Naumenko, Henson, & Hutchins, 2017

STEM Early College Expansion Partnership is among the first set of large-scale efforts to apply Early College strategies in comprehensive high schools and the first one to attempt to simultaneously integrate STEM instructional and curriculum changes.

Supported by a $12 million grant from U.S. Department of Education's Investing in Innovation (i3) Program, the STEM Early College Expansion Partnership (SECEP) was designed to

> …improve STEM education for 22,000 high-need middle and high school students, decreasing drop-out rates and boosting college enrollment in a number of districts in Connecticut and Michigan. SECEP will further improve underrepresented populations' access to STEM careers by increasing the number of students enrolling in dual credit STEM courses and pursuing postsecondary credentials (SECEP Year 2 Management Plan).

SECEP took place in two areas: one large urban district in Connecticut and four Intermediate School Districts (ISDs) in Michigan. The project was a partnership between three primary organizations, each with a long history of Early College work. The overall effort was led by the National Center for Restructuring Education, Schools and Teaching (NCREST) at Teachers College, Columbia University, collaborating with Jobs for the Future (JFF), and the Middle College National Consortium (MCNC). JFF was responsible for project implementation in Connecticut, while MCNC was responsible for project implementation in Michigan.

SECEP set a bold goal for itself: 90% of students in SECEP schools would graduate high school with at least one college credit. This goal was intended to promote broader change in the schools, focusing on four Design Principles to be described in more depth below.

The SECEP Model

SECEP's goal was to redesign high schools by enhancing STEM curriculum and instruction in schools while also expanding access to college courses for students. The project intended to accomplish this by supporting the implementation of the STEM Early College High School Model in comprehensive high schools. A primary emphasis of the program was to increase the number of students who participate in college credit-bearing courses while in high school.

Each participating school was expected to implement four Early College Design Elements, as articulated by the project:

1. **A STEM College-focused Academic Program.** This included providing students with early access to college courses, with an emphasis on STEM-oriented pathways that provided a bridge to STEM postsecondary studies. There was also an emphasis on changing instruction in two areas: college readiness and STEM. Schools were expected to ensure that students were ready for college courses by embedding key college preparatory and college navigational skills into high school courses. Teachers were also expected to utilize STEM instructional practices, such as inquiry-based learning and problem- and project-based learning.
2. **Student Support.** This Design Principle included providing students with the necessary academic and affective supports to be successful in high school and college.
3. **High School-College Collaboration.** This Design Principle represented a strong partnership between the high school and a postsecondary institution around dual enrollment courses, student supports, and data.
4. **Culture of Continuous Improvement.** Schools were expected to regularly use data for improvement and provide opportunities for teachers to learn through professional development and collaboration with each other.

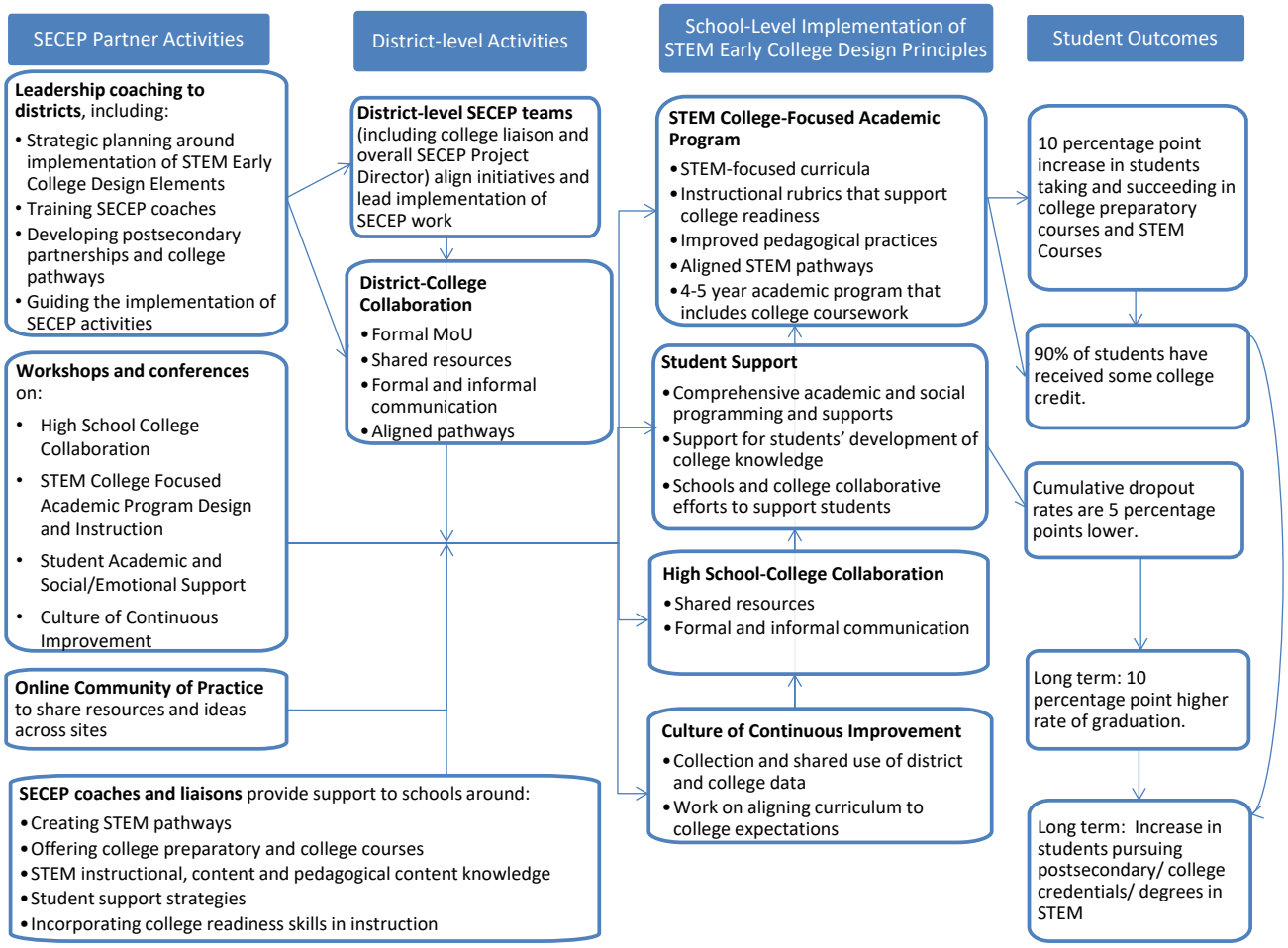
To support schools in this work, the SECEP partners provided a series of implementation supports. These included:

1. leadership coaching and technical assistance to districts around strategic planning, alignment of resources, and the creation of postsecondary partnerships that provide access to dual credit courses;
2. workshops and conferences focused on the Design Principles and on STEM-focused and rigorous instructional practices;
3. an online Community of Practice;
4. school-based SECEP coaching whereby external coaches worked with principals and teachers around implementation of the Early College Design Principles and the targeted instructional strategies;

5. district SECEP implementation teams, which were tasked with managing the implementation of the project; and
6. district-college collaboration, which included the creation of formal partnerships between the district and the postsecondary institutions.

Figure 1 presents the different model components and their relationship to each other and to student outcomes.

Figure 1. SECEP Logic Model



Evaluation Methodology

The external evaluation, which was conducted by a team from the University of North Carolina at Greensboro, was designed to examine the impact of the project on targeted outcomes and to explore changes occurring in the comprehensive high schools as they sought to implement the STEM Early College Model.

The evaluation was designed to answer the following research questions:

1. What is the impact of SECEP on schools' implementation of the STEM Early College Design Principles?
2. What is the impact of SECEP on key student outcomes, including their attainment of college credits and their rate of dropping out of school?

The methodology used to answer each question is described separately.

Impact on School-Level Outcomes

To examine changes in school-level implementation of the Design Principles across the two states, we used two different sources of data. First, we administered an annual survey to staff in all treatment schools that captured targeted changes in coursetaking, instruction, school culture, teacher collaboration, use of data, and school-college partnerships. A total of 451 staff responded in 2015, a 69% response rate, and 392 responded in 2018, a 66% response rate. This survey was also administered to administrators in comparison schools—18 comparison schools responded in both the first project year (2015) and in the fourth project year (2018). Survey data were used in two ways: (1) to look at changes over time in treatment schools and (2) to compare survey responses from administrators in both treatment and comparison schools.

The second source of data was site visits conducted in the spring of 2016 and the spring of 2018. The evaluation team visited the same sample of 12 schools (six high schools and six middle schools) in 8 local districts across the two states. During these site visits, we conducted a total of 124 staff interviews as well as focus groups with 74 students. The interviews focused on implementation of the project activities, implementation of the Design Principles, perceptions of project impacts, and potential sustainability of the work. These school site visits were supplemented by annual interviews with district and project staff.

Impact on Student Outcomes

To look at the impacts on student outcomes, we used a quasi-experimental study in which SECEP high schools were matched to comparison schools that were similar to the SECEP schools before the project started. Due to differences in context and data access, the impact study looked separately at Michigan and at Connecticut.

For Michigan, we identified a set of 42 comparison schools that were comparable to the 11 SECEP high schools on baseline measures of the outcomes and on demographic characteristics. All differences between the two groups were less than 0.16 standard deviations, meeting expectations for baseline equivalence set by the What Works Clearinghouse. We used student-level data to examine the following outcomes:

1. enrollment in a college credit-bearing course, which included both dual enrollment and Advanced Placement (AP) courses;
2. the percentage of students who received at least one potential college credit, defined as students who either passed a dual enrollment course or received a passing score on the AP exam;
3. the number of potential college credits earned through either dual enrollment or AP courses in high school; and
4. dropout rates.

In terms of analysis, students in SECEP schools were compared to students in comparison schools using hierarchical linear modeling (HLM). A benefit of HLM is that it takes into account that students are clustered within schools when estimating program impacts. To improve the statistical precision, we included characteristics of the schools in the analyses (e.g., baseline measures of the outcome, school enrollment). We also included characteristics of the students themselves in the analyses (e.g., baseline reading test scores, underrepresented-minority status, economically disadvantaged status, gender, special education status).

In Connecticut, the impact study faced several significant challenges that limited our ability to make definitive statements about the impact of SECEP. First, the SECEP schools were among the lowest performing in the state; thus, it was impossible to find schools that could serve as good matches on baseline measures of the outcomes and demographic characteristics. Second, the three SECEP schools were located in one district, which meant that any school impacts could be a result of district-level effects instead of the intervention. Third, we were unable to obtain student-level data from the state and had to use school-level data, which restricted our options for outcomes that could be used in these analyses. Despite these caveats, we did attempt to identify comparable schools; in the end, we had to use different samples for each of the three different outcomes. We found schools that were equivalent for two of the outcomes at baseline but were not equivalent on percentage poverty or minority. We were unable to identify schools that were comparable on the third outcome. Nevertheless, we consider the comparison schools as providing suggestive information about the potential impact of SECEP.

We looked at the following outcomes that were available at the school level in Connecticut: (1) percentage of 11th- and 12th-grade students taking at least two AP, Dual Credit, or Career or Technical Education (CTE) courses (measured in 2017-18); (2) cohort dropout rate (available only from 2016-17); and (3) percentage of course enrollments in college

preparatory courses, including Algebra I or higher and English I or higher, in 9th grade (measured in 2017-18). It is important to note that the school-level measure of advanced coursetaking did not include CTE courses at the baseline year (2013-14) but it did include those in the outcome year (2017-18). To look at the difference between SECEP and comparison schools, we used a regression analysis that controlled for the baseline measure of the outcome, economic disadvantage, and minority status.

Changes in Schools

As a result of services provided in SECEP, schools were expected to implement the four STEM Early College Design Principles: (1) STEM College-focused Academic Program, (2) Student Support, (3) High School-College Partnerships, and (4) Continuous Improvement. Surveys and site visits provided data about their implementation in schools. Each Design Principle is discussed below.

STEM College-Focused Academic Program

The first Design Principle has a focus on STEM and consists of three components designed to create learning environments that prepare students for college and career: (1) college-level courses, including STEM-focused pathways; (2) activities to support college readiness; and (3) improved instructional practice.

College-Level Courses and Pathways. Across both states, SECEP schools expanded their offerings of college courses; many of those courses were offered within STEM-focused pathways. The pathways were a sequence of aligned high school and college courses that led to a degree, a technical credential, or provided students credits needed for a postsecondary major in the field. Schools and districts developed pathways that focused on science, engineering, aviation, computer systems and construction technologies, robotics, culinary arts, advanced manufacturing, healthcare, and business. Especially popular were pathways focused on biomedical sciences, healthcare, and engineering. Results from the staff survey showed reported increases in students' enrollment in honors courses, STEM pathways, and college-credit-bearing courses.

College Readiness Activities. Schools also placed an increased emphasis on college readiness. Responses to the staff survey showed statistically significant increases in college-going expectations over time; additionally, SECEP administrators reported statistically significantly higher college-going expectations than comparison administrators did.

> *[We're] trying to get our students ready for college at an earlier stage. Normally, in the past, we were just thinking high school, but now we have to think a little bit further. We have to have our kids prepared because, to be honest, our students are underrepresented at the college level.*
>
> *—School Staff Member*

Responses to the survey also showed statistically significant increases in staff working on students' college readiness skills; there was also a statistically significant difference between treatment and comparison schools on this measure. One way that schools improved college readiness was through a specific class that provided instruction on academic college skills, college expectations, and navigating college procedures. In some of the high schools, this class was offered for college credit.

Improving Instruction. In SECEP schools, there was also an emphasis on changing instructional practices to better prepare students for college (although the focus differed slightly by state). In Michigan, the emphasis was on integrating project-based and inquiry learning. In the first year, all Michigan districts introduced cross-curricular STEM projects in the 8th grade, followed by 9th-grade projects in the second year, and so on. As noted by one middle school teacher,

> We've been building each year and trying to add more...project-based lessons and inquiry lessons, more things where the kids are thinking their way through the projects instead of us just leading them or stuffing them with information.

In Connecticut, the project provided supports in project-based and inquiry learning, but it also used the Common Instructional Framework, six student-centered instructional practices designed to increase rigor and engagement in the classroom. Connecticut interview participants suggested that some teachers implemented the targeted instructional practices and saw positive results, while others suggested that there was uneven implementation. Students did not necessarily report witnessing their implementation.

Survey results demonstrated positive, statistically significant changes in both rigorous instructional practices and inquiry/project-based learning practices for the full sample and for Michigan schools. There were also statistically significant differences between SECEP and comparison principals (combined across the two states) on reported implementation of the targeted instructional strategies. There were no significant changes in instructional practices in Connecticut, except for an increase in use of inquiry/project-based learning practices for math and science teachers.

Student Support

The Student Support Design Principle recognizes that an increasingly rigorous academic environment requires extensive academic and affective supports. As articulated by the model, these supports are expected to be collaborative with the college. Schools were expected to support students' development of "college knowledge," including assistance in college and career planning and in the transition to college. Results from the staff survey showed a statistically significant increase in the implementation of school systems of support, but not necessarily in the amount of support provided by individual teachers, which could possibly be explained by the initially high self-reported levels of these supports. Interviews suggested that the changes in supports focused primarily on support related to college classes. For example, multiple districts created a college liaison position, who was intended to support students in enrolling and succeeding in college classes. Schools also paid more attention to providing support around preparing for college placement exams and applying to college. Schools also received college coursetaking data from NCREST and, in some cases, from their college partners; staff reported that these data allowed high schools to support those students more effectively.

High School-College Collaboration

The third Design Principle, High School-College Collaboration, involves developing strong partnerships between the districts and postsecondary institutions. To implement the project, districts and college partners negotiated Memoranda of Understanding that delineated the responsibilities for each partner, including how college courses would be funded. The survey results showed statistically significant increases in the support provided by the colleges over time. Our initial interviews with district and school staff indicated that most districts had collaborated with postsecondary partners prior to SECEP; however, we also saw that existing relationships were strengthened and new relationships formed as the grant required districts and college partners to work together to expand and improve dual enrollment and pathway opportunities. This appeared to be due in part to schools and colleges developing a better understanding of each other's worlds. As one district leader said,

> I think now that we've been in this for four years, the colleges really understand, especially in a school like ours, all of the components that we have to deal with, and all of the challenges that our students bring to us. And there's a lot less blame game on their part, when the students go over there, because they get it now. And also, we understand the system that they work in, and who they have to report to, with the board and their board's expectations. It's really more of a shared understanding and we're much...quicker to accommodate based on understanding what they need and what we need. It's a much nicer flow of information back and forth.

Culture of Continuous Improvement

The final Design Principle incorporates the creation of a culture of continuous improvement through regular reflection around, and use of, high school and college performance data, and ongoing teacher collaboration and professional development.

SECEP coaches provided assistance in improving the use of data and in helping schools and colleges share data. NCREST also modeled data usage to administrators in both states. They shared data on: student enrollment and performance in college-level courses, school-level results from a student survey data they administered, and results from a teacher survey collected as part of the evaluation. NCREST staff conducted workshops on how to interpret and use the data to make decisions. In interviews, district staff commented how they were better able to use data as a result of these workshops.

Overall, the survey data showed that SECEP school staff significantly increased their use of data relative to students' performance in college courses. This is consistent with the findings that supports for students in college classes also increased over the duration of the grant.

In interviews, school staff reported substantial changes in collaboration, in many cases due to the implementation of interdisciplinary projects. Results from the survey suggested, however, that teachers were not necessarily given more time to collaborate as a result of the project.

> *We have a lot of teacher-led professional development or teacher-led staff meetings or teacher-led training, because certain teachers have taken on leadership roles in SECEP and are experts in certain areas.*
>
> *—SECEP coach*

A culture of continuous improvement also includes opportunities for teachers to participate in ongoing professional development. SECEP supported workshops with external professional development providers, but schools also provided their own supports.

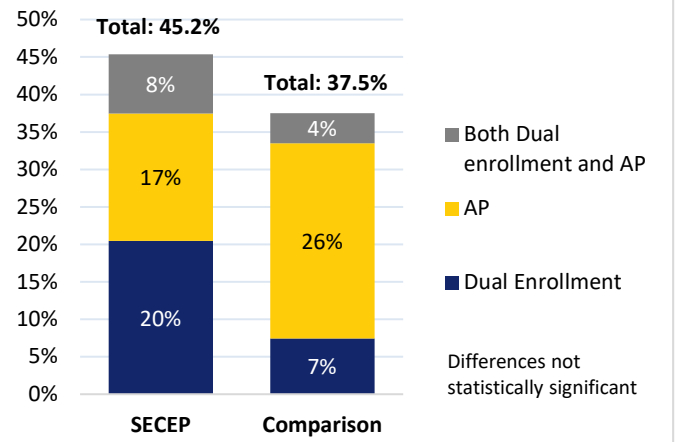
Impact on Student Outcomes

The changes in schools were intended to improve student outcomes. Because of the difference in context, implementation, and data access, the results for Michigan and Connecticut are reported separately.

Impact on Student Outcomes in Michigan

One of the primary goals of SECEP was to increase the number of students taking college courses while in high school. We looked at three specific outcomes related to college courses. First, we looked at the percentage of 11th and 12th graders who enrolled in college credit-bearing courses at some point during their high school career; college credit-bearing courses were defined as either dual enrollment courses or AP courses. We report both the total percentage of students taking college courses and the percentages broken out by whether students were taking dual enrollment, AP, or both dual enrollment and AP. Figure 2 shows that more students were taking college courses in SECEP schools than in comparison schools, although the difference was not statistically significant.

Figure 2. Percentage of 11th and 12th Graders Enrolled in College-Level Courses



The figure also suggests that some of the increase is being driven by a switch between AP and dual enrollment courses, with more students enrolled in dual enrollment courses in SECEP schools and more students enrolled in AP courses in comparison schools.

The second outcome we examined was the percentage of 11th and 12th graders earning at least one potential college credit at some point over their high school career. Potential college credit could be earned by passing a dual enrollment course or by taking an AP exam and passing it with an appropriate score[4] (we call this "potential college credit" because, of course, college credit can only be officially awarded by a postsecondary institution). Figure 3 shows that there

[4] To determine college credit for AP courses, we used credits awarded by the University of Michigan at Flint. The actual score required for credit varied by the subject.

was a statistically significant impact on the percentage of students earning at least one potential college credit.

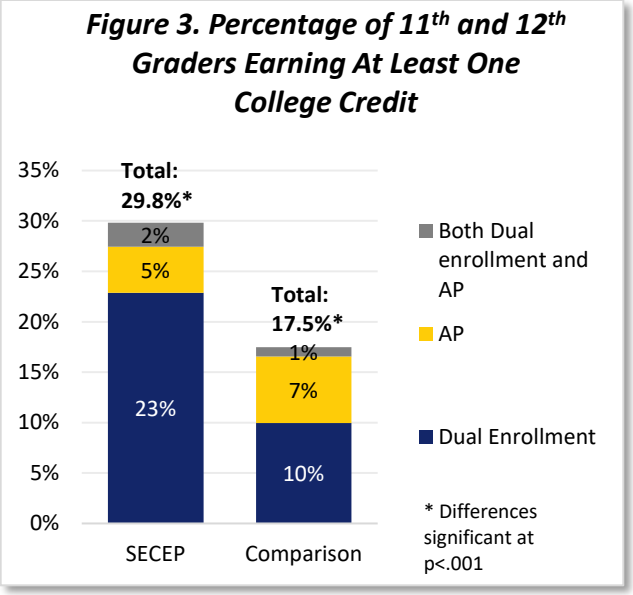


Figure 3. Percentage of 11th and 12th Graders Earning At Least One College Credit

Like Figure 2, we also broke this out by the percentage of students who earned college credit through dual enrollment, AP, or both AP/DE. As the figure shows, the majority of students earning college credit in both groups come from dual enrollment.

Why was there a larger impact on the percentage of students earning at least one college credit than there was on enrollment? To answer this question, we did some exploratory analyses, which showed that this was driven by the differing proportions of students taking AP vs. dual enrollment. These analyses showed that over 90% of students who took dual enrollment courses passed the course and received potential college credit for it; on the other hand, less than 10% of students who took AP courses received a score on the exam that would allow them to earn potential college credit.

The third outcome related to college coursetaking was the number of potential college credits earned by 11th- and 12th-grade students over the course of their high school careers. Students in SECEP schools earned, on average, twice as many credits as students in comparison schools (see Figure 4). Similar to the results shown in Figure 3, the majority of these credits were earned in dual enrollment courses.[5]

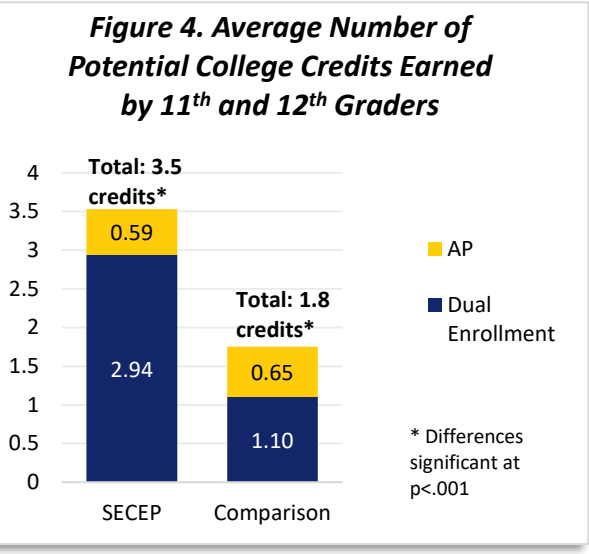


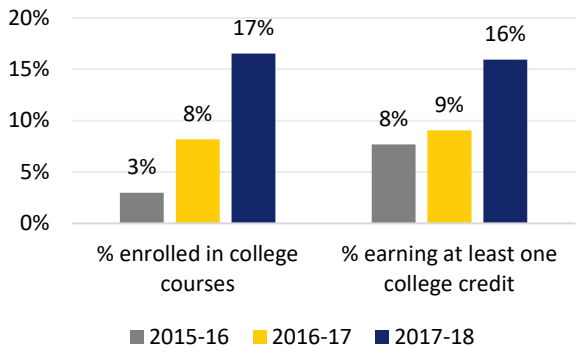
Figure 4. Average Number of Potential College Credits Earned by 11th and 12th Graders

The impacts reported above combine three cohorts of students: from the second, third, and fourth years of implementation. Because the STEM Early College Model is complex and requires the establishment of systems over time, we might expect to see impacts increase as the program becomes more mature. In other words, we might expect impacts for students in the fourth year of implementation (2017-18) to be higher than impacts were in the

[5] Because we are looking at credits here and not students, we do not have a category of both AP and dual enrollment as with the previous two figures.

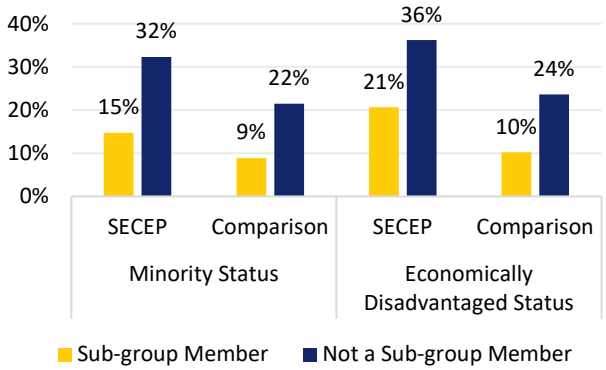
second year of implementation (2015-16). In breaking out the impacts by year, we see exactly what we might have predicted. As shown in Figure 5, the impact (or difference between the SECEP and comparison schools) was lowest in 2015-16 and increased each year through the fourth year of implementation.

Figure 5. Difference Between SECEP and Comparison Schools, By Year



We also looked at the impacts for specific sub-groups, including students who are members of minority groups underrepresented in college and students who are economically disadvantaged. In looking at the percentage of students who earn at least one college credit, we see that 15% of underrepresented minority students in SECEP schools earned at least one college credit. This is more than the 9% of underrepresented minority students earning at least one college credit in comparison schools, but it is also substantially less than the percentage of non-minority students earning at least one college credit (32% in SECEP schools). These results are shown in Figure 6.

Figure 6. Percentage Receiving At Least One College Credit, by Sub-Group Membership

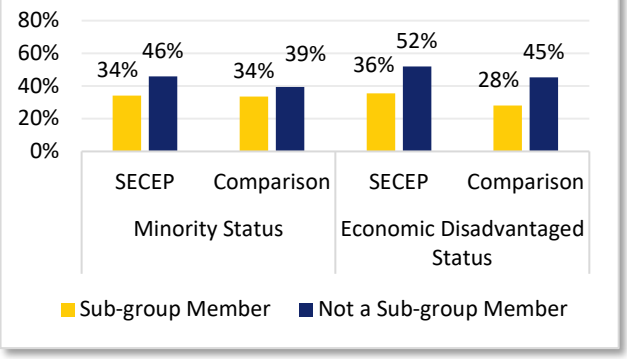


When we look at the size of the difference—the gap between the percentage of minority students in a school taking college-level courses and the percentage of non-minority students taking college-level courses—we see that gaps between minority and non-minority students are larger in SECEP schools than in comparison schools. For example, the gap between the percentage of minority and non-minority students earning at least one college credit in SECEP schools is approximately 17 percentage points in SECEP schools compared to 13 percentage points in comparison schools. On the other hand, when looking at gaps between economically disadvantaged and not economically disadvantaged students, they are essentially the same in both SECEP and comparison schools (15 percentage points in SECEP schools and 14 percentage points in comparison schools).

When thinking about possible explanations for these gaps, we wanted to test whether this was due to gaps in enrollment in the courses (i.e., gaps in access) or gaps in successful completion once a student was enrolled in the course.

As Figure 7, shows, there is also a gap in enrollment between underrepresented minority and non-minority and between economically disadvantaged and not economically disadvantaged. This suggests that underrepresented minority and low-income students have less access to college-level courses in both treatment and comparison settings, with a larger enrollment gap for minority students in SECEP schools than in comparison schools.

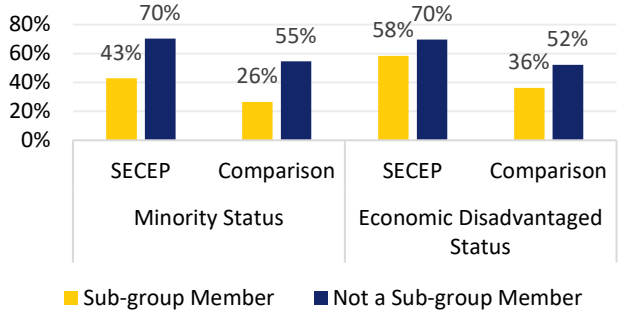
Figure 7. % Enrolling in College-Level Courses, by Sub-Group Membership



When we look at successful completion of courses once students are enrolled, we see that gaps are present in that situation as well. As Figure 8 shows, once a minority student is enrolled in a college-level course, the gap in successful completion rates between minority and non-minority students is similar in both SECEP and comparison schools (27 percentage points in SECEP schools and 29 percentage points in comparison schools). However, it is also important to note that all students in SECEP schools were also more likely to receive potential college credit for their classes than were similar students in comparison schools. This may be due, at least partially, to the increased success rate in dual enrollment courses as opposed to AP courses.

These findings suggest that the gaps between minority and non-minority students and between economically disadvantaged and not economically disadvantaged students are due to inequities both in access and in successful completion.

Figure 8. % Receiving At Least One Credit Out of Those Taking At Least One College-Level Course, by Sub-group Status



The increase in college coursetaking is expected to result in increased student motivation to stay in school and a corresponding decrease in dropout rates. Analysis of the dropout rates showed descriptive declines in dropout rates overall and across almost all sub-groups, but none of the differences were statistically significant.

Table 1. Impacts on Percentage of Students Dropping Out of School, Michigan

Outcome and Population	SECEP Adjusted Mean	Comparison Unadjusted Mean	Adjusted Impact Estimate
% of students who dropped out of school –All students	1.6%	1.8%	-.2%
% Underrepresented minority students who dropped out of school	2.4%	3.0%	-.6%
% NON-minority students who dropped out of school	1.5%	1.3%	+.2%
% Economically disadvantaged students who dropped out of school	2.5%	2.7%	-.2%
% NON-Economically disadvantaged students who dropped out of school	0.7%	1.1%	-.4%

**No differences were statistically significant.*

Impact on Student Outcomes in Connecticut

As noted in the methodology discussion, the outcome analysis for Connecticut faced considerable challenges. As such, our design did not allow us to make definitive statements about the impact of the project on SECEP schools in Connecticut. We do present estimated impacts based on the differences between the SECEP schools and comparison schools that started at approximately the same baseline measure of outcome and that were as equivalent as the data would allow on race and poverty. Our analyses also took into account the differences in baseline measures of outcomes, race, and poverty.

As Table 2 shows, the SECEP schools and comparison schools provided similar levels of access to college credit/CTE courses (with estimated means of 67% for both). It is important to note that this school-level measure includes CTE courses, which were not an emphasis of the intervention. Data collected by NCREST showed that dual enrollment/AP participation rates were approximately 15-17% in 2016-17, which suggests that the bulk of student participation shown in the table was driven by CTE courses and not dual enrollment/AP courses.

As Table 2 also shows, SECEP expanded their enrollment in college preparatory courses at a higher rate than did comparison schools when adjusted for demographic characteristics, although the difference was not statistically significant. Finally, dropout rates were higher in SECEP schools than in comparison schools by approximately five percentage points, although the difference was not statistically significant.

Table 2. Estimated Impacts on Student Outcomes, Connecticut

Outcome (Year measured)	Treatment Model adjusted Mean	Comparison Unadjusted Mean	Adjusted Impact Estimate
% 11th and 12th graders taking at least two college credit or CTE courses (17-18)	66.7%	66.8%	-.1%
Cohort dropout rate (16-17)	21.6%	17.0%	4.6%
% 9th-grade course enrollments in college preparatory courses (17-18)	87.9%	81.6%	6.4%

Note. The treatment mean was calculated by adding the impact estimate from the model to the unadjusted comparison mean; essentially, the model estimates what the mean for the treatment schools would be if they had the same levels of poverty and race/ethnicity as the comparison schools. No differences were statistically significant.

Discussion and Conclusions

SECEP was the first effort to integrate the proven Early College Model with a STEM focus and implement it in comprehensive high schools. As described above, the comprehensive schools in this project made changes to their schooling environment, increasing the emphasis on college-going and working to implement changes in instructional practices. These changes made by the schools were expected to lead to improved student outcomes, including more college credits earned and reduced dropout rates. To test these hypotheses, the evaluation study conducted two separate impact studies, broken out by state. This turned out to be appropriate and necessary given that the context and implementation varied substantially by state. Due to the challenges with the Connecticut impact analyses, however, we focus this discussion primarily on the results from Michigan.

In the Michigan schools, we saw an overall positive impact on students' earning of college credits. The percentage of students who earned at least one potential college credit was substantially higher (about 12 percentage points) in the SECEP schools than in the comparison schools, and students in SECEP schools earned approximately double the number of college credits as students in comparison schools (on average 3.5 and 1.8 potential credits, respectively).

Evidence from the Michigan impact study suggests that enrollment in dual credit courses may have come somewhat at the expense of enrollment in AP courses. For example, the percentage of students enrolled only in dual credit courses was 13 percentage points higher than in the comparison schools, while the percentage enrolling only in AP courses was nine percentage points lower. However, study results also suggest that enrollment in dual credit courses made it more likely that a student would earn potential college credit. We found a very small proportion of our sample scoring sufficiently high on AP exams to earn college credit, while over 90% of the students taking dual enrollment courses received a passing grade. Of course, it is important to acknowledge that earning actual credit, whether through dual enrollment courses or AP exams, always depends on the college or university granting that credit.

There is also evidence from Michigan that dual enrollment was not reaching all students equally, particularly with regard to underrepresented minority students. For example, project impacts were smaller for underrepresented minority students, as they were less likely to enroll in dual enrollment courses than non-underrepresented minority students. These findings are consistent with other literature that has shown that expansion of dual enrollment opportunities often comes first to white or more advantaged students, resulting in concerns about equity.[6] These data suggest that schools will want to regularly look at the characteristics of their dual enrollment students to ensure that there is equity in their coursetaking opportunities.

[6] Miller et al., 2018; Pierson, Hodara, & Luke, 2017

The strengthened college-going culture was intended to give students a better sense of their future and encourage them to remain in school. The dropout data showed descriptively lower dropout rates in the Michigan SECEP schools, although the difference was not statistically significant.

Overall, results from the SECEP study show that comprehensive high schools can make significant changes to their culture and their instruction. The hope is that these changes will be sustained and will lead to more students graduating from high schools prepared to be successful in careers or further postsecondary education.

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