Evaluation of the Connecticut Health and Life Sciences Career Initiative

Final report

Christine Mokher, Ph.D.

Juliana Pearson

August 2016

Connecticut
Health & Life Sciences
Career Initiative

CNA
ANALYSIS & SOLUTIONS

Cleared for Public Release

Acknowledgements

This evaluation was conducted by CNA with support from the National Research Center for Career and Technical Education (NRCCTE), and Social Science Consultants. The authors would like to thank Tom Geraghty, James Stone, and Marisa Castellano for their helpful feedback on this report and/or prior reports, and Bettina Kimpton for editing.

This product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the external evaluator for the grant and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability or ownership.

Approved by: **August 2016**

Stacey Jordan
Vice President and Director
CNA Education

Executive Summary

TAACCCT program description and activities

CNA Education served as the third-party evaluator for the Connecticut Health and Life Sciences Career Initiative (HL-SCI), a statewide initiative funded from September 2012 to March 2016 through a Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant from the U.S. Department of Labor. The purpose of HL-SCI is to prepare workers throughout Connecticut for high-wage, in-demand jobs in health and life science fields, with a particular focus on recruiting veterans and workers who are unemployed, underemployed, or displaced by foreign trade. The HL-SCI Consortium consists of five community colleges (Capital, Gateway, Manchester, Middlesex, and Norwalk), the online Charter Oak State College, Eastern Connecticut State University, and local workforce investment boards.

HL-SCI partners developed new health and life science certificate and associate's degree programs and revised previously existing programs. The new and revised programs incorporate several core programmatic components, including online and hybrid coursework; online booster modules providing supplemental instruction in key course concepts; increased prior learning assessment (PLA) to award students credit for prior noncredit coursework, training, and knowledge; and enhanced job and internship placement services.

Evaluation design summary

Implementation study design

At the beginning of the grant, the Consortium set 17 goals for implementing HL-SCI deliverables (such as the number of new certificate and degree programs to be created). To measure capacity building, the evaluation team collected data from HL-SCI annual reports to the U.S. Department of Labor to track actual performance relative to grant goals.

The implementation evaluation also examined the five key components of HL-SCI, as well as the structures and strategies supporting it. The implementation evaluation sought to answer two principal research questions:

1. What are the challenges to the implementation of each of the HL-SCI grant components (booster modules, online and hybrid courses, PLAs, and internship/job placement services)?

2. What are promising practices related to the implementation of each of the HL-SCI grant components (booster modules, online and hybrid courses, PLAs, and internship/job placement services)?

This report includes a summary of feedback collected through interviews and focus groups throughout the grant period, the spring 2016 results of a student survey administered to all HL-SCI participants, and the results of a Survey Monkey questionnaire administered to students at the conclusion of each booster module.

Impact study design

To evaluate the overall impact of the HL-SCI grant, the impact evaluation sought to answer the following research questions:

1. (College persistence) Do HL-SCI participants persist in their colleges at higher rates than students who enrolled in similar programs prior to the implementation of the intervention?

2. (Credential completion) Do HL-SCI participants complete certificate or degree programs at a higher rate than students who enrolled in similar programs prior to the implementation of the intervention?

3. (Credit accumulation) Do HL-SCI participants complete more credits than students who enrolled in similar programs prior to the implementation of the intervention?

All of these outcomes can be measured reliably using databases of student records from each of the Consortium colleges. The impact evaluation also includes separate effectiveness analyses for three components of HL-SCI: PLAs, booster modules, and online and hybrid courses.

The analysis employed a quasi-experimental approach to compare the outcomes of HL-SCI participants with those of participants in the same or similar programs at their colleges prior to the start of the grant. Students in the comparison group were carefully selected to match the students in the intervention group, using coarsened exact matching. The outcomes for the two groups were compared after one and two years of program participation. These impacts should not be interpreted as causal, as there may be unobserved differences between the HL-SCI and comparison groups that are not accounted for in the analysis and may influence student outcomes.

The evaluation team also conducted a quantitative descriptive analysis that assessed Consortium performance on nine student outcome goals (such as the number of participants completing a TAACCCT-funded program of study) using data from HL-SCI annual reports to the U.S. Department of Labor.

Implementation findings

The Consortium exceeded all of the final deliverable goals (table S1). This indicates that the Consortium greatly expanded access to HL-SCI programs of study, the types of programs offered, and the availability of academic supports.

Table S1. Summary of actual performance relative to HL-SCI grant deliverable goals

Grant deliverable	Target	Actual	Goal met?
1. Number of new certificates and degrees	15	20	Yes
2. Number of revised certificates and degrees	34	48	Yes
3. Number of students enrolled in new certificates and degrees	600	637	Yes
4. Number of existing programs of study revised so that credentials are stacked / latticed	30	44	Yes
5. Number of students enrolled in revised certificates and degrees	2,700	4,371	Yes
6. Number of students taking online skills assessments	1,350	2,478	Yes
7. Total math and science booster modules	140	154	Yes
8. Number of students taking math and science booster modules	3,200	4,792	Yes
9. Number of new online and hybrid courses offered	60	71	Yes
10. Number of online modules with feedback/assessment	450	789	Yes
11. Total number of students taking online and hybrid courses	2,400	3,248	Yes
12. Number of students receiving PLA credits	675	1,629	Yes
13. Total number of PLA credits awarded	10,000	15,164	Yes
14. Number of additional noncredit programs recognized by CCAP	36	57	Yes
15. Number of additional credits available by CCAP	324	719	Yes
16. Number of participants placed in internships	360	2,412	Yes
17. Number of participants receiving job placement services	2,000	4,248	Yes

The evaluation team also identified strengths and weaknesses of the program and its components based on the qualitative data analysis. Key findings include:

- **Program enrollment and recruitment.** Most students learned about their programs independently, although those who did learn about their programs from faculty or staff members at the college found this input to be very influential in their decision to enroll.
- **Booster modules.** Most students who had taken booster modules found them useful because they provided another method through which to learn course material.
- **Online and hybrid courses.** Most participants preferred in-person courses to online and hybrid formats because in-person courses allow for more interaction

between students and professors. Some students appreciated online courses because they were convenient and allowed students to complete content at their own pace.

- **Prior learning assessments (PLA).** Most students believed that the PLA process was easy to understand, they received the right amount of credit, and they would be able to complete their programs more quickly.

- **Employment and placement services.** Students liked that clinical experiences were hands-on and allowed them to apply what they had learned in the classroom. Most students found employment and placement services helpful although some students expressed the need for additional career guidance.

Participant impacts and outcomes

The Consortium exceeded seven of the nine student outcome goals (table S2). The two unmet goals pertained to employment outcomes for program completers who were not employed at initial program enrollment. However, many HL-SCI participants were still enrolled in their programs of study at the end of the grant period, so there was insufficient follow-up time to assess these outcomes for the majority of participants.

Table S2. Summary of actual performance relative to student outcome goals

Student outcome	Target	Actual	Goal met?
1. Unique participants served	2,700	4,530	Yes
2. Number of participants completing a HL-SCI program of study	783	1,069	Yes
3. Number of new and continuing participants retained in a HL-SCI program of study (not unique)	2,244	5,152	Yes
4. Number of participants completing credit hours	2,430	3,491	Yes
5. Total credentials earned	861	1,096	Yes
6. Number of completers enrolled in further education	196	234	Yes
7. First-time employment for completers	587	388	No
8. Retention in first-time employment for completers	470	283	No
9. Number of participants receiving a wage increase	405	1,408	Yes

Key findings from the impact evaluation include:

- HL-SCI students and comparison students performed similarly on all outcomes (table S3).

- Results for the intervention group also tended to be similar by program category, except that HL-SCI students in science programs completed approximately one to two courses fewer than HL-SCI students in all programs after two years of program enrollment.

- HL-SCI participants who received PLA credit were more likely to complete a credential within one or two years than participants without PLA credits.
- HL-SCI participants who received PLA credits were less likely to persist after the first year than participants without PLA credits.

Table S3. Summary of the overall impact of the HL-SCI grant on the predicted probability of student outcomes

Outcome	Years of exposure	Regression-adjusted mean or predicted probability		
		HL-SCI group	Comparison group	Difference
College persistence	1 year	68.9%	68.8%	0.1%
	2 years	66.2%	65.5%	0.7%
Credential completion	1 year	1.6%	1.1%	0.5%
	2 years	17.1%	15.3%	1.8%
Credits accumulated	1 year	14.74	15.01	-0.27
	2 years	27.46	26.17	1.29

We also examined course completion and performance outcomes for the booster module and online and hybrid course HL-SCI components. HL-SCI participants enrolled in these courses were matched to other students enrolled in the same course before the HL-SCI component was added. Key findings include:

- There were no differences in course completion rates, which were greater than 90 percent before and after the HL-SCI component.
- There is some evidence that course grades were higher for students in online and hybrid courses than for students enrolled in the same course in traditional in-person format.

Conclusions

Using the findings from the evaluation, the evaluation team generated recommendations for staff at Consortium colleges. Many of these recommendations are general enough that they may inform other groups involved in similar initiatives.

Program enrollment and recruitment

- Increase efforts by staff at Consortium colleges to recruit students.
- Have college staff members guide students in selecting a program of study.

Booster modules

- Maintain and expand student access to booster modules.

Online and hybrid courses

- Improve student engagement and interaction with faculty in online and hybrid courses.
- Continue to offer online courses to ensure flexibility for students.
- Further investigate why students perceive that they learn more in in-person courses.

Prior learning assessments (PLA)

- Ensure that students who might benefit from PLA take advantage of the opportunity.
- Ensure that the process for awarding credit is straightforward and transparent.

Employment and placement services

- If possible, ensure that clinical hours are flexible so that students can meet other obligations.
- Expand access to college and career guidance for continuing students and graduates.

Implications for future workforce and education research

- Overall, results were similar on all outcomes for the HL-SCI students and the matched comparison students. However, this evaluation included only students who entered an HL-SCI program of study in the first two years of the grant and tracks outcomes for one to two years, so it is possible that it may be too early to detect an impact. Future research should examine the impacts of the strategies tested under the grant after a longer duration.
- Results for PLAs were mixed among HL-SCI participants. If implemented properly, PLAs should assist students in completing their programs and earning credentials more quickly. If, however, PLA credits are granted too freely, students may not possess the background they need to master the material in more advanced courses. Future research may examine differences in policies for awarding PLA credits and the impact on student outcomes.

Contents

List of Figures

List of Tables

Glossary

ATT	Average treatment effect on the treated
AS	Associate of Science
CCAP	Connecticut Credit Assessment Program
CEM	Coarsened exact matching
CI	Curriculum innovation coordinator
GPA	Grade point average
HL-SCI	Connecticut Health and Life Sciences Career Initiative
IT	Information technology
PLA	Prior Learning Assessment
TAA	Trade Adjustment Assistance
TAACCCT	Trade Adjustment Assistance Community College and Career Training

Overview of the HL-SCI Evaluation

CNA Education served as the third-party evaluator for the Connecticut Health and Life Sciences Career Initiative (HL-SCI), which is funded through a Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant from the U.S. Department of Labor. The purpose of the HL-SCI grant is to prepare veterans; trade adjustment assistance (TAA)–eligible workers (that is, those displaced by foreign trade); and dislocated, unemployed, and underemployed workers for high-paying, in-demand careers in health and life science fields.

Through the initiative, a consortium of five community colleges,[1] the online Charter Oak State College, and Eastern Connecticut State University developed new certificate and associate's degree programs, revised existing programs, and put in place other strategies to support student success. The new and revised programs were developed with input from industry partners to ensure that the programs align with labor market demands. Grant funding and program development began in October 2012, while program implementation began in spring 2013 and continued through the end of March 2016.

The third-party evaluation used a mixed methods research design to assess the implementation and effectiveness of the initiative. The evaluation had three primary components: a descriptive component tracking actual performance relative to goals outlined in the original grant proposal, a qualitative implementation evaluation, and a quantitative impact evaluation.

First, the descriptive analysis compared actual performance relative to targets for 17 HL-SCI deliverable goals and 9 student outcome goals using data from HL-SCI annual reports to the U.S. Department of Labor. Second, the qualitative component of the evaluation examined implementation progress and opportunities for and barriers to success within the program. Throughout the grant period, CNA collected feedback from students at all five Consortium colleges through interviews, focus groups, and surveys. Previous reports also included an analysis of documents provided on program implementation throughout the Consortium and case studies of one

[1] The five community colleges are Capital, Gateway, Manchester, Middlesex, and Norwalk Community Colleges.

"flagship" program at each college that was a focus of grant activities (Pearson, Daponte, & Cruz, 2015a, 2015b, 2016). Third, the impact evaluation component examined the program's impact on student outcomes, including college persistence, credential completion, and credit accumulation.

Description of the HL-SCI intervention

HL-SCI provides targeted training leading to industry-recognized certificates and associate's degrees in health and life science fields at five community colleges in Connecticut: Capital, Gateway, Manchester, Middlesex, and Norwalk Community Colleges. HL-SCI includes a set of five evidence-based program components:

- **New and revised credential programs** that align with industry-recognized credentials and include stacked / latticed credentials, which help workers advance along a career pathway, move up a career ladder (stacked), or shift to a related field (latticed). HL-SCI credentials lead to certificates and associate's degrees that can articulate with baccalaureate degree programs.

- Online **booster instructional modules**, which provide supplemental instruction to help students succeed. Some booster modules review course content, while others cover more general topics such as study skills, time management, and note-taking. Additionally, some booster modules were designed specifically to support veterans; these booster modules cover topics such as how to return to campus life and (for college staff) how to advise veterans.

- **Online and combined online/traditional classroom (hybrid) courses** to make credential programs more accessible by giving students greater flexibility in scheduling courses.

- In partnership with Charter Oak State College, **the development of a standardized prior learning assessment (PLA) system** to award students with credit for prior credit and noncredit coursework, training, and knowledge gained on the job, as well as a coordinated effort to increase prospective and current students' awareness of the PLA system.

- **Internship and job placement services** to help students secure internships or jobs in their fields of study while enrolled in college and find permanent employment following program completion. These services include advice on searching for internships and permanent jobs, resume and interview preparation, and guidance on the soft skills necessary for all health and life science occupations.

The ultimate goal of TAACCCT grants is to prepare program participants for employment in high-wage, high-skill occupations. According to data from EMSI Analyst™ presented in HL-SCI's technical proposal, at the beginning of the grant period the state of Connecticut employed approximately 200,000 people in the health and life science industries and expected to add 11,000 jobs in these industries in the next eight years These data are supported by nationwide job growth projections within the healthcare field. An aging population and advances in medical technologies continue to drive growth in the healthcare professions. The Center on Education and the Workforce at Georgetown University found that healthcare had the greatest increase in the number of jobs among all major occupation groups from December 2007 to January 2016 (N=2.3 million new jobs). Two out of three jobs added in healthcare professional and technical occupations during this time required a bachelor's degree or higher (Carnevale, Jayasundera, & Gulish, 2016).

Data and methods

The program evaluation used both qualitative and quantitative research methods, with a focus on the implementation of specific HL-SCI intervention components and the overall effectiveness of the HL-SCI initiative. This section describes the data and methodological approaches used to determine the results included in the final report.

Consortium-wide performance relative to goals

The original HL-SCI TAACCCT grant proposal to the U.S. Department of Labor established numerical goals for development of and student participation in each component of the HL-SCI grant: the new or revised certificate or degree programs, booster modules in math and science, online and hybrid courses, PLA, and internships and job placements.[2] This report documents actual performance relative to the 17 deliverable goals displayed in table 1. The results for these goals are included with the implementation evaluation results section of the report.

[2] Some of these goals pertain to the total number of students who participated in grant-funded activities, regardless of whether they were HL-SCI participants. For example, some students in non-HL-SCI programs of study enrolled in courses with booster modules. Other goals pertain only to participants of HL-SCI programs of study. The terms "student" and "participant" are used to distinguish who is included in each goal.

Table 1. HL-SCI grant deliverable goals

Grant deliverable	Target
1. Number of new certificates and degrees	15
2. Number of revised certificates and degrees	34
3. Number of students enrolled in new certificates and degrees	600
4. Number of existing programs of study revised so that credentials are stacked / latticed	30
5. Number of students enrolled in revised certificates and degrees	2,700
6. Number of students taking online skills assessments	1,350
7. Total math and science booster modules	140
8. Number of students taking math and science booster modules	3,200
9. Number of new online and hybrid courses offered	60
10. Number of online modules with feedback/assessment	450
11. Total number of students taking online and hybrid courses	2,400
12. Number of students receiving PLA credits	675
13. Total number of PLA credits awarded	10,000
14, Number of additional noncredit programs recognized by CCAP	36
15. Number of additional credits available by CCAP	324
16. Number of participants placed in internships	360
17. Number of participants receiving job placement services	2,000

The grant also outlined nine goals for student outcomes related to enrollment in and completion of HL-SCI programs of study and continuing education and employment of program completers (table 2).[3] The results for these goals are included with the impact evaluation results.

Table 2. HL-SCI grant student outcome goals

Student outcome	Target
1. Unique participants served	2,700
2. Number of participants completing an HL-SCI program of study	783
3. Number of participants retained in an HL-SCI program of study	2,244
4. Number of participants completing credit hours	2,430
5. Total credentials earned	861
6. Number of completers enrolled in further education	196
7. Number of completers employed	587
8. Number of completers retained in employment	470
9. Number of participants receiving a wage increase	405

[3] These student outcome goals include only participants who completed or were retained in an HL-SCI program of study. They do not include students who switched to a non-TAACCCT-funded program of study. This means that the outcomes reported may underestimate total completion and retention rates.

Approach to the implementation evaluation

The implementation evaluation examined the five key components of HL-SCI, as well as the structures and strategies supporting it. The implementation evaluation sought to answer two principal research questions:

3. What are the challenges to the implementation of each of the HL-SCI grant components (booster modules, online and hybrid courses, PLAs, and internship/job placement services)?

4. What are promising practices related to the implementation of each of the HL-SCI grant components (booster modules, online and hybrid courses, PLAs, and internship/job placement services)?

These research questions were addressed using interviews and focus groups with students, a student survey administered to all grant participants, and a Survey Monkey survey administered to all students who completed math and science booster modules. Previous reports also included a survey of Consortium faculty members on the development and implementation of booster modules and case studies on one program at each college that was a focus of grant activities (Pearson, Daponte, & Cruz, 2015b).

Focus groups and interviews

The qualitative implementation evaluation included in-depth interviews and focus groups conducted either in-person or over the phone with students participating in HL-SCI programs of study. The purpose of the interviews and focus groups was to gather student feedback on implementation.

The data collected from the interviews and focus groups were designed to answer the following research questions on program implementation and student success:

1. Why did the student select the particular program in which s/he is participating?

2. How have the booster modules, online and hybrid courses, and PLAs been implemented to support students and their learning?

3. What steps can the colleges take to improve students' experiences with booster modules and online and hybrid courses?

4. Did the Consortium colleges make students aware of opportunities to earn credit for prior learning? To what extent do students receive PLA credits they can use toward completion of a degree or certificate?

5. Did students receive career guidance or placement services? If so, how did these services support their ability to secure a program-related internship or permanent employment?

6. What were the most important factors contributing to students' progress through and success in their HL-SCI programs of study?

7. What are the main barriers students must overcome to complete their programs successfully?

CNA collected feedback from students through focus groups and interviews throughout the grant period, alternating the campuses at which data were collected. Researchers spoke with students at Capital, Gateway, and Middlesex Colleges in the fall of 2014 and the spring of 2016. Students at Manchester and Norwalk Community Colleges provided feedback in the spring/summer and fall of 2015. CNA structured the timing of the interviews to ensure that we received feedback from students at each college during both a fall and a spring semester.

The evaluation team worked with grant staff to ensure that the sample of focus group and interview participants reflected a wide range of student views. Researchers spoke with program coordinators at each college to find out which programs they considered particularly important to include in the sample of students invited to participate. Priority programs included those that had undergone significant revision, were a focus of the grant, or enrolled a large number of students. A stratified random sample was drawn that included representation from each of these programs.[4]

In the initial round of recruitment, between 25 and 50 students from the stratified random sample at each campus were invited to participate in the focus groups. The focus groups were scheduled over multiple days during times when students were likely to be on campus (for example, before or after times when classes were offered). All recruited students received an email invitation, up to two follow-up e-mails, and up to two follow-up phone calls. Email invitations were sent to both personal and college email addresses to increase the likelihood that the students would receive and read them. Lunch and refreshments were provided to incentivize students to

[4] Despite the above recruitment efforts, the number of participants at one of the campuses was initially quite low. To increase participation, the curriculum innovation coordinator at the college reached out to faculty members, who invited their students to contact the evaluation team if they were interested in participating in an interview. These students were not selected at random so they may not be as representative of the larger sample from which they were drawn, but it provided us with much-needed feedback from students at this campus. Overall, the findings from the interviews and focus groups at this campus were similar to those from the other campuses, which suggests that the use of the nonrandom sample did not bias the results.

participate. If students were unable to attend a focus group, they were offered the opportunity to participate in an on-campus interview at another time or a phone interview at their convenience. A second round of recruitment was added for campuses with low response rates.

Some of the grant staff at the Consortium colleges also made concerted efforts to increase student participation in interviews and focus groups. For example, the curriculum innovation coordinator (CI) at one college emailed all participants to let them know that they might be contacted by the evaluators, and also contacted the program coordinators to ask them to tell their students to participate in the evaluation if contacted. Grant staff also engaged in additional advertising and promotion through activities such as posting or handing out flyers about the focus groups.

In total, 167 students across the five colleges provided feedback during the grant period. Table 3 shows the total number of students participating in interviews and focus groups at each college. Focus group and interview findings were similar across semesters.

Table 3. Focus group and interview respondents at each campus, by semester

College	Fall 2014	Spring and summer 2015	Fall 2015	Spring 2016	Total participants
Capital	8	-	-	22	30
Gateway	6	-	-	27	33
Manchester	-	6	26	-	32
Middlesex	5	-	-	26	31
Norwalk	-	16	25	-	41
Total	**19**	**22**	**51**	**75**	**167**

Challenges associated with the methods used for student recruitment and lack of student interest led to low response rates during the first two data collection cycles. The research team and Consortium colleges undertook extensive efforts to increase the number of students participating in focus groups in the fall of 2015 and spring of 2016. The results of these efforts can be seen in the greater number of participants in these semesters.

HL-SCI student survey

CNA administered a student survey to all HL-SCI participants in the spring of 2015 and in the spring of 2016. This report includes the results from the 2016 administration of the survey, which are similar to the 2015 results. The purpose of the student survey was to gather feedback similar to that of the focus groups and interviews but from a larger group of students. In March of 2016, CNA sent a link to the survey to 2,314 students who were currently enrolled in HL-SCI programs of study. Of those, 14 percent (N=335) opened and responded to at least part of the survey. Participation was voluntary; grant funding could not be used to provide financial incentives for participation.

Of the 335 students who completed at least part of the survey, 96 percent identified their college (N=320). Capital and Norwalk had the highest response rates—20 and 22 percent, respectively. Middlesex had the lowest response rate. Approximately 7 percent of the potential respondents completed the survey and identified their college (table 4). Thus, although the student survey provides valuable feedback from students, it may not be representative of all HL-SCI participants.

The overall response rate of 14 percent in spring 2016 was higher than in the spring 2015 administration, which had a response rate of 11 percent. The increase in participation resulted from efforts taken by grant staff. The grant's CIs encouraged students to participate in the survey through activities such as emailing participants directly with the link to the survey, and posting flyers with a shorted link to the survey. Some CIs talked directly with students about the importance of providing their feedback through the survey or asked other college staff or instructors to discuss this with their students.

Table 4. Number of student survey respondents and response rates, by college

College	Total students receiving the survey	Number of respondents	Response rate
Capital	435	87	20
Gateway	608	70	12
Manchester	327	34	10
Middlesex	543	40	7
Norwalk	401	89	22
College not identified	-	15	N/A
TOTAL	2,314	335	14

The number of questions on the spring 2016 survey was reduced from the prior year to encourage more students to complete the survey. The survey began with a series of questions about where students were enrolled, the programs in which they were participating, the people and sources of information influencing students' decisions to enroll in the college, and their reasons for enrolling. Subsequent sections of the survey asked students for detailed feedback on the HL-SCI grant's core components: online and hybrid courses, prior learning assessments, and enhanced career guidance and placement services.

Booster module survey

Student feedback on Consortium-wide implementation of booster modules was collected through a separate, voluntary online survey administered by a Survey Monkey link posted at the end of the booster module. HL-SCI staff developed the survey for all Consortium students who completed a booster module between the fall of 2014 and the spring of 2016. The survey was offered at the completion of each booster module. Although no data are available on the total number of students who completed a booster module, 4,792 students had the opportunity to complete at least one booster module by spring 2016. Therefore, we estimate that the response rate is around 14 percent (685/4,792).

The survey asked students to rate whether the booster was easy to follow, whether the booster increased his or her understanding of the subject matter, how the student would improve the booster, and whether or not he or she would recommend it to others.

This report builds on booster survey results presented in earlier reports (Pearson, Daponte, & Cruz, 2015a, 2015b, 2016). It presents results by academic semester to track changes in student feedback over the duration of the grant period. Results from the spring and summer of 2015 are combined because relatively few students completed boosters during the summer as Consortium colleges did not offer many courses that semester. Table 5 displays the number of students who responded during each academic time period.

Table 5. Number of booster survey respondents, by academic term

Academic term	Respondents	Percent of total respondents
Fall 2014	165	24
Spring and summer 2015	270	39
Fall 2015	184	27
Spring 2016	66	10
TOTAL	685	100

Approach to the impact evaluation

The quantitative portion of the evaluation seeks to determine whether the HL-SCI grant had an impact on student outcomes such as college persistence, credential completion, and credit accumulation.[5] Outcomes for HL-SCI participants are compared with those of a matched comparison group of students enrolled in the same or similar programs at Consortium colleges prior to the start of the grant. The impact evaluation also includes separate effectiveness analyses for three components

[5] The impact evaluation does not include any student employment outcomes because student-level employment data were not available. Grant staff sent a list of HL-SCI participants to the Connecticut Department of Labor (CT-DOL), and CT-DOL provided a report with aggregate employment outcomes for these participants. However, because of student privacy concerns, the employment data could not be linked to individual student records and sent to the external evaluators. The impact evaluation reports on actual employment outcomes relative to the goals for the HL-SCI grant as a whole, but there is no student-level analysis of the impact of the HL-SCI grant on employment outcomes.

of HL-SCI: PLAs, booster modules, and online and hybrid courses. An overview of the data and methods for the impact evaluation is provided in this section, and additional detail is included in the technical appendix.

Research questions

Overall HL-SCI grant. To evaluate the overall impact of the HL-SCI grant, we answer the following questions:

4. (College persistence) Do HL-SCI participants persist in their colleges at higher rates than students who enrolled in similar programs prior to the implementation of the intervention?

5. (Credential completion) Do HL-SCI participants complete certificate or degree programs at a higher rate than students who enrolled in similar programs prior to the implementation of the intervention?

6. (Credit accumulation) Do HL-SCI participants complete more credits than students who enrolled in similar programs prior to the implementation of the intervention?

For each of these research questions, we examine outcomes separately after one year and two years of program enrollment. See tables A1 and A2 in the technical appendix for additional information on the outcome variables for the impact analyses. We also examine whether there are any differences in outcomes by the category of the program of study.

Prior learning assessments. An important component of HL-SCI is to systematically award credit for prior education and work experience through PLA systems. PLAs allow students to earn credits for experience outside the college, which should allow them to progress through their programs more quickly than if they had to accumulate all of their credit hours through new coursework. There is some evidence in the research literature to support that PLAs increase the likelihood of credential completion and reduce time-to-credential (Council for Adult and Experiential Learning, 2010; Hayward, 2012).

To evaluate the effectiveness of PLAs in the HL-SCI grant, we answer the following questions:

1. (College persistence) Do HL-SCI participants who receive PLA credits persist in their colleges at higher rates than participants who do not receive PLA credits?

2. (Credential completion) Do HL-SCI participants who receive PLA credits complete certificate or degree programs at a higher rate than participants who do not receive PLA credits?

3. (Credit accumulation) Do HL-SCI participants who receive PLA credits complete a greater number of credits than participants who do not receive PLA credits?

Booster modules. The purpose of booster modules is to provide remediation for students in the context of a college-level course. Booster modules are intended to be self-paced and adaptable to a student's schedule. They are meant to allow students to hone essential skills, which may improve academic performance and persistence. There is limited research available on supplemental instruction similar to the booster modules, and the findings are mixed. Some studies have found no effect of supplemental instruction on course performance (DeBord, Aruguete, & Muhlig, 2004), or inconclusive evidence (Hodara, 2011). However, other studies have found a positive impact of supplemental instruction on students' post-test scores (Aberson, Berger, Healy, & Romero, 2003; Hagerty & Smith, 2005) and course completion rates (Jenkins, Speroni, Belfield, Jaggars, & Edgecombe, 2010).

To evaluate the effectiveness of booster modules in the HL-SCI grant, we answer the following questions:

1. (Course completion) Do students who enroll in courses containing booster modules complete courses at a higher rate than students who enroll in nonbooster versions of the same courses?

2. (Course performance) Do students who complete courses containing booster modules perform better in those courses in terms of course grades than students who complete nonbooster versions of the same courses?

Online and hybrid courses. Online and hybrid courses are designed to increase student access to courses and allow students to do self-paced learning, in many cases reducing the time needed to complete a course and in some cases permitting "asynchronous" learning in which students can view archived lectures when they choose. The research evidence of the impact of online and hybrid learning is somewhat mixed, with some studies finding negative impacts on student learning outcomes such as course persistence and grades (Xu & Jaggars, 2013) and other studies finding positive impacts on direct measures of student learning such as standardized test scores and course grades (Means, Toyama, Murphy, & Baki, 2013).

To evaluate the effectiveness of online and hybrid courses in the HL-SCI grant, we answer the following questions:

1. (Course completion) Do students who enroll in online and hybrid courses complete those courses at a higher rate than students who enroll in traditional in-person versions of the same courses?

2. (Course performance) Do students who complete online and hybrid courses perform better in those courses in terms of course grades than students who complete traditional in-person versions of the same courses?

Data sources and collection

The primary source of data for the quantitative part of the evaluation consists of databases of student records at each of the Consortium colleges from fall 2009 to fall 2015. This data source provides for both HL-SCI participants and comparison groups the following information:

- Basic demographic information.
- Which college the student is attending, with initial enrollment date and date of withdrawal or graduation (if available).
- Whether the student is enrolled full-time or part-time.
- The certificate or degree program the student is enrolled in, with date of entry to the program and date of program withdrawal or completion.

These databases also provide transcripts for online and hybrid courses and courses with booster modules the students have enrolled in and completed, with course performance data such as the number of credits and grades earned.

We also use data collected through HL-SCI grant monitoring activities. The CIs provided lists of courses that contain booster modules at their college by semester, as well as lists of online and hybrid courses offered by their college by semester. In addition, they provided data on the number of credits HL-SCI participants earn through PLAs.

Analysis of outcomes for overall program effectiveness

For the analysis of outcomes for overall program effectiveness, the intervention group consists of cohorts of HL-SCI participants enrolled in spring 2013 (the first full semester of implementation of the HL-SCI grant) to fall 2014. As shown in table 6, there are three cohorts of students who were enrolled in the first year of the grant (spring 2013, summer 2013, and fall 2013), and their outcomes can be followed for up to two full years. There are an additional four cohorts of students who were enrolled in the second year of the grant (winter 2013, spring 2014, summer 2014, and fall 2014) that can be followed for one full year. The comparison group consists of students who were enrolled beginning in fall 2009 up to the year prior to the new or revised HL-SCI program of study. A list of the specific programs of study in the HL-SCI and comparison groups is provided in table 7.

Table 6. Timeline for HL-SCI cohorts

Grant year	Cohort entry Term	Last data collection Term	N years of follow-up
1	Spring 2013	Spring 2015	2
1	Summer 2013	Summer 2015	2
1	Fall 2013	Fall 2015	2
2	Winter 2013	Winter 2014	1
2	Spring 2014	Spring 2015	1
2	Summer 2014	Summer 2015	1
2	Fall 2014	Fall 2015	1

Table 7. Programs of study in the HL-SCI and comparison groups, by program category.

HL-SCI programs of study	Comparison programs of study
Health/medical	
• CT tomography – new (C) • Dental assistant – revised (C) • Diagnostic medical sonography – revised (AS) • Dietetic and nutrition advising pathway – revised (AS) • Exercise science – revised (AS) • Exercise science and wellness – revised (AS) • Firefighter 1 and 2 certification academy – new (C) • Fitness specialist – revised (C) • Gerontology – revised (AS) • Gerontology – revised (C) • Group exercise instructor – new (C) • Health and exercise science – revised (AS) • Health science – revised (C) • Mammography – new (C) • Medical assisting – revised (AS) • Nursing – revised (AS) • Nutrition and dietetics – revised (AS) • Occupational therapy assistant – revised (AS) • Ophthalmic medical assistant – new (C) • Paramedic: limited certification – revised (C) • Paramedic studies: emergency management – revised (AS) • Paramedic studies: emergency medical services – revised (AS) • Paramedic studies: general – revised (AS) • Physical therapy assistant – revised (AS) • Pre-dental hygiene – revised (AS) • Public health advising pathway – revised	• Dental assistant (C) • Diagnostic medical sonography (AS) • Dietetic and nutrition advising pathway(AS) • Exercise science (AS) • Exercise science and wellness (AS) • Fitness specialist (C) • Gerontology (AS) • Gerontology (C) • Health and exercise science (AS) • Health science (C) • Medical assisting (AS) • Nursing (AS) • Nutrition and dietetics (AS) • Occupational therapy assistant (AS) • Paramedic limited certification (C) • Paramedic studies: emergency management (AS) • Paramedic studies: emergency medical services (AS) • Paramedic studies: general (AS) • Physical therapy assistant (AS) • Pre-dental hygiene (AS) • Public health advising pathway (AS) • Radiation therapy (AS) • Radiography (AS) • Radiologic technology (AS) • Respiratory care (AS) • Surgical technology (AS) • Therapeutic recreation (AS) • Therapeutic recreation (C)

HL-SCI programs of study	Comparison programs of study
(AS) • Radiation therapy – revised (AS) • Radiography – revised (AS) • Radiological science – radiation therapy – new (AS) • Radiological science – radiography – new (AS) • Radiologic technology – revised (AS) • Respiratory care – revised (AS) • Surgical technology – revised (AS) • Therapeutic recreation – revised (AS) • Therapeutic recreation – revised (C) • Veterinary technology – new (AS)	
Science	
• Biotechnology – new (AS) • Biotechnology – new (C) • Biotechnology – revised (AS) • Engineering science – revised (AS) • Environmental science – revised (AS) • Environmental sciences advising pathway – new (AS) • Environmental science and toxicology – revised (AS) • Environmental science and toxicology – revised (C) • Natural sciences and mathematics – revised (AS)	• Biotechnology (AS) • Engineering science (AS) • Environmental science (AS) • Environmental science and toxicology (AS) • Environmental science and toxicology (C) • Natural sciences and mathematics (AS)
Data/ IT	
• Administrative assistant: medical option – revised (AS) • Communications networking – revised (C) • Computer engineering technology – new (AS) • Data security specialist – new (AS) • Electronic health record and coding – new (AS) • Electronic health record specialist – new (C) • Health information management – new (AS) • Health information management – new (C) • Help desk technician – revised (C) • Medical administrative assistant – revised (AS) • Medical administrative assistant – revised (C) • Medical insurance specialist – revised (C) • Mobile application development – new (AS)	• Administrative assistant: medical option (AS) • Communications networking (C) • Computer and information systems (AS) • Computer engineering technology (AS) • Computer hardware support specialist (C) • Computer security (AS) • Help desk technician (C) • Medical administrative assistant (AS) • Medical administrative assistant (C) • Medical insurance specialist (C) • Medical office specialist (C) • Medical office management (AS) • Network administrative assistant (C)

Notes: (AS) indicates associate's degree programs and (C) indicates certificate programs. Noncredit programs were not included in the impact evaluation.

Students in the comparison group are carefully selected to match the students in the intervention group, using coarsened exact matching (CEM). CEM allows us to correct for selection bias in the estimation of intervention and comparison group outcomes, thus strengthening the causal implications of any effect that we do find (where selection bias is the possibility that students with specific characteristics are more likely to choose or be chosen for program participation).

As the first step in our CEM analysis, we categorize students into groups, or strata.[6] We use an exact matching process that matches a student in the HL-SCI group to a student in the comparison group with the same values on key characteristics, including:

- Student status:
    - New student: a student whose first credit earned is upon entry in program of study.
    - Continuing student: a student enrolled in any semester in the year prior to the first year in a HL-SCI or comparison program.
    - Returning student: a student who was not enrolled in any semester in the year prior to the HL-SCI or comparison program, but who earned credit at an earlier time.
- Program category: health/medical, science, or data/information technology (IT).
- Program duration:
    - Fewer than 20 credit hours.
    - 20 to 24 credit hours.
    - 25 to 29 credit hours.
    - 30 to 36 credit hours.
    - 60 to 64 credit hours.
    - 65 to 69 credit hours.

[6] Additional information on the variables used in the matching process can be found in the technical appendix in table A4 and the corresponding text. Table A3 provides additional detail on the classifications for student status and the number of students in each group.

This matching process ensures that the HL-SCI and comparison students are the same in terms of amount of academic experience, program content area, and program duration. This is important for ensuring that outcomes are comparable between the two groups. For example, imagine a scenario where:

- Intervention: N=10 new students in 20-hour programs and N=10 new students in 60-hour programs
- Comparison: N=10 new students in 20-hour programs and N=20 new students in 60-hour programs

We would not want to directly compare credential completion rates against the two groups because there are more students in the comparison group who are in programs of longer duration (N=20 versus N=10 in 60-hour programs). The CEM process would keep all 20 comparison students in the sample, but these students would be weighted by .5 so that the intervention and comparison groups would be similar overall in terms of program duration. This allows us to use more of the data in the sample than if each HL-SCI participant was matched to a single comparison student.

If the scenario was the same as above but the intervention group also included ten students in 10-hour programs, these records would be dropped from the sample because there are no students in programs of similar duration in the comparison group. However, in our study the comparison group is much larger than the intervention group, so most HL-SCI students can be matched to comparison students in programs of similar duration and type.

In our data there are 25 different strata. Observations are dropped from three strata that do not include at least one treated student and one comparison student. In our analysis, 1,364 of the 1,366 HL-SCI students (99.9 percent) and 5,428 of the 5,461 of the potential comparison students (99.4 percent) are matched. In the remaining analytic sample, comparison units within each stratum are weighted to equal the number of intervention units in that stratum. This weighting process ensures that the results are representative of the students who participated in the intervention.

Since the research questions examine outcomes separately for one year and two years after initial program enrollment, separate rounds of matching are conducted for students with at least one year of follow-up data and at least two years of follow-up data (the maximum time for which outcome data can be collected for the first cohort of HL-SCI students). This ensures that outcomes are being compared after the same duration of time after initial program enrollment for all cohorts. The total sample size is 6,782 students with at least one year of follow-up data and 4,201 students with at least two years of follow-up data (table 8).

Table 8. Number of intervention and comparison group students in the matched sample, by years of follow-up data

Years of follow-up data	Comparison group	Intervention Group	Total N
At least 1 year	5,428	1,364	6,782
At least 2 years	3,592	709	4,201

After matching, to confirm that the intervention and comparison groups are similar to each other, we conduct a balancing condition test—that is, whether, among the analytic sample, assignment to the intervention group is independent of the covariates. We compare the means of the intervention and comparison groups on the following characteristics:

- Student demographic characteristics: percent female, percent Black, percent Hispanic, and age.
- Test scores: scale scores on the Accuplacer assessment in algebra, arithmetic, reading, and sentence skills (for the subset of students with test scores).
- Student characteristics: number of terms enrolled prior to study entry, and percent enrolled full-time.
- College attended (Capital, Gateway, Manchester, Middlesex, or Norwalk Community College).

We find that the intervention and comparison groups are similar on most of these covariates (see tables A5 and A6 in the technical appendix). However, the intervention group is slightly younger (average age of 28 years versus 32 years for the comparison group) and the distribution of colleges differs somewhat because some campuses expanded more rapidly than others after the HL-SCI grant began.

Finally, we estimate the program effect by comparing the outcomes between the treated and matched comparison students in all strata. For all of the research questions, we examine outcomes separately after one year and two years of initial program enrollment. Our primary estimator is the average treatment effect on the treated (ATT)—that is, the difference between the average outcomes of treatment group members and the (estimated) average outcomes of treatment group members had they not been treated. The latter term is not observable and therefore must be estimated. We perform the estimation using weighted regression analyses to control for demographic characteristics, student characteristics, program characteristics, and college attended variables, as described above. It is important to note that these impacts should not be interpreted as causal, as there may be unobserved differences between the HL-SCI and comparison groups that are not accounted for in the analysis and may influence student outcomes.

Analysis of outcomes for HL-SCI grant components

Prior learning assessments. To evaluate the impact of PLAs for HL-SCI participants, we use the same regression models as for the overall impact of program effectiveness, but we add a dichotomous variable equal to one if any PLA credits have been received by HL-SCI participants and zero otherwise. Data on the number of PLA credits received were not available for comparison students enrolled prior to HL-SCI.

We also look at the distribution of PLA credits by calculating the number and percentage of students completing different ranges of PLA credit. The percentage of HL-SCI students in our sample with PLA credits was 15.3 percent (N=208) for students with at least one year of outcome data, and 12.3 percent (N=87) for students with at least two years of outcome data. Among HL-SCI participants who did have PLA credits, the number of credits ranged from 1 to 22 with an average of approximately 4 credits. We also examine how the number of credits affects student outcomes by substituting the dichotomous PLA variable with a categorical variable that quantifies the number of credits earned (no PLA credits, 1 to 3 credits, 4 to 6 credits, more than 6 credits). However, due to the small number of students in each of these categories, we can conduct the analyses only for students with at least one year of follow-up data.

Booster modules and online and hybrid courses. For booster modules and online and hybrid courses, the research design involves comparing course outcomes (course completion and grades) between:

- An intervention group, consisting of HL-SCI participants who enroll in a course with an HL-SCI component.
- A comparison group, consisting of HL-SCI participants and/or comparison students who enroll in the same course in another semester prior to the HL-SCI component.

The sample includes all intervention and comparison group students, including some HL-SCI students who entered their program of study in the third year of the grant (from winter 2014 to fall 2015). The outcomes for these analyses are measured at the end of the term in which the course was taken, so it is not necessary for students to have a full year of follow-up as in the previous analyses of the overall impact of the HL-SCI grant. This means that the intervention and comparison groups are larger for these HL-SCI component analyses because they include all students enrolled through fall 2015 regardless of follow-up time available. Additionally, students who enrolled in multiple courses with an HL-SCI component have a separate record for each course, so they are included in the sample multiple times.

The research design involves comparing an intervention group of HL-SCI participants who have enrolled in an online or hybrid course with a carefully constructed comparison group consisting of students who enrolled in a prior year in a non-online or hybrid version of the same course. The comparison group is constructed using coarsened exact matching to require an exact match on course number, and we develop an ATT estimator for the difference in outcomes between intervention and comparison group members. The booster analysis includes 8,559 students who took the course before the booster was added and 1,038 students who took the same courses after the booster was added. The online and hybrid course analysis includes 5,310 students who took the course in traditional in-person format, and 2,098 students who took the same courses in online and hybrid formats.

Implementation Evaluation Results

This section presents the results of the implementation evaluation and reports on actual performance relative to grant goals for HL-SCI deliverables. Each subsection includes figures showing the extent to which the Consortium met the goals of the grant at the end of the TAACCCT grant term, a summary of related focus group and interview results, and the results of student surveys. The program evaluation results related to implementation and performance relative to goals are organized as follows:

- Development and revision of certificate and degree programs.
- Enrollment and recruitment.
- Booster modules.
- Online and hybrid courses.
- Prior learning assessments.
- Internship and job placement services.
- Overall student feedback.

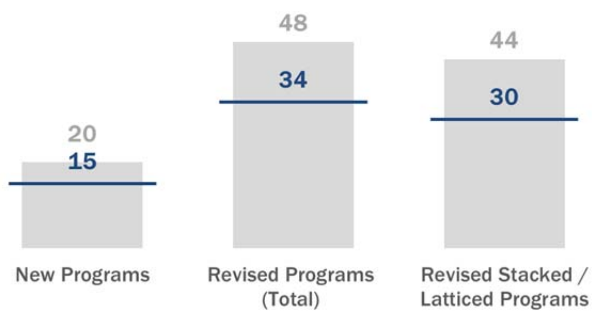
Development and revision of certificate and degree programs

Two primary goals of the HL-SCI grant were to develop 15 new health and life science certificate and associate's degree programs and to revise 34 existing programs by the end of year 3 of the grant.[7] HL-SCI also established a goal to ensure that 30 of the programs offered are considered stacked / latticed credentials. This means that the programs are developed so that a sequence of credentials can be

[7] The Consortium developed 22 new programs, but two were duplicated across campuses so progress toward the goals includes only the 20 new programs that were nonduplicated. The revised programs were revised in a unique way at each campus, so the total includes some programs of study that were revised at multiple campuses.

accumulated over time to build up an individual's qualification. To achieve this goal, the grant staff followed the definitions of stacked / latticed credentials from the U.S. Department of Labor, and any programs that were identified in these categories were verified by the Consortium's Project Assistant, Assistant Project Director, and Senior Director. A program was classified as stacked if there was an articulation agreement in place that Eastern Connecticut State University cataloged for the Consortium indicating that the program was aligned with a more advanced credential. A program was classified as latticed if it could be transferred to another similar program of study with very little loss of initial coursework. The Consortium exceeded all three of the goals related to the development and revision of certificate and degree programs. In total, 20 new, nonduplicated programs and 48 revised programs have been implemented across the Consortium. Of these revised programs, 44 are stacked / latticed credential programs (figure 1).

Figure 1. Number of new, revised, and stacked / latticed credential programs implemented at Consortium colleges exceeded goals (shown in blue)

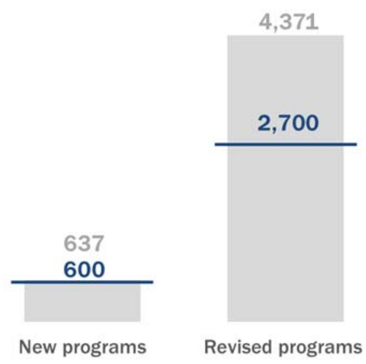


Source: Consortium annual reports to the U.S. Department of Labor.

Enrollment and recruitment

The HL-SCI Consortium exceeded its goal of enrolling 600 students in new programs by the conclusion of the grant period. By the spring 2016 semester, 637 unique students had enrolled in new HL-SCI programs of study at the five colleges (figure 2). The HL-SCI Consortium also greatly exceeded its goal of enrolling 2,700 students in revised programs by the conclusion of the grant. As of the spring 2016 semester, 4,371 students are participating or had previously participated in revised programs.

Figure 2. Number of participants in new and revised HL-SCI certificate and degree programs exceeded goals (shown in blue)



Source: Consortium annual reports to the U.S. Department of Labor.

Focus group findings on program recruitment and selection

The first research question for the implementation evaluation addresses why students selected the particular program in which s/he is participating. We find that most students learn about the HL-SCI programs of study on their own, either through an online search or by word of mouth from friends or family members. A few students found out about the HL-SCI programs of study because they enrolled in other courses at the college and subsequently gained interest in the health and life science fields of study. Still others learned about the programs from browsing their colleges' catalogs. Occasionally, students were referred to the program by professionals in their fields. For example, staff members at Hartford Hospital referred three students to the Radiologic Science program at Manchester. Similarly, students in the firefighting program at Gateway and the paramedic program at Capital received information about the program from professionals in their fields.

During each interview cycle, a number of students learned about the programs through direct contact with someone at their colleges. Some participants reached out directly to program advisors or faculty members, while others attended open houses or other recruitment events. A few students were unsure of which program of study to pursue and spoke with college advisors, who assessed their interests and recommended the HL-SCI programs of study as possibilities.

Students' reasons for enrolling

Across semesters and college campuses, several common reasons emerged for enrolling in programs. Students frequently mentioned their interest in or passion for their fields of study as a reason. Many students also spoke about the importance of switching careers or using their certificates or degrees to advance in their current work settings.

Others cited the reputation or quality of the program of study at their college. A student studying to be a paramedic at Capital said, “I like that it has a good reputation. People have told me that the classes are a lot harder than the test [to be certified to become a paramedic]. If you do well in the classes, you’ll do well on the test.” Another student, studying radiology at Middlesex, said, “It is a highly reputable program, one of the best in the state.”

For many students, affordability and convenience to their homes or jobs were important factors in enrolling. Students said the tuition was “attractive” and “cost-effective” compared with those of four-year institutions or for-profit options. Some students considered four-year or private options, but determined they were too expensive and/or far away from home. Other students saw their colleges as the most convenient option because they were already employed nearby.

Guidance on choosing a program

Each semester, a number of students said they received guidance from program advisors or faculty on deciding which program aligned best with their professional goals and which courses to take. Most students who received such guidance found it helpful. However, some would have liked access to additional advisors with in-depth knowledge of HL-SCI programs of study from the beginning of their studies. For example, one student at Norwalk said she was initially confused about which program would best fit her needs and would have liked more “hands-on” assistance from an advisor.

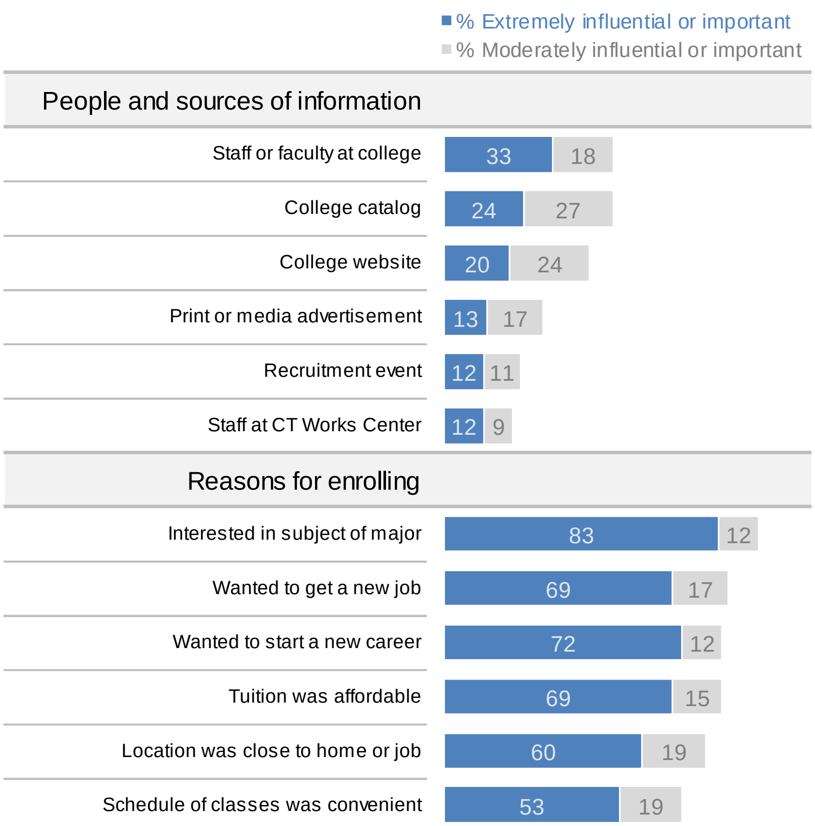
Student survey findings on enrollment and recruitment

More than three-quarters of the students who took the survey are enrolled in associate’s degree programs. Of the 323 students who indicated which type of credential they are pursuing, 83 percent (N=268) are pursuing an associate’s degree. The remaining 17 percent indicated that they were enrolled in certificate programs.

Factors influencing enrollment

Two questions on the survey focused on the factors that influenced students’ decisions to enroll (figure 3). The first question asked about the extent to which various people and sources of information contributed to students’ decisions. Notably, a third of students indicated that staff or faculty members at their college were “extremely influential” to their decision to enroll. An additional 18 percent indicated that faculty or staff members were “moderately influential.” College websites and catalogs also influenced students’ decisions to enroll. Half of students reported that the website was extremely or moderately influential to their decisions to enroll, while 44 percent indicated that the catalog was extremely or moderately influential. Less than a quarter of students (23 percent) said that a recruitment event was extremely or moderately influential to their decisions to apply or enroll.

Figure 3. Factors influential or important to student survey respondents' decisions to enroll



Source: HL-SCI student survey, spring 2016.

Next, the survey presented students with a series of possible reasons for choosing to participate in their programs. They were asked to rank on a 5-point scale how important each reason was to their decision to enroll. Nearly all students (96 percent) cited their interest in their majors as extremely or moderately important to their decisions to enroll.

Booster modules

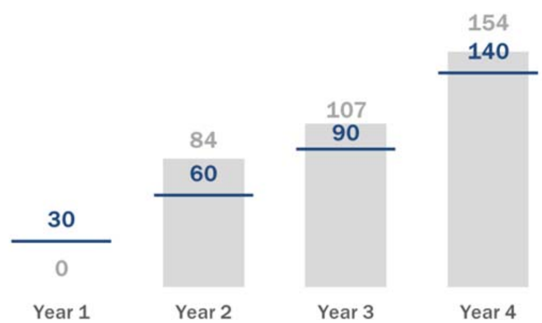
As part of the grant, faculty members at Consortium colleges developed booster modules, which are incorporated into coursework across the curriculum as appropriate. Boosters, offered through the online learning management software BlackBoard, may provide either supplemental course material or a review of content that students have previously learned. Some professors require students to complete boosters, while others provide them as supplemental assignments or additional instructional resources.

Boosters often contain Microsoft® PowerPoint presentations of lectures and multimedia content, such as videos from the Khan Academy or other websites. All boosters are designed to include opportunities for students to assess their skills, including a pretest, a post-test, and quizzes. Each booster is designed to be completed in one sitting, with the range of intended length from 30 to 75 minutes.

Boosters completed and in development

Booster modules were offered to students beginning in fall 2014. The Consortium's goal was to develop and implement 140 booster modules across the Consortium by the conclusion of the grant period. The Consortium exceeded this goal during years 2 through 4 of the grant. In total, 154 boosters have been developed and implemented during the grant period (figure 4).

Figure 4. Number of math and science booster modules exceeded goals (shown in blue) in most years



Source: Consortium annual reports to the U.S. Department of Labor.

In addition, HL-SCI staff aimed to have 3,200 unique students take boosters, and the Consortium has greatly exceeded this goal. As of the spring 2016 semester, 4,792 students have taken at least one booster module.

In spring 2015, HL-SCI contracted with Microburst Learning, an e-learning company, to evaluate and enhance the quality of the booster modules and ensure that they are compliant with the Americans with Disabilities Act of 1990.

Focus group findings on booster modules

Throughout the grant period, many of the students who participated in focus groups and interviews were unfamiliar with booster modules or had not taken one. Those who had taken boosters generally found them helpful and useful. For example, a student from Gateway found that the booster modules were "clearer than the book [and] helped me understand the material." The student said she wished there were more booster modules available. Another student described how the booster modules provided extra time and resources to improve her understanding of the material. She said, "It takes a while for me to really comprehend what was taught. Getting a booster module helps solidify what I already know so that I can store it in my long-term memory." Other students said that taking a booster module helped them prepare for upcoming material in their courses. Therefore, a recommendation would be that the colleges consider expanding access to booster modules, given that self-reported data indicate that they support student success.

Occasionally, students said that boosters did not hold their attention, were repetitive, or were a waste of time. One student from Middlesex recalled taking the same booster module three times, saying "they always give us the microscope booster module. It is used too much and repeated. I've taken the same microscope booster module multiple times across multiple different courses." Another student thought that the booster modules were not necessarily a priority given all of the material he needed to learn for his course. He said, "Taking five to ten minutes to worry about the [booster module] when I could be doing other things as far as studying made it not worth it. I didn't think it was really helpful. It was informative, but it was not the information that I needed at the time."

Some students who initially were not familiar with boosters said they would be interested in completing boosters if they were offered as part of their courses. Others said they would likely complete booster modules only if they were a required component of their courses. Another recommendation would be that instructors consider requiring students to complete boosters to incentivize students to use them as a learning tool.

Survey Monkey student survey on booster modules

HL-SCI grant staff used the Survey Monkey website to develop a satisfaction survey that students at all Consortium campuses were asked to complete after they took a booster. Administration began in fall 2014 and continued through the spring 2016 semester.

As of May 2016, 685 students across all five college campuses had completed the booster survey. This section of the report updates results from the December 2015 interim report, disaggregated by academic semester to show any changes in responses over time. The spring and summer 2015 semesters were combined because few students took the survey in the summer. In the analysis, the results are reported by "academic time period." Relatively few students took the survey in the spring of 2016 because not all booster modules included the link to the survey (N=66). Nonetheless, these results are presented separately to highlight the responses that were not included in previous reports.

Total results disaggregated by academic time period

Table 9 shows the number of students who completed the booster survey during each academic time period: fall 2014, spring and summer 2015, fall 2015, and spring 2016. Fewer students took the booster survey in fall 2015 and spring 2016 than in previous semesters because some boosters were taken offline in the fall pending the results of the content review and enhancements by Microburst Learning. New and revised boosters were administered in the spring, but they did not contain the Survey Monkey link.

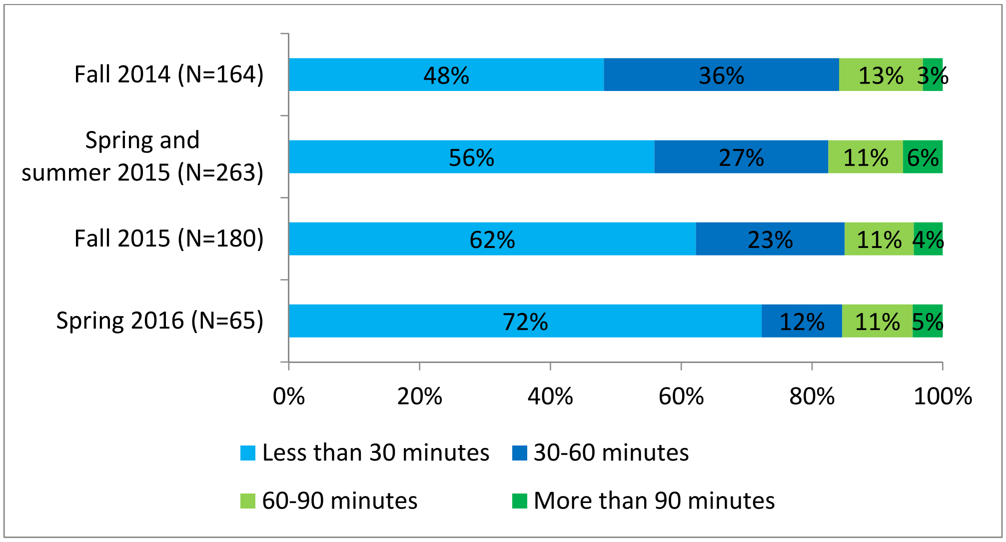
Table 9. Booster survey respondents by academic term

Academic term	N	Percent of total respondents
Fall 2014	165	24
Spring and summer 2015	270	39
Fall 2015	184	27
Spring 2016	66	10
Total	**685**	**100**

The survey included a question on how long students spent on booster modules, scaled in 30-minute increments (figure 5). During all time periods, more than 80 percent of students completed the booster modules in an hour or less. As booster implementation has progressed, the percentage of students who reported completing boosters in fewer than 30 minutes has risen, while that of students who reported completing a booster in 30 to 60 minutes has declined. Nearly three-quarters of spring 2016 respondents reported that they completed the booster module in 30 minutes or less. Only 12 percent reported dedicating between 30 and 60 minutes of time. Very few students reported that it took more than 90 minutes to complete the booster.

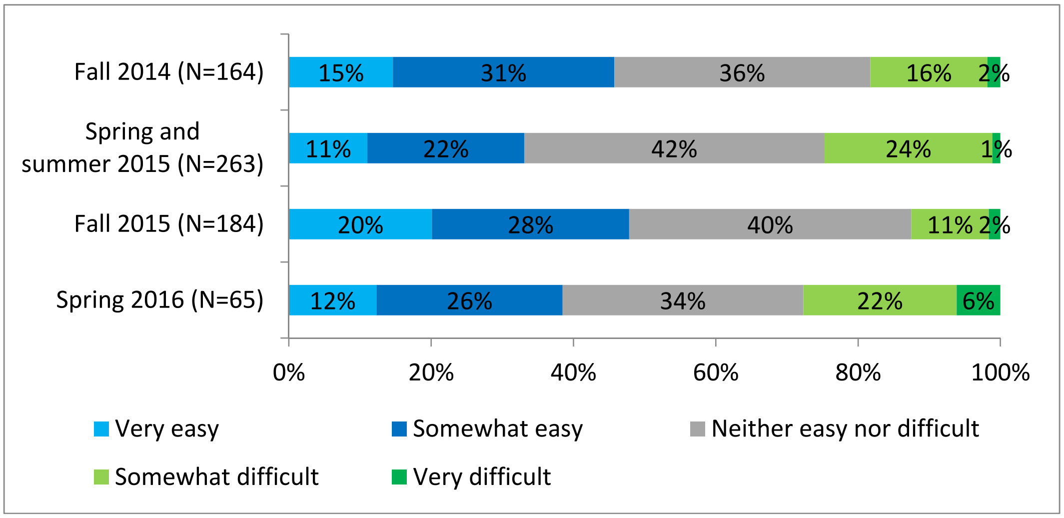
Students were also asked to rate the booster's level of difficulty. More than one-third of respondents indicated that the booster was appropriately challenging, with few students describing the boosters as "very easy" or "very hard" (figure 6). Across all time periods, more students found the booster too easy than too difficult (approximately 41 percent versus 21 percent). These results may be expected because the content of the boosters is designed to be remedial to help students who need additional academic support.

Figure 5. Most booster survey respondents reported that they completed boosters in an hour or less



Source: Math and science booster survey, fall 2014 to spring 2016.

Figure 6. Most booster survey respondents found the boosters to be appropriately challenging



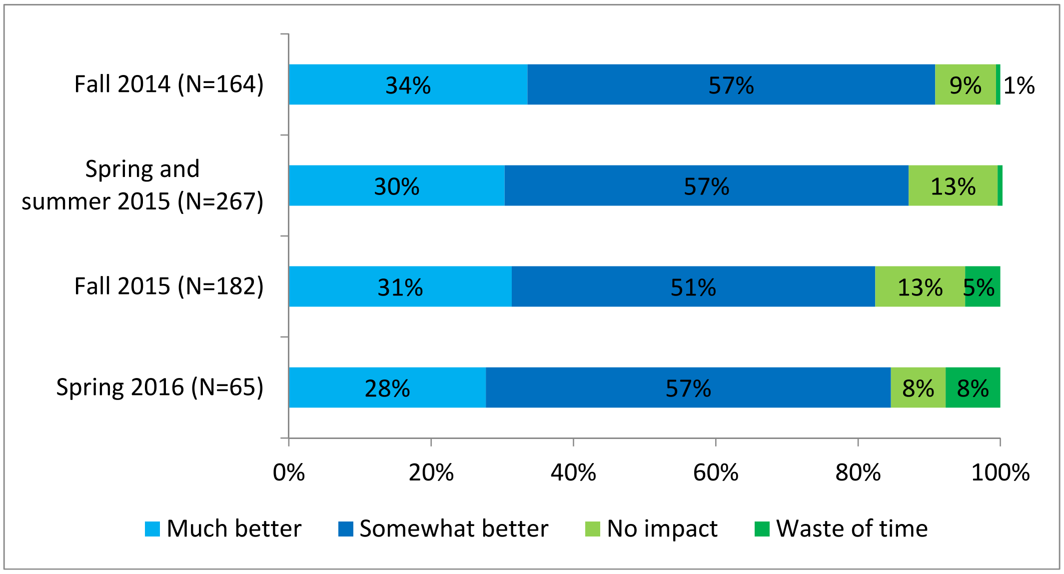
Note: Totals may not sum to 100 due to rounding.

Source: Math and science booster survey, fall 2014 to spring 2016.

Overall, students indicated that boosters generally increased their level of understanding of a subject. The students were asked the extent to which the booster increased their understanding, and responded to four options: “much better,” “somewhat better,” “the booster had no impact on my understanding,” and “the booster was a waste of time.”

Across all four academic time periods, more than 80 percent of students indicated that they understood the topic the booster covered either “much better” or “somewhat better” after completing it, although a larger percentage of students selected “somewhat better” than “much better” (figure 7). A relatively small percentage of students, between 8 and 13 percent, said that the booster had no impact. The percentage of students who reported the booster was a “waste of time” rose slightly over the duration of the grant, but remained quite small in the spring of 2016 (8 percent).

Figure 7. Most booster survey respondents reported a better understanding of course content

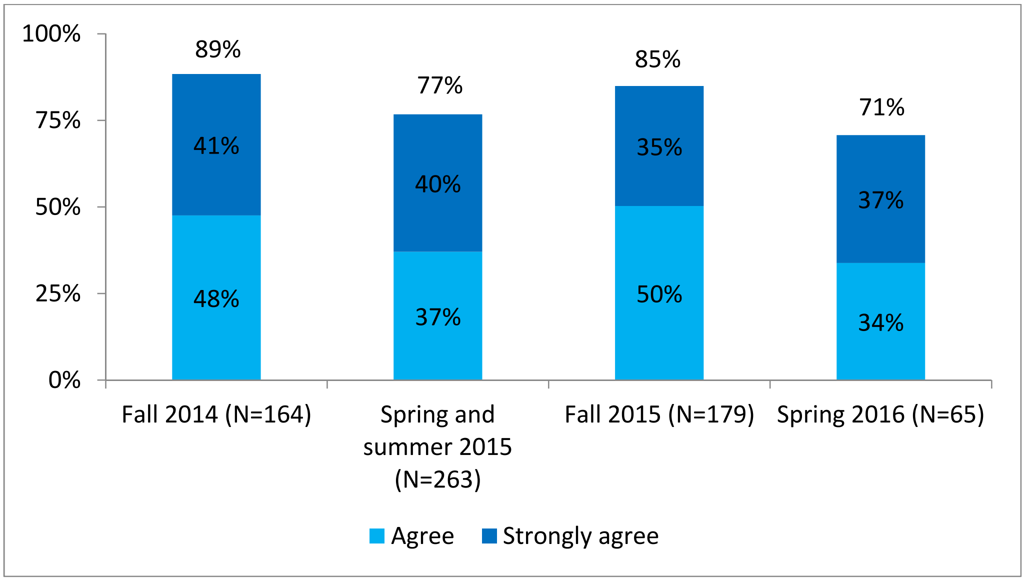


Note: Totals may not sum to 100 due to rounding.

Source: Math and science booster survey, fall 2014 to spring 2016.

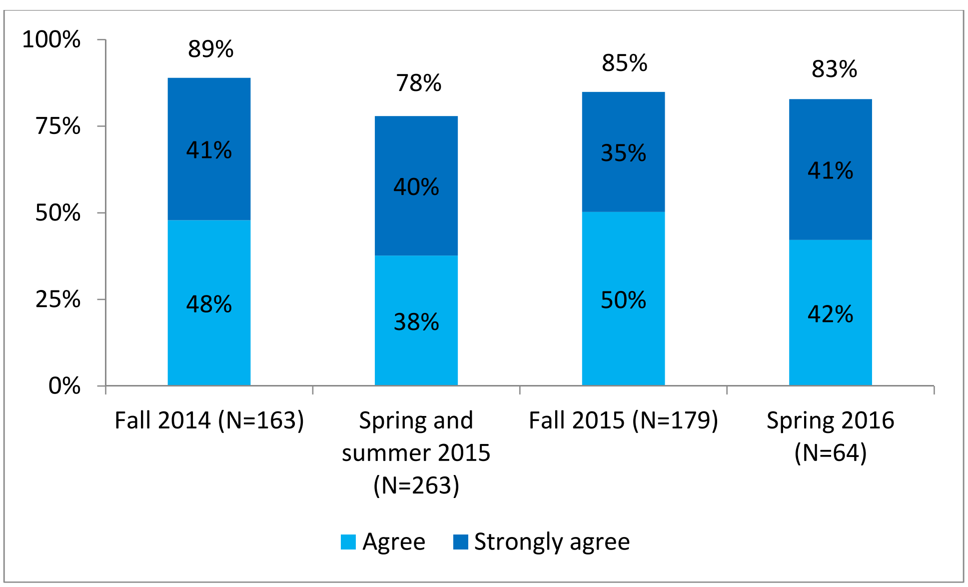
Students were then asked to rate their level of agreement on whether it was easy to follow the content of the booster. Between 71 percent (spring 2016) and 89 percent (fall 2014) of students agreed or strongly agreed that the booster was easy to follow (figure 8). Similarly, most students agreed or strongly agreed that the booster clearly defined its learning objectives (figure 9).

Figure 8. Most booster survey respondents agreed that the boosters were easy to follow



Source: Math and science booster survey, fall 2014 to spring 2016.

Figure 9. Most booster survey respondents agreed that the booster objectives were clearly defined



Source: Math and science booster survey, fall 2014 to spring 2016.

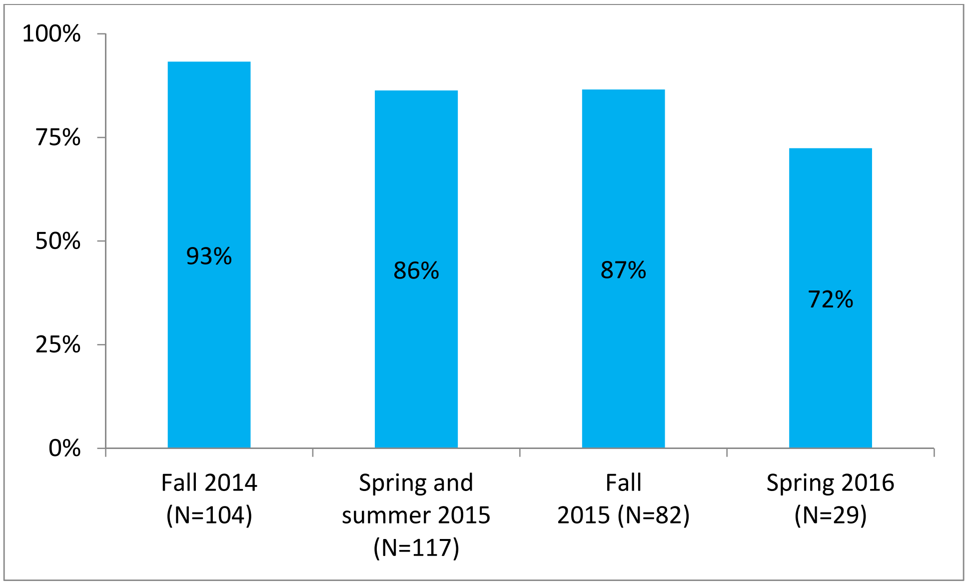
The next question asked respondents to indicate which factors could have improved the booster. The potential responses included “more multimedia,” “less multimedia,” “more chances to quiz myself,” “more PowerPoint presentations,” “less PowerPoint presentations,” “more written information,” “less written information,” “more information overall,” and “no improvement needed.” Students were allowed to select multiple items. Of the 685 total responses across the grant period, 90 percent (N=615) answered the question.

“No improvement needed” was the most common response, closely followed by “more chances to quiz myself.” The following responses were the most commonly selected, generating more than 10 percent of responses cumulatively during all four time periods:

- “No improvement needed” (37 percent, N=225).
- “More chances to quiz myself” (35 percent, N=216).
- “More multimedia” (17 percent, N=102).
- “More written information” (13 percent, N=82).

Across academic time periods, the majority of the respondents would recommend boosters to other students. Students indicated through an open-ended question whether or not they would recommend a booster to a friend. Each survey was coded as either “yes” or “no” based on the open-ended responses. The percentage of students who would recommend a booster declined slightly after the fall 2014 semester (figure 10). Although the percentage of students who would recommend a booster dropped in the final semester, these results should be interpreted with caution due to the small sample size (N=29).

Figure 10. Most booster survey respondents would recommend boosters to others

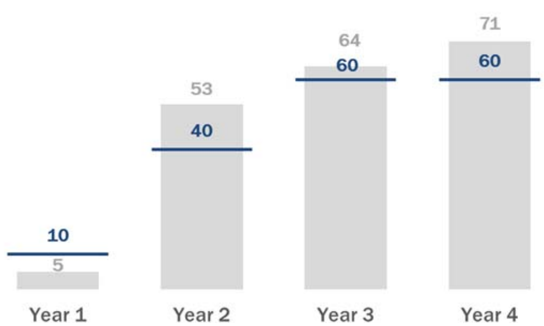


Source: Math and science booster survey, fall 2014 to spring 2016.

Online and hybrid courses

One of HL-SCI's goals was to develop and implement a total of 60 new online and hybrid courses across the five Consortium community colleges. The Consortium has exceeded this goal (figure 11). In total, 71 online and hybrid courses have been developed and offered to students. This total includes courses that are offered through both online and hybrid formats on the same campus. It also includes courses that are offered on more than one campus, in one or more formats.

Figure 11. Number of online and hybrid courses offered exceeded goals (shown in blue) in most years

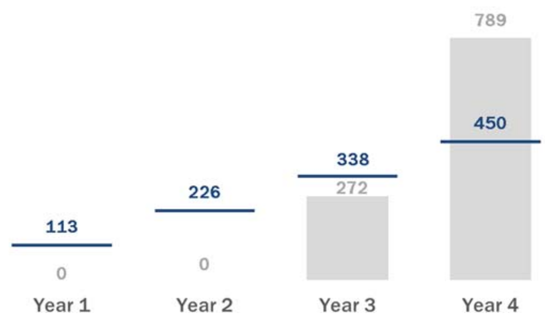


Source: Consortium annual reports to the U.S. Department of Labor.

In addition, the Consortium exceeded its goal of enrolling 2,400 students in online and hybrid courses throughout the grant period. By the spring of 2016, 3,248 unique students had enrolled in at least one online or hybrid course.

The Consortium's final goal for online and hybrid courses was for instructors at the colleges to develop and implement online modules with feedback for students. A module is defined as an online lecture equivalency to a traditional, in-person session. Therefore, across the 60 online and hybrid courses, the goal sought to ensure and increase the availability for students to assess themselves during an online lecture, while at the same time receiving instructor feedback on that assessment. The Consortium greatly exceeded this goal in the fourth year of the grant. In total, 789 online modules with feedback have been developed (figure 12).[8]

Figure 12. Number of online modules with feedback exceeded goals (shown in blue) in year 4



Source: Consortium annual reports to the U.S. Department of Labor.

Focus group and interview findings on online and hybrid courses

Throughout the grant period and across campuses, most students preferred in-person courses to the online and hybrid formats.[9] Generally, students preferred in-person instruction because it allowed for greater interaction with professors. In class, they could ask questions of their professors and receive immediate responses. One

[8] Microburst Learning conducted a review of online courses after year 2 of the grant, and as part of this review it counted the online modules with feedback. These online modules with feedback existed when the courses were developed but were not counted until Microburst Learning review, so figure 12 shows no online modules with feedback in the first two years.

[9] During the focus groups, students were asked about their experiences with any online and hybrid courses at the college. The responses may include feedback about some online and hybrid courses that were not developed as part of the TAACCCT grant.

participant said, "I'm an old-school student. I like to sit in front of the class and raise my hand if I have a question. I don't feel I can teach myself a subject." Some students liked the in-person interactions with instructors because it helped motivate them. They also appreciated how their classroom professors often went above and beyond their normal teaching duties by providing academic and social support outside of class hours.

Some students felt that the learning that took place during their online and hybrid courses was less authentic or challenging than in in-person courses. One participant reported learning more during in-person courses, particularly during assessments. The student said, "Testing is the biggest thing since if you take a test online, you can cheat with a book next to you. With an in-person test, you have to know it." Other students complained that the professors' expectations for online courses were not clear. One student said, "It's difficult to follow the course guidelines and instructions for the hybrid and online courses. It took three sessions to figure out what was expected."

A few focus group and interview participants experienced technological problems with the computer software or hardware required for their online and hybrid courses. In some cases, students had difficulty meeting the requirements of online and hybrid courses because their personal computers did not have the appropriate technological capabilities. For example, their operating systems were not compatible with the software required for online and hybrid courses or were too slow to run all of the programs required to the extent necessary. In addition, a few students had difficulties submitting assignments or quiz responses because BlackBoard did not allow for different response formats.

Although most students expressed a preference for in-person courses, some also appreciated online and hybrid courses because they were convenient for students who had busy schedules and/or lived far away from campus. Students also liked that they could cover course material at their own pace. The flexibility was especially important for students who were balancing class schedules with full-time jobs or family responsibilities. One student said, "I like going at my own pace. I can knock out 80 percent of the class early in the semester and leave myself more time to work on other courses later in the semester." A few students said that the online format allowed them to take more courses in one semester than their schedule would generally allow.

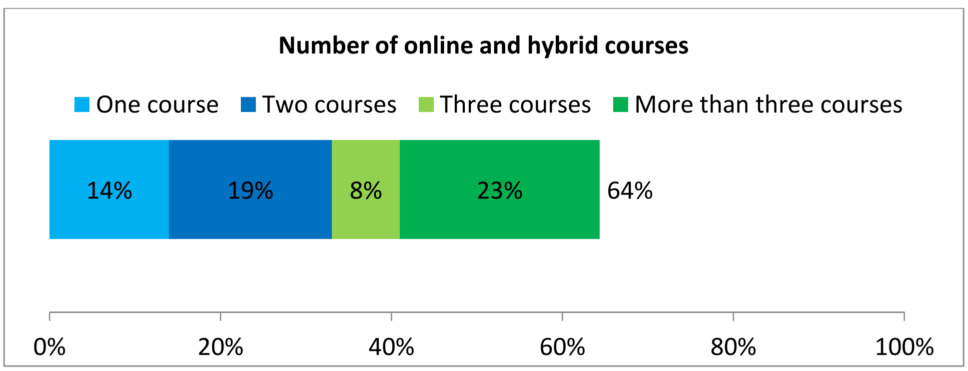
In addition, the relative lack of interaction in online and hybrid courses was not an issue of concern for all participants. Some students praised their online and hybrid course instructors for being particularly helpful or responsive. A number of students said that their instructors created in-person lab sessions or offered office hours to increase interaction between faculty and students. A few students said that online and hybrid courses actually created opportunities for collaboration and interaction. For example, a professor in an online Mobile Application Development course graded students on the extent to which they interacted with each other through an online discussion board. One of this professor's students said, "I think that it's important in my field…or any other computer science field [because] you are always working as a team. Sometimes in the global economy, team members might not even be in the same country as you, so it is important to learn those skills to work with other people in an online forum."

Students generally believed that the online and hybrid formats were more appropriate for some subjects than for others. Students said that courses that require either a great deal of explanation or hands-on instruction, such as biological sciences, should be taught in-person. According to one student, "it is more difficult for students to do science in a hybrid [format]. It's not great; it's cheaper, but it's not good for students." Students said that the online and hybrid course formats may be especially appropriate for information technology courses.

Student survey findings on online and hybrid courses

The majority of survey respondents (64 percent of a total N of 300) had participated in at least one online or hybrid course as part of their studies (figure 13).[10] A third of students had taken either one or two courses, while nearly a quarter said they had taken more than three or more online or hybrid courses.

Figure 13. Most student survey respondents had taken at least one online or hybrid course.



Source: HL-SCI student survey, spring 2016.

Students who had taken online and hybrid courses were asked to provide additional feedback on their experiences. The survey included a question about how often

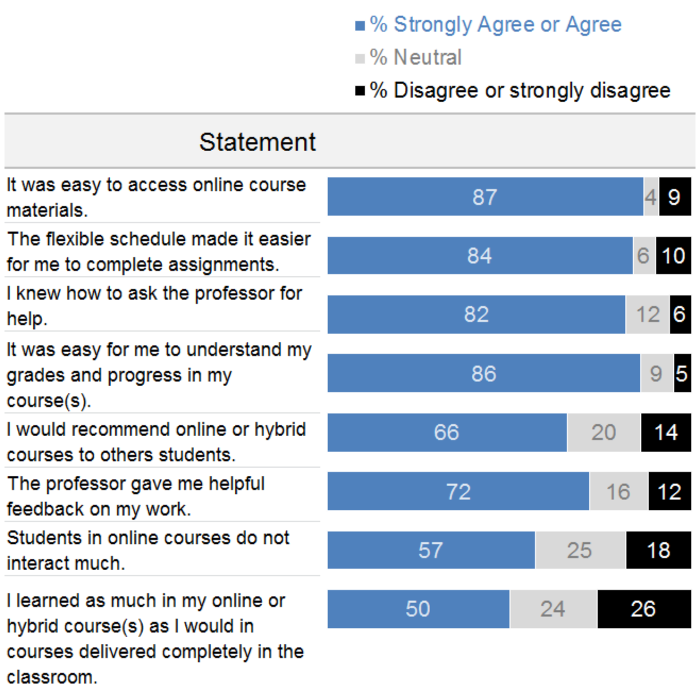
[10] As with the focus groups, students were asked about their experiences with any online and hybrid courses at the college. The responses may include feedback about some online and hybrid courses that were not developed as part of the TAACCCT grant.

respondents accessed course material from different locations, based on a 4-point scale: “very often,” “often,” “sometimes,” or “never.” Most students (92 percent) accessed course materials from home very often or somewhat often. Far fewer accessed materials from college computer labs or the college library very often or somewhat often (33 percent each).

Experiences in online and hybrid courses

Students who reported taking at least one online or hybrid course were asked to rate on a 5-point scale their agreement with statements about their experiences in these courses (figure 14). Overall, the feedback on online and hybrid courses was positive, with more than 80 percent of students agreeing or strongly agreeing that it was easy to access course materials, the flexible schedule made it easier to complete assignments, they knew how to ask the professor for help, and it was easy to understand their progress in the course. Nearly two-thirds (66 percent) would recommend online or hybrid courses to other students. However, one disadvantage, according to more than half of student respondents, was that students in online and hybrid courses do not interact with each other much.

Figure 14. Student survey respondents’ level of agreement with statements about online and hybrid courses



Source: HL-SCI student survey, spring 2016.

Open-ended survey feedback on online and hybrid courses

The survey included an open-ended item asking students for additional suggestions to improve online and hybrid courses. Thirty-five students answered the question, and their responses were consistent with the feedback received through interviews and focus groups. The most common suggestion was to increase the interaction in online and hybrid courses, particularly between students and professors. Some students would also like additional opportunities to interact with other students in their classes. Two students suggested that instructors in purely online courses hold dedicated virtual office hours, time set aside for professors to answer student questions by email.

A few students said that professors did not post course materials or provide feedback in a timely way. They would like their online and hybrid course instructors to be held accountable for doing so. Three students mentioned experiencing technology issues in on-campus computer labs. One said the Internet browser crashed during exams, while another said that students are not permitted to download software required for online and hybrid courses on campus computers. Therefore, many students brought laptops from home to complete online and hybrid content on campus.

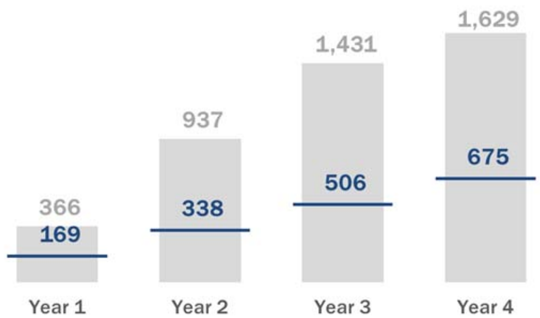
As in focus group and interview responses, several survey respondents believed that the online and hybrid formats were more appropriate for some subjects than for others. Some students felt that they missed out on opportunities for hands-on and interactive learning. One student perceived offering science courses in a hybrid format as a cost-saving measure. He or she wrote, "I am currently taking a hybrid class in pharmacology, and it is a nightmare. It takes at least five times the amount of time to complete lectures and notes as an in-person class does. It is not a good format for science." Other students said they felt that they had to teach themselves science content offered through an online or hybrid format. Some students indicated that these formats worked best for data/IT programs of study.

Prior learning assessments

In collaboration with the Connecticut Career Assessment Program (CCAP), administered by Charter Oak State College, the Consortium colleges refined PLA systems to award credit for relevant credit and noncredit coursework, prior training, and work experience. Charter Oak worked with the Consortium colleges to coordinate and standardize the PLA process at each college. For example, Charter Oak helped to revise the PLA process at one college from a tedious, paper-based portfolio to a fully online application and upload process for students.

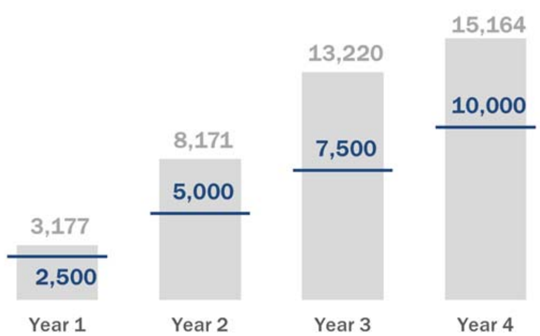
At the outset of the grant, the Consortium set goals of awarding 675 students prior learning credit and awarding 10,000 credits throughout the grant period (figures 15 and 16). The Consortium has exceeded both goals by large margins. By the end of the grant period, the five colleges awarded 15,164 credits to 1,629 unique students (figures 15 and 16). This averages out to approximately nine credits per student, although the impact on the remaining number of credits needed for credential completion varies by credential type and program of study. HL-SCI certificate programs require 8 to 36 credits and associate's programs require 60 to 69 credits.

Figure 15. Cumulative number of students receiving PLA credits at the conclusion of each grant year exceeded goals (shown in blue)



Source: Consortium annual reports to the U.S. Department of Labor.

Figure 16. Cumulative number of PLA credits awarded to students at the conclusion of each grant year exceeded goals (shown in blue)

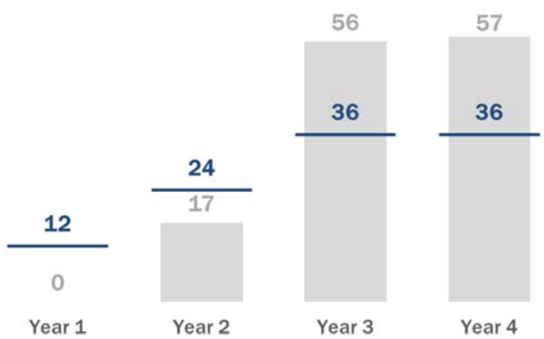


Source: Consortium annual reports to the U.S. Department of Labor.

As part of their partnership with Charter Oak, each of the Consortium colleges, as well as area noncredit training programs and agencies, has identified noncredit credential programs that are eligible for college credit. Charter Oak worked with the colleges to identify the applicability of these noncredit programs to certificate and degree programs, as well as the number of credits for which students who complete the programs are eligible. In 2014, Charter Oak staff met with grant staff at each college to streamline the review of noncredit programs at each community college. Additionally, Charter Oak promoted the ability for area noncredit training programs and agencies to apply for program review and awarding of college credit for their programs.

As a result of its partnership with Charter Oak, the Consortium has exceeded its deliverable goal of completing the credit recognition process for 36 training programs by the end of the grant period. By the end of the grant period Charter Oak had reviewed and granted credit for 57 programs (figure 17).

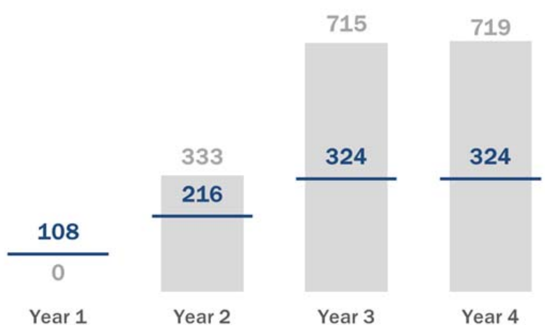
Figure 17. Number of programs processed in the Connecticut Career Assessment Program (CCAP) exceeded goals (shown in blue)



Source: Consortium annual reports to the U.S. Department of Labor.

The Consortium also set a goal of working with Charter Oak to recognize 324 credits from noncredit training programs and high school career and technical education programs that can satisfy requirements for college credits. The Consortium exceeded this goal by year 2 of the grant and exceeded it by more than twofold in the subsequent two years. As of the spring of 2016, Charter Oak has recognized 719 credits through the CCAP (figure 18).

Figure 18. Cumulative total credits recognized by Charter Oak through the Connecticut Career Assessment Program (CCAP) exceeded goals (shown in blue)



Source: Consortium annual reports to the U.S. Department of Labor.

Focus group and interview findings on prior learning assessments

Generally, students were aware of the process for awarding prior learning credits, but most students who participated in the focus groups and interviews did not apply for prior learning assessment nor receive prior learning credit. Of students who did participate in the PLA process most generally described the process as straightforward and believed they received the appropriate amount of credit for their prior experience or knowledge. Among students who attempted to obtain PLA credit through an exam (such as CLEP exams or Credit by Exam), a few said that they had little information about the format or content of the exams prior to taking them.

Students' perceptions of transferring prior learning credits and academic credits

Most students said that transferring credits from other institutions was easy and convenient. In addition, many students perceived the process of transferring credits as fair. Some students, however, fought to ensure that certain credits transferred when they believed they had the requisite training and experience. One student, for example, experienced challenges with receiving credit for his previous coursework and work experience in the military. He said, "They were leery of accepting two advanced chemistry courses that I took at [previous college] because they were more than five years old. I had to petition for their acceptance by giving them my resume [which included] work experience heavy in a chemistry background…I had to go through a tortuous process with [my college] for them to overlook that my chemistry classes were outside of a five-year timeframe." Another student had completed a bachelor's degree in psychology prior to enrolling in her program, but had to take developmental psychology again because the course names at the two institutions did not align.

Other students perceived the process for transferring credits as administratively burdensome or were unsure of the criteria that their colleges used to award credit. Some students said that the process for transferring credits took a long time, requiring multiple email exchanges and in-person visits to the college. One student at Norwalk was enrolled in a physical therapy program, but staff members mistakenly thought she was a nursing student and initially did not award her the correct number of transfer credits. She appealed their decision, but it took three months for them to award credits for her prior coursework. Several international students experienced challenges with attempting to transfer credits from foreign institutions. These students often paid substantial fees for translating foreign transcripts, which presented a financial challenge.

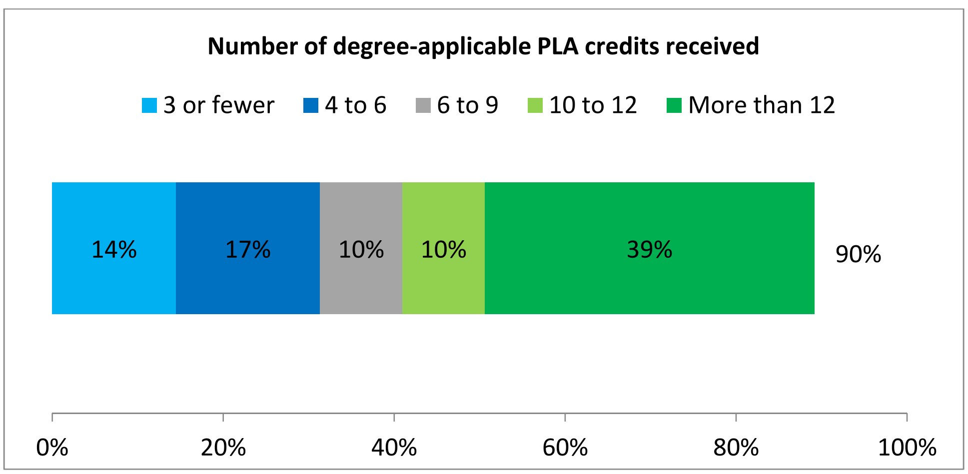
A few students would have preferred a more personalized process for determining whether students should receive prior learning credit. For example, one student said that the process for awarding credit should be based on students' familiarity with the course material and their abilities to apply what they have learned to subsequent, more advanced coursework. The student said, “They should take more time in getting an overall picture, rather than going line by line.” Students said that program-specific advisors often knew more about which credits would be appropriate to transfer into HL-SCI programs of study than collegewide advisors. They often preferred meeting with advisors within their department or major.

Student survey findings on prior learning assessments

The section of the student survey on PLA opened with a question about whether students had received prior learning credit. Of the 285 students who answered the question, 29 percent said yes, 40 percent said no, and 31 percent were unsure. Only those students who answered yes were asked subsequent questions on PLAs.

These students were asked how many credits they had received through the PLA process that counted toward their certificate or degree program. Only 11 percent of respondents said that none of their PLA credits counted toward their programs, while nearly 40 percent said they received more than 12 credits to fulfill degree requirements (figure 19).

Figure 19. Most student survey respondents who participated in the PLA process received credits that were applicable toward their degrees



Source: HL-SCI student survey, spring 2016.

Because of the highly applied nature of the coursework and courses in the HL-SCI programs of study, students are not able to transfer credits for many of their required courses. Additionally, many of the outside accrediting bodies of the HL-SCI programs specifically prohibit transferring of credits toward the required core courses. However, depending on the PLA credits awarded, students may be able to apply those credits to general education requirements for their degrees.

As in the section of the survey on online and hybrid courses, students who had received prior learning credits were asked to indicate on a 5-point scale the extent to which they agreed with a series of statements on the PLA process ("strongly agree," "agree," "neither agree nor disagree," "disagree," and "strongly disagree"). Table 10 displays the statements, as well as the number of students who responded to each, the percentage who agreed or strongly agreed, and the percentage who disagreed or strongly disagreed.

Table 10. Student survey respondents' level of agreement with statements about prior learning assessments

Statement	Agreeing or strongly agreeing	Disagreeing or strongly disagreeing
The process for receiving prior learning credit was easy to understand.	77%	10%
I think I received the right amount of credit for my prior coursework, training, or experience.	71%	14%
As a result of receiving prior learning credit, I think I will complete my certificate or associate's degree program faster.	69%	12%
As a result of receiving prior learning credit, I am more motivated in my courses.	60%	11%
I am more likely to complete my certificate or associate's degree program because I received prior learning credit.	57%	13%

Source: HL-SCI student survey, spring 2016.

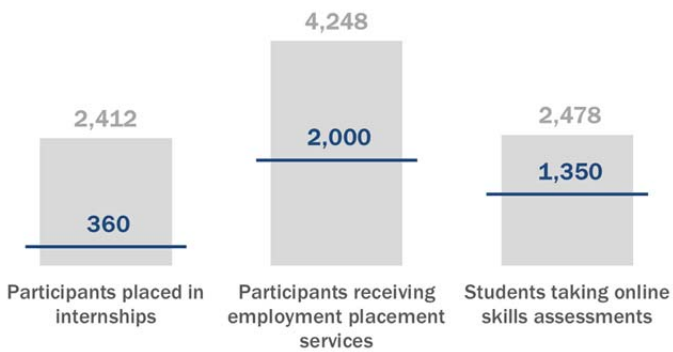
Most students believed that the process for receiving prior learning credit was straightforward. In addition, more than 70 percent believed that they had received the correct amount of credit given their prior knowledge and experience. More than half (57 percent) reported that receiving prior learning credit increased their likelihood of completing a degree or certificate.

Internships and job placement services

Across campuses, the HL-SCI grant deliverable goals for internships and job placement services were to place 360 participants in internships and provide job placement services to 2,000 participants. The Consortium has greatly exceeded each of these goals. During the grant period, 2,412 unique participants have completed an internship and 4,248 unique participants have received employment placement services (figure 20).

A final Consortium goal related to employment and placement services was for 1,350 students to take online career or soft skills assessments, such as Focuses, Bridges, and Career Edge. The definition also included online soft skills assessments with instructor feedback that might be offered within specific courses. The Consortium exceeded its deliverable goal. Throughout the grant period, 2,478 unique students took an online skills assessment.

Figure 20. Number of participants placed in internships and receiving employment placement services, and students taking online skills assessments exceeded goals (shown in blue)



Source: Consortium annual reports to the U.S. Department of Labor.

Focus group and interview findings on internships and employment placement services

Across semesters and campuses, most of the students who participated in hands-on work experiences as part of their HL-SCI programs of study participated in clinical practicums. Overall, these students spoke positively about their clinical experiences. They appreciated that they were hands-on, reinforced academic content, and allowed them to apply what they had learned in the classroom. Students were able to see a connection between their clinical experiences and future careers. According to one student, "The bulk of my job now is working with patients and understanding how they get treated and why we treat them this way, and I believe the clinical portion really did prepare us for working in the field."

A couple of students said that the professionals supervising their clinical experiences had limited time to provide hands-on instruction and guidance. "They're often busy and don't have time to teach you," one student said. "You can make observations about what is going on, but they don't have time to explain to you what is happening." In addition, a few students disliked the rigid scheduling of clinical experiences, noting that it is especially challenging to participate in practicums and hold a full- or part-time job. Students would like more input into both the hours they worked and their clinical placement sites.

Some students reported receiving career advice or guidance from their colleges, including career advice and help with resumes and interview skills. Those who received guidance from either program advisors or faculty members generally found it useful. Students cited faculty members as especially helpful with finding permanent jobs. According to one nursing student, "They are helping us with our CVs [curriculum vitae]. The teachers are willing to write us reference letters. If you get an interview, the professors are available to help you prepare."

Throughout the grant period, some students said they would like additional career guidance, including help with securing a job within their fields while they are still in school and obtaining permanent employment once they complete. At Capital, focus group participants recommended the development of an HL-SCI mentoring program. Community members who worked in health and life science fields would serve as mentors and help students transition from college to career.

In multiple interviews and focus groups, nursing students said they would have liked more information about the value of an associate's degree in nursing prior to entering the program, since most nursing jobs in Connecticut now require a bachelor's degree in nursing. According to one student at Norwalk, "There needs to be more advising for students to figure out how they can get the [B.S.N.] degree. There should be mandatory check-ins with our advisors once a semester." In a subsequent semester, a Norwalk nursing student said that faculty had arranged for four-year universities to provide information on how to apply for bachelor's degree programs.

Student survey findings on internships and employment placement services

The section of the student survey on internships and placement services included a multipart question on whether students had received specific types of internships and placement services and how helpful they found them. Table 11 displays the services, the percentage of respondents who received each service, as well as the percentage who found them helpful, unhelpful, or neither.

Most commonly, students reported receiving assistance with course selection, and nearly three-quarters of these students found the advising helpful. More than half of the respondents received information on jobs to pursue either while enrolled or after completing the program. A majority of students also found these services helpful. However, fewer than half of students who received help with resume revision or finding a permanent job found these services helpful. The survey section concluded with an open-ended question about what students would improve about internship and employment placement services. Overall, students would like more employment advising. Some students said that they received more effective advising from faculty than staff members designated as advisors. Two respondents said that students were responsible for finding and securing their own internships in their programs. These students would like additional information about prospective employers prior to beginning the application process. Finally, several students who work while attending college would like employers to offer internships with more flexible schedules. They said that most internships require students to work full-time, but a part-time internship would provide them with valuable skills to add to their resumes.

Table 11. Student survey respondents who received specific placement services and their ratings of the level of helpfulness of each service

Service	Percent receiving the service	Rating of those receiving the service: Very helpful or somewhat helpful	Neither helpful nor unhelpful	Unhelpful or very unhelpful
Assistance with course selection	76%	74%	16%	10%
Information on jobs to pursue after program completion	65%	71%	21%	8%
Information on jobs to pursue during the program	59%	66%	23%	11%
Help with resume revision	52%	59%	26%	15%
Assistance with internship placement	48%	58%	27%	15%
Help with interview skills	47%	45%	41%	15%
Assistance with job-shadowing or another work-based training experience	44%	56%	32%	12%
Assistance with placement in a permanent job	40%	40%	42%	18%

Source: HL-SCI student survey, spring 2016.

Focus group and interview findings: overall student feedback

What students liked best about their programs

On the whole, students provided positive feedback about their HL-SCI programs of study. Most interview and focus group participants believed that their programs would change their lives by allowing them to secure a well-paying job in an in-demand career field. Students said their classes motivated them to achieve academically. One student said of her program, “It has shown me that I can do this and will give me the direction that I want.”

Students especially appreciated that much of their course content was offered through hands-on instruction in laboratory or clinical settings. In the spring of 2016, students at Gateway had particularly favorable impressions of the Human Cadaver Anatomy course, offered through the biology department, which provided hands-on training that students would not receive elsewhere. According to one student, "This class is really awesome! We're working on a real-life human cadaver…we're basically dissecting and looking at parts of the body, and that's awesome." Another student said, "It is probably the best undergraduate course I have ever taken...usually, students with our background wouldn't have this experience." Several other students made similar comments about the class.

A fire science student also appreciated the hands-on experience in his courses. He said, "We were able to use the New Haven Fire Academy, which offers a lot of tools and training. We had access to their burn building, and we had access to their tower. We were able to use these for practical exercises." In previous semesters, students similarly praised laboratory and clinical experiences because they offered the opportunity to apply what they had learned.

Students nearly universally spoke favorably about their professors. Students said that professors were well-prepared and dedicated to students. Overall, they presented the course material clearly and were responsive to questions. One student said, "I love my instructors. They go above and beyond to make sure you understand what they are teaching, and they don't mind taking the time out of their busy schedules to help you." Students liked that many of their professors either had current or prior work experience in health and life science fields. Thus, they were able to relate lectures and labs to on-the-job experiences. According to one student, "It's so very easy to learn from them because they have stories they can tell and that makes it easier to learn." A few students were critical of their professors, but their complaints were generally specific to the context of each course. There were no consistent criticisms across either time or HL-SCI colleges.

We spoke with a limited number of students who were veterans, who generally provided positive feedback on both their overall experiences and the support services designed specifically for veterans. For example, students at Gateway praised the veterans' coordinator at the college and described him as a "problem solver." These students said that he served as a liaison between students and faculty and staff members, helping students address any issues that arose. One of the Gateway students appreciated the extra services and "community" available for veterans at Gateway so much that he or she elected to commute over an hour to attend the college.

Students' challenges and suggestions for improvement

Throughout the grant period, the most significant challenge for HL-SCI students was balancing their course loads with work, family responsibilities, or both. Some students had difficulty arranging their course schedules around other obligations. Students suggested offering commonly required courses during both day and evening sessions to ensure that as many students as possible can participate. One student said that the introductory chemistry and biology courses he needed for his degree were scheduled at the same time, which made it challenging to progress through the program at the rate he would have liked. Similarly, a student at Norwalk said that it was difficult to get through a new program in a timely manner, since only one or two required courses were offered per semester.

Time management also presented a challenge. Some students had difficulty finding time to complete homework and other assignments given their competing demands. Some students dropped courses or reduced their hours at work to ensure that coursework was completed.

Some students would like additional access to on-campus facilities to support their coursework. For example, students at Manchester would like to extend the library hours beyond the 8 p.m. closing time to allow them greater flexibility. Also at Manchester, an occupational therapy student cited the need for additional course content in skilled nursing and pediatric therapy. The student said, “Other programs have pediatric gyms that you can work in, and I never got to see that.”

Some students requested additional support services from their colleges. During data collection cycles early in the grant, students requested additional childcare on campus or assistance with childcare expenses. Other students requested assistance with nontuition expenses. For example, students would like assistance with paying for parking at clinical sites.

Impact Evaluation Results

This section describes the results from analyses assessing the impact of the HL-SCI grant on student outcomes. We begin by providing information about the extent to which the Consortium achieved its goals for student outcomes. Next, we examine the overall impact of the HL-SCI grant on college persistence, credential completion, and credit accumulation. Finally, we provide results for the effectiveness analyses of three HL-SCI components: PLAs, booster modules, and online and hybrid courses.

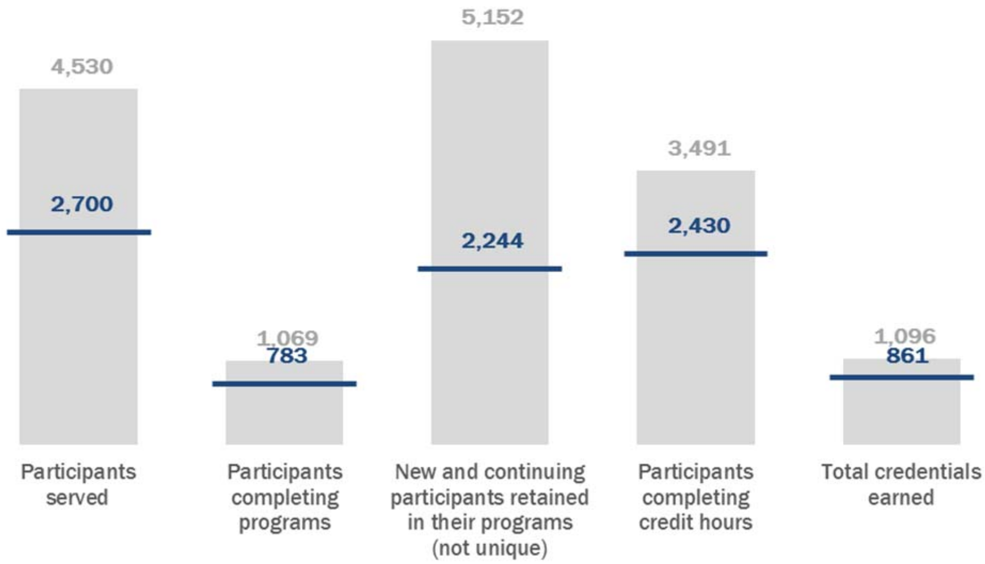
Actual performance relative to student outcome goals

In the original grant application, HL-SCI staff set nine goals for student outcomes, and progress toward these goals was monitored in annual reports to the U.S Department of Labor. The first set of goals relate to student enrollment and completion outcomes by the end of the third year of the grant. The Consortium exceeded all of these goals (figure 21). In particular, the number of students who participated, remained in their programs, and completed credit hours exceeded the goals by more than 1,000.[11] The goals for the number of participants completing their programs and the total number of credits earned were exceeded by a smaller amount, although the majority of HL-SCI participants were still enrolled at the end of the follow-up period, so these outcomes are assessed among a much smaller group.[12]

[11] The indicator for the number of participants retained includes the total number of new and continuing participants who were retained in each year of the grant. Participants are double-counted if they are retained for more than one year.

[12] The number of participants completing programs is a unique count of students who earned a credential. This differs from the total number of credentials earned, which double-counts participants who completed multiple credentials such as a certificate and an associate's degree.

Figure 21. Performance on student enrollment and completion outcomes through year 3 exceeded goals (shown in blue)

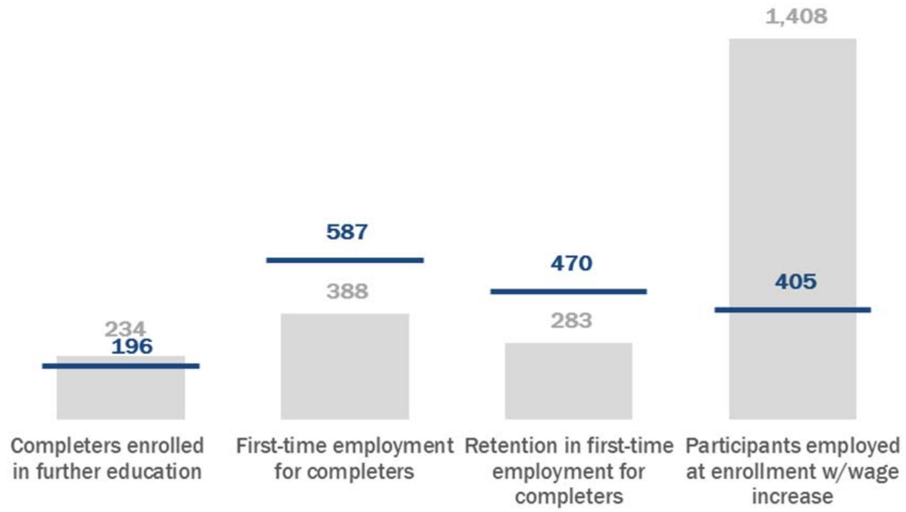


Source: HL-SCI annual reports to the U.S. Department of Labor.

The second set of student outcome goals relate to continuing education and employment, and are measured four years after the start of the grant. The Consortium exceeded two of these four goals (figure 22). First, the number of completers who continued their education exceeded the goal (234 versus 196). This number includes only completers who attended a public college in Connecticut, so the actual number may be even higher if some completers attended a private or out-of-state college to continue their education. Additionally, data on continuing education were available only after a two semester delay, so the totals do not include participants who continued their education at a four-year state institution after fall 2014.

Next, the Consortium more than tripled its goal for the number of participants employed at enrollment who received a wage increase (1,408 versus 405). This number includes all participants (not just completers) who have received a pay raise, which may be a result of pursuing new or additional credentials (although some may have received a pay raise for other reasons). In total, 69.4 percent of incumbent workers had a wage increase in any quarter after HL-SCI enrollment. The average annual wage increase was $7,036, but varied by college from $5,397 to $8,789. Earnings outcomes for incumbent workers also differed by the category of the program of study (table 12).

Figure 22. Performance on student continuing education and employment outcomes through year four exceeded two of four goals (shown in blue)



Source: HL-SCI annual reports to the U.S. Department of Labor.

Table 12. Earnings outcomes for HL-SCI participants who are incumbent workers, by program of study

Program category	Total incumbent worker participants	Participants with wage increases	Percent of participants with wage increase	Average wage increase
Health/medical	1,631	1,107	67.9	$7,137
Science	202	157	77.7	$5,983
Data/IT	196	144	73.5	$7,461
All	2,029	1,408	69.4	$7,036

Source: Employment data provided by the Connecticut Department of Labor.

The two student outcome goals that the Consortium did not meet are measured only for graduates who were not employed at the time of enrollment in HL-SCI. They do not consider prior, historical employment nor employment post-enrollment; they are a snapshot at time of intake only. These outcomes examine whether these graduates gained employment in the quarter following completion of their HL-SCI program, then subsequently retained employment for three quarters following initial employment. However, there was considerable variation in these outcomes across programs and colleges (table 13). The percentage of graduates in post-completion employment was highest for science programs of study (68.2 percent), followed by health/medical (61.1 percent), and then data/IT (58.5 percent). The percentage of completers employed ranged by college from 53.2 to 78.2 percent. For the outcome examining the percentage of graduates retained in employment for three continuous quarters after initial employment, the rates were similar (within 3 percentage points) for all program categories. There was greater variation in this outcome across colleges, where employment retention rates for first-time workers ranged from 28.6 percent to 62.2 percent (table 14).

Table 13. Employment outcomes for HL-SCI graduates who were not employed at the time of enrollment, by program of study

		Employment at 1st quarter after graduation		Continuous employment for 3 quarters after initial employment	
Program category	**Total graduates**	**N**	**Percent**	**N**	**Percent**
Health/medical	560	342	61.1%	248	44.3%
Science	22	15	68.2%	10	45.5%
Data/IT	53	31	58.5%	25	47.2%
All	635	388	61.1%	283	44.6%

Source: Employment data provided by the Connecticut Department of Labor.

Table 14 Employment outcomes for HL-SCI graduates who were not employed at the time of enrollment, by college

		Employment at 1st quarter after graduation		Continuous employment for 3 quarters after initial employment	
College	**Total graduates**	**N**	**Percent**	**N**	**Percent**
Capital	255	136	53.3%	73	28.6%
Gateway	143	102	71.3%	89	62.2%
Manchester	87	68	78.2%	51	58.6%
Middlesex	11	8	72.7%	6	54.5%
Norwalk	139	74	53.2%	64	46.0%
All	635	388	61.1%	283	44.6%

Source: Employment data provided by the Connecticut Department of Labor.

Overall impact of HL-SCI on student outcomes

This section examines the overall impact of the HL-SCI grant on student outcomes, including college persistence, credential completion, and credit accumulation.

Outcomes for HL-SCI students are compared with a matched comparison group of students enrolled in the same or similar programs of study prior to the new or revised HL-SCI programs of study. The matching process ensures that the intervention and comparison students are the same in terms of their prior academic experience (new, continuing, or returning student), the content area of their program of study (health/medical, science, or data/IT), and the duration of their program of study (fewer than 20 credit hours, 20 to 24 credit hours, 25 to 29 credit hours, 30 to 36 credit hours, 60 to 64 credit hours, or 65 to 69 credit hours). This is done by making comparisons among intervention and comparison groups within the same stratum, and then aggregating the results across all strata.

For each student outcome assessed, we provide an illustrative graphical display of the results from the regression models using bar charts. These charts display the results for two hypothetical populations—one with all HL-SCI students and one with all comparison students—that have the same values on all other variables in the model, including student demographics, student characteristics, program characteristics, and college attended (see technical appendix for more detail). This shows how outcomes for the two groups would differ if all other factors were held constant.

The notes at the bottom of each figure provide the p-value, which is used to assess the statistical significance of the impact estimate. The p-value represents the likelihood of obtaining a finding due to random chance rather than to the investigated effect. Using a two-tailed test, we consider an impact to be statistically significant if there is less than a 5 percent chance of obtaining a random finding (a p-value of less than 0.05). The figures also include an asterisk next to the value for the HL-SCI students if the results are statistically significant. Detailed regression results are presented in tables A7 and A8 of the technical appendix.

College persistence

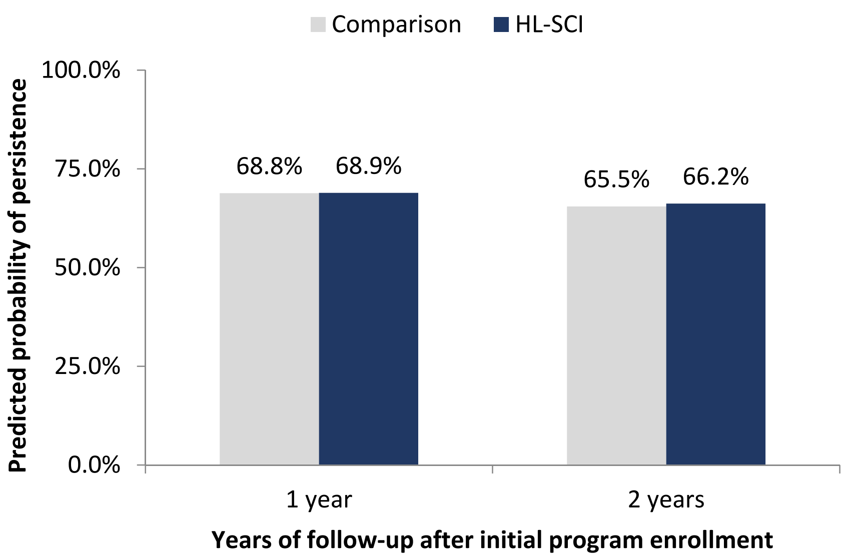
The first outcome that we examine for the overall impact of the HL-SCI grant is a dichotomous variable for whether the student persisted in college one year after initial program enrollment (0=no longer enrolled, 1=still enrolled or completed the program). For example, if a student enrolled in an HL-SCI program of study during spring 2013, we would examine whether the student was still enrolled in college during spring 2014 (in any program of study).[13] We also assess the impact of the HL-

[13] Note that if a student enrolled in an HL-SCI program of study during spring 2013, did not enroll in spring 2014, but returned in a subsequent semester, the student is still classified as "no longer enrolled" for the year 1 persistence outcome since outcomes are being compared after the same duration for all cohorts. However, if the same student was enrolled again in spring 2015, the student would be classified as "still enrolled" for the year 2 persistence outcome.

SCI program of study on continued persistence for two years after initial program enrollment for the subset of students with at least two years of follow-up data.

We find that the HL-SCI grant does not have a statistically significant impact on college persistence in either year. The predicted probability of persistence for HL-SCI students is 68.9 percent after one year of program enrollment and 66.2 percent after two years of program enrollment (figure 23). Persistence outcomes are similar for students in the comparison group.

Figure 23. Predicted probability of persisting in college for students in the comparison and HL-SCI groups, after one and two years of program enrollment



Notes: Results are from a logit model that accommodates for clustering of students within colleges (N=6,197 in year 1 and N=3,836 in year 2). The model is used to calculate the probability of persisting in college by HL-SCI status, while holding constant all other variables. The coefficient on the HL-SCI variable is 0.007 (p=0.938) in year 1 and 0.033 (p=0.817) in year 2.

* Coefficient (of estimated intention-to-treat impact) is statistically significant at the 95 percent confidence level using a two-tailed test.

We also examine whether there are any differences in the likelihood of persistence by program category. The sample sizes are small for some program categories (particularly for outcomes after two years of follow-up), which means that the impact estimates by program category are subject to lower reliability than the impact estimates for the program as a whole. It is important to consider not only the differences in the marginal effects between the program categories, but also the confidence intervals which provide a range of likely values for the effects. If the 95 percent confidence intervals overlap between two program categories, then any differences may have occurred by chance.

Predicted probabilities are calculated by HL-SCI status and program category while holding constant student demographics, student characteristics, program characteristics, and college attended. We find that in the intervention group, the predicted probability of persisting in college for one year and two years is similar regardless of program category (table 15). The 95 percent confidence intervals for each of the program categories overlap with the confidence interval for all programs among HL-SCI participants. In the comparison group, persistence rates are mostly similar by program category, except that the science program category has a lower persistence rate in year one relative to all programs in the comparison group.

Table 15. Predicted probability of persisting in college by program category, after one and two years of program enrollment

	Comparison group				Intervention group			
Persistence: One year								
	N	Margin	95% confidence interval		N	Margin	95% confidence interval	
Health/medical	3,488	70.6%	67.8%	73.4%	856	71.1%	67.9%	74.3%
Science	539	57.2%	51.2%	63.3%	246	68.8%	62.7%	74.9%
Data/IT	833	74.5%	70.9%	78.1%	235	61.9%	55.4%	68.4%
All	4,860	68.8%	66.7%	71.0%	1,337	68.9%	66.2%	71.4%
Persistence: Two years								
	N	Margin	95% confidence interval		N	Margin	95% confidence interval	
Health/medical	2,218	67.8%	63.5%	72.1%	480	71.9%	67.2%	76.6%
Science	377	52.0%	40.5%	63.5%	105	55.7%	44.8%	66.5%
Data/IT	539	68.2%	60.5%	75.8%	117	54.9%	45.6%	64.2%
All	3,134	65.5%	62.0%	68.9%	702	66.2%	62.3%	70.4%

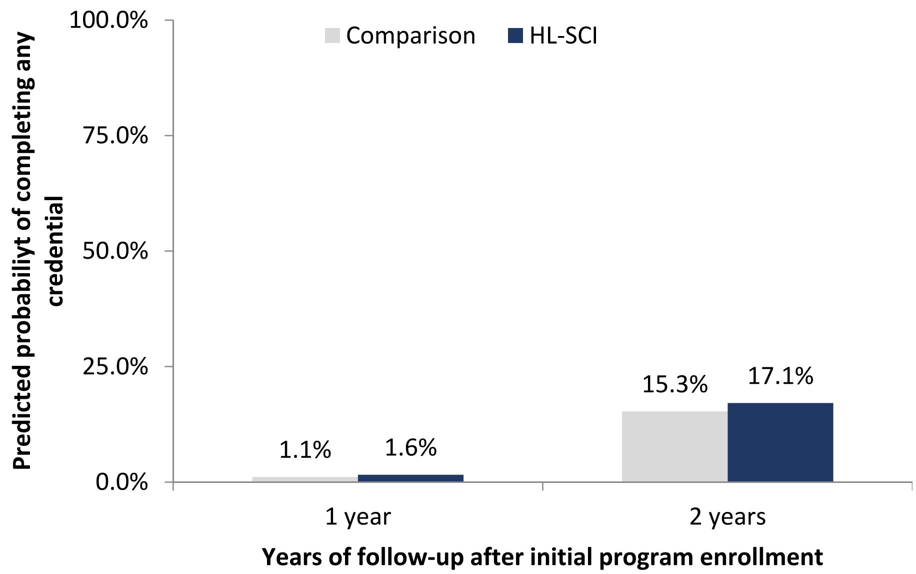
Notes: Results are from a logit model that accommodates for clustering of students within colleges (N=6,197 in year 1 and N=3,836 in year 2). The model is used to calculate the probability of persisting in college by HL-SCI status and program category, while holding constant all other variables.

Credential completion

Next, we examine whether the HL-SCI grant has an impact on the likelihood that students will complete a credential after one or two years of program enrollment. The primary outcome that we examine is the likelihood of completing any credential for all students. However, we also examine the likelihood of completing an associate's degree for students in programs of study that lead to an associate's degree, and the likelihood of completing a certificate for students in programs of study that lead to a certificate. One caveat is that many students who register for a certificate program are also registered for the relevant Associate's degree program. Because of the U.S. Department of Labor's limitations on unique participant coding, at time of student intake, each college chose whether to code students as certificate or associate-seeking students, with the majority choosing the former. In these cases, students would not be shown as completing a certificate until after they graduated with an associate's degree. This may underestimate the number of students completing a certificate since there is a limited follow-up period for tracking both certificate and associate's degree completion for those students. Each outcome for credential completion is operationalized as a dichotomous variable where a value of one indicates that the student completed a credential and a value of zero indicates that the student did not complete a credential within the follow-up period.

In both the HL-SCI and comparison groups, less than 2 percent of students complete any credential (certificate or associate's degree) within one year of program enrollment (figure 24). This low rate is not surprising given that most programs of study require more credits than students can complete in a single year. Among all students in the sample, the average number of credits required for program completion is 60.8 credits. That means that a full-time student would not be expected to complete their program of study for at least two years (for example, 15 credits per semester in the fall and spring semesters over two years, for a total of 60 credits). Time-to-credential will be even longer if students are required to complete courses that are not offered every semester, or if they are enrolled part-time (only about one-third of students in our sample are enrolled full-time). We find that in our sample, the predicted probability of completing a credential after two years of program enrollment is 17.1 percent for HL-SCI students, which is not statistically different from the comparison group.

Figure 24. Predicted probability of completing any credential for students in the comparison and HL-SCI groups, after one and two years of program enrollment



Notes: Results are from a logit model that accommodates for clustering of students within colleges (N=6,218 in year 1 and 3,840 in year 2). The model is used to calculate the probability of completing a credential by HL-SCI status, while holding constant all other variables. The coefficient on the HL-SCI variable is 0.401 (p=0.180) in year 1 and 0.145 (p=0.442) in year 2.

* Coefficient (of estimated intention-to-treat impact) is statistically significant at the 95 percent confidence level using a two-tailed test.

Credential completion rates also tend to be similar by program category (table 16). Within the intervention group, the 95 percent confidence interval for each program category falls within the range of the confidence interval for all programs. In the comparison group, students in science programs are less likely to complete a credential after two years of program enrollment, holding other factors constant.

Within our sample, approximately 90 percent of students are enrolled in associate's degree programs. When we estimate the likelihood of completing an associate's degree after one or two years of program enrollment for these students, there are no statistically significant differences between the HL-SCI group and the comparison group. We also examined credential completion outcomes for the small subset of students enrolled in certificate programs. We find a small increase in the predicted probability of completing a certificate after one year for HL-SCI students relative to comparison students (5.5 percent versus 2.5 percent). However, this difference is small in magnitude and is not robust to sensitivity analyses that exclude continuing students (see table A8 in the technical appendix for complete results). We also do not find any statistically significant differences between HL-SCI and comparison students on the likelihood of completing a credential after two years of program enrollment.

Taken together, these results suggest that HL-SCI grant does not have an impact on credential completion.

Table 16. Predicted probability of completing any credential by program category, after one and two years of program enrollment

	Comparison group				Intervention group			
Any credential: One year								
	N	Margin	95% confidence interval		N	Margin	95% confidence interval	
Health/medical	3,493	1.1%	0.9%	1.5%	865	1.8%	0.8%	2.8%
Science	539	0.5%	0.0%	1.0%	248	1.8%	0.0%	3.6%
Data/IT	833	1.2%	0.7%	1.7%	240	1.2%	0.1%	2.3%
All	4,865	1.1%	0.9%	1.3%	1,353	1.6%	0.9%	2.3%
Any credential: Two years								
	N	Margin	95% confidence interval		N	Margin	95% confidence interval	
Health/medical	2,219	19.4%	15.9%	22.9%	481	20.3%	16.1%	24.6%
Science	377	0.6%	0.0%	1.3%	106	10.3%	4.1%	16.5%
Data/IT	539	10.1%	5.6%	14.6%	118	8.8%	3.8%	13.8%
All	3,135	15.3%	12.9%	17.7%	705	17.1%	13.7%	20.1%

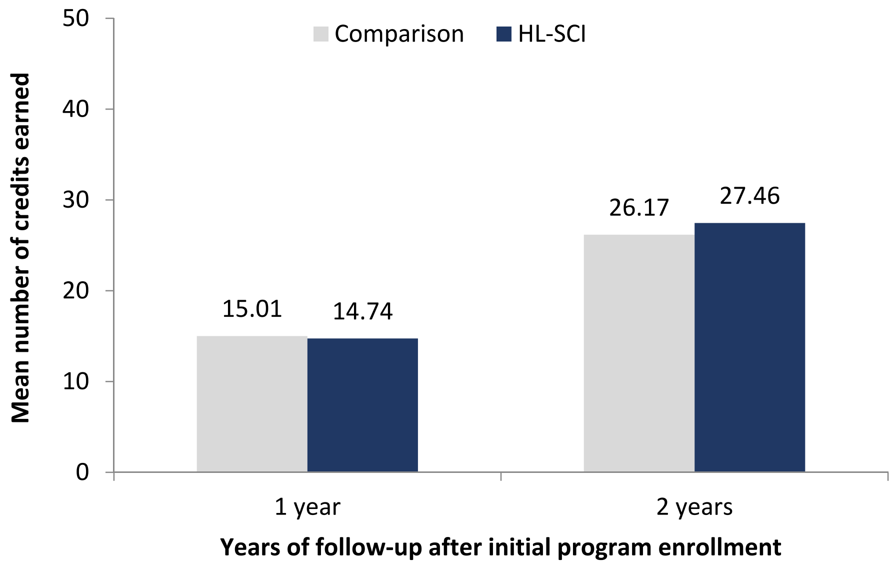
Notes: Results are from a logit model that accommodates for clustering of students within colleges (N=6,218 in year 1 and 3,840 in year 2). The model is used to calculate the probability of completing a credential by HL-SCI status and program category, while holding constant all other variables.

Credit accumulation

The last outcome that we examined for the overall impact of the HL-SCI grant is credit accumulation. This is a continuous variable for the total number of credits earned through coursework during the study period. It does not include any credits earned for previous coursework for continuing or returning students, or credits that were acquired through the PLA process. This outcome is examined after one year and two years of initial program enrollment.

We find no statistically significant differences in credit accumulation between the HL-SCI students and comparison students. The regression-adjusted mean is approximately 15 credits earned in year 1 and 27 credits earned in year 2 for HL-SCI students, and results are similar for the comparison students (figure 25).

Figure 25. Regression-adjusted mean number of credits earned for students in the comparison and HL-SCI groups, after one and two years of program enrollment



Notes: Results are from a linear regression model that accommodates for clustering of students within colleges (N=5,665 in year 1 and 3,295 in year 2). The model is used to calculate the mean number of credits earned by HL-SCI status, while holding constant all other variables. The coefficient on the HL-SCI variable is -0.266 (p=0.499) in year 1 and 1.289 (p=0.324) in year 2.

* Coefficient (of estimated intention-to-treat impact) is statistically significant at the 95 percent confidence level using a two-tailed test.

Credit accumulation tends to differ by program category, particularly in the comparison group. Comparison students in health/medical programs tend to have more credits earned after one year of program enrollment than students in all programs, while comparison students in science programs tend to have fewer credits earned after both one and two years of program enrollment (table 17). There are fewer differences in credit accumulation outcomes in the intervention group. HL-SCI students in science programs earn an average of 22.1 credits after two years, compared with 27.4 credits for HL-SCI students in all programs, holding other factors constant. This difference of 5.3 credits is equivalent to between one and two courses, as most courses carry 3 credits.

Table 17. Regression-adjusted mean number of credits earned by program category, after one and two years of program enrollment

	Comparison group				Intervention group			
Credits earned: One year								
	N	Margin	95% confidence interval		N	Margin	95% confidence interval	
Health/medical	3,079	16.2	15.7	16.6	865	15.0	14.3	15.7
Science	477	12.8	11.8	13.7	248	15.3	14.1	16.5
Data/IT	756	14.4	13.6	15.1	240	13.8	12.3	14.4
All	4,312	15.0	14.7	15.5	1,353	14.7	14.1	15.3
Credits earned: Two years								
	N	Margin	95% confidence interval		N	Margin	95% confidence interval	
Health/medical	1,810	28.3	27.0	29.6	481	28.5	26.7	30.3
Science	318	18.4	15.5	21.4	106	28.5	25.1	32.0
Data/IT	462	24.8	22.8	26.9	118	22.1	19.2	24.9
All	2,590	26.2	25.0	27.4	705	27.4	25.6	28.8

Notes: Results are from a linear regression model that accommodates for clustering of students within colleges (N=5,665 in year 1 and 3,295 in year 2). The model is used to calculate the mean number of credits earned by HL-SCI status, while holding constant all other variables

Effectiveness of HL-SCI components

After assessing the overall impact of the HL-SCI grant, we examined whether there are any differences in outcomes for HL-SCI students based on whether they participated in grant-related components for PLAs, booster modules, and online and hybrid courses.

Prior learning assessments

To evaluate the impact of PLAs, we use the same regression models as for the overall impact of program effectiveness, but we add a dichotomous variable equal to one for HL-SCI participants who received any PLA credit and zero for HL-SCI participants who did not receive any PLA credit.[14] For students with at least one year of follow-up data, we also examine whether the results differ if we use a categorical variable that quantifies the number of PLA credits received. This allows us to check if the relationship between PLA credits is not linear. For example, getting credit for a few courses helps students complete programs faster, but getting many PLA credits means students are unprepared for higher-level courses in the program. Data on PLA credits were not available for comparison students enrolled prior to HL-SCI.

The impact of PLAs on outcomes for HL-SCI participants appears to be mixed (table 18). On the negative side, participants with PLAs were less likely to persist in college after one year than students without PLAs (58.69 percent versus 69.88 percent, a difference of 11.19 percentage points). However, the two groups had similar outcomes for college persistence after two years of enrollment in the program. On the positive side, participants with PLAs were more likely to complete credentials after one and two years of program enrollment, particularly among students in associate's degree programs. The predicted probability of completing an associate's degree was 5.20 percentage points higher for participants with PLAs after one year, and 33.42 percentage points higher for participants with PLAs after two years. There were no statistically significant differences in the total number of credits earned through coursework during the study period among participants with and without PLAs.

[14] This analysis does not include comparison students because data on PLA credits were available only for HL-SCI participants.

Table 18. Student outcomes for HL-SCI participants with and without PLA credits, after one and two years of program enrollment

	1 Year		2 Years	
Persistence				
Participants with PLAs	58.69%		75.37%	
Participants without PLAs	69.88%		65.65%	
Difference	-11.19%	*	9.72%	
Credential: any				
Participants with PLAs	5.59%		45.22%	
Participants without PLAs	1.31%		15.28%	
Difference	4.28%	*	29.94%	*
Credential: associate's degree				
Participants with PLAs	5.71%		44.46%	
Participants without PLAs	0.51%		11.04%	
Difference	5.20%	*	33.42%	*
Credential: certificate				
Participants with PLAs	[a]		40.74%	
Participants without PLAs	[a]		37.53%	
Difference	[a]		3.21%	
Credits earned				
Participants with PLAs	14.70		27.63	
Participants without PLAs	14.74		27.44	
Difference	-0.04		0.19	

Notes: Results are from a logit model (for dichotomous variables) or linear regression model (for continuous variables) that accommodates for clustering of students within colleges. The model is used to calculate the probability of each dichotomous variable by PLA status (or the regression-adjusted mean for continuous variables by PLA status), while holding constant all other variables.

* Coefficient (of the PLA variable) is statistically significant at the 95 percent confidence level using a two-tailed test.

[a] Fewer than 10 HL-SCI students completed a certificate in one year, and none had received PLA credit.

Next, we examined whether the impact of PLAs differs depending on the number of credits earned through the PLA process (table 19). Results are presented only after one year of program enrollment due to the small number of students with PLAs in each category in the year 2 follow-up sample. For the college persistence outcome, we find that the probability of persistence is lowest for students with 4 to 6 PLA credits (55.88 percent) and highest for students with no PLA credits (69.89 percent).

Table 19. Student outcomes for HL-SCI participants by number of PLA credits received, after one year of program enrollment

Persistence		
No PLA credits	69.89%	
3 or fewer PLA credits	59.03%	
4 to 6 PLA credits	55.88%	*
More than 6 PLA credits	66.39%	
Credential: any		
No PLA credits	1.30%	
3 or fewer PLA credits	3.87%	~
4 to 6 PLA credits	3.50%	~
More than 6 PLA credits	13.66%	*
Credential: associate's degree		
No PLA credits	0.50%	
3 or fewer PLA credits	4.13%	*
4 to 6 PLA credits	5.49%	*
More than 6 PLA credits	7.32%	*
Credential: certificate		
No PLA credits	[a]	
3 or fewer PLA credits	[a]	
4 to 6 PLA credits	[a]	
More than 6 PLA credits	[a]	
Credits earned		
No PLA credits	14.76	
3 or fewer PLA credits	14.33	
4 to 6 PLA credits	14.29	
More than 6 PLA credits	16.68	

Notes: Results are from a logit model (for dichotomous variables) or linear regression model (for continuous variables) that accommodates for clustering of students within colleges. The model is used to calculate the probability of each dichotomous variable by the number of PLA credits received (or the regression-adjusted mean for continuous variables by the number of PLA credits received), while holding constant all other variables.

* Coefficient (of the PLA variable) is statistically significant at the 95 percent confidence level using a two-tailed test. The reference group is students with no PLA credits.

~ Coefficient (of the PLA variable) is statistically significant at the 90 percent confidence level using a two-tailed test. The reference group is students with no PLA credits.

[a] Fewer than 10 HL-SCI students completed a certificate in one year, and none had received PLA credit.

For the credential completion outcomes, there is some evidence that the probability of completing a credential increases as the number of PLA credits increases. For example, the predicted probability of completing an associate's degree is lowest for participants with no PLA credits (0.50 percent), followed by participants with 3 or fewer PLA credits (4.13 percent), then participants with 4 to 6 PLA credits (5.49 percent), and highest for participants with more than 6 PLA credits (7.32 percent). These results are as anticipated, since PLA credits should allow students to progress through their programs more quickly than if they had to accumulate all of their credit hours through new coursework.

Booster modules and online and hybrid courses

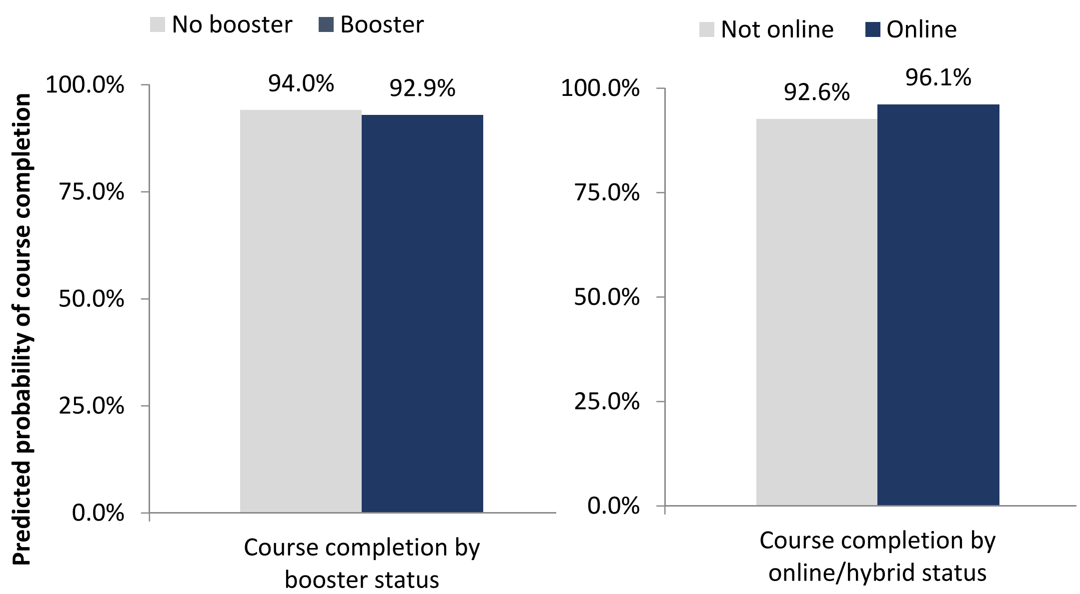
Finally, we examine how course outcomes differ for HL-SCI participants who participated in booster modules or online and hybrid courses. We compare outcomes for an intervention group of HL-SCI participants who have enrolled in a booster or online/hybrid course with those of a comparison group consisting of students who enrolled in a prior year in the same course without the HL-SCI component. Regression models are estimated separately for the booster component and the online and hybrid component.

The first outcome of interest is course completion, which is a dichotomous variable for whether the student successfully completed the course with a grade of C- or above (which is considered passing by the Consortium colleges). Students with a grade of A to C- are coded as one, while students with a grade of D+ to F are coded as zero. The second outcome is a continuous variable for course grade on a scale from 0 (F) to 4 (A), which corresponds to grade point average (GPA) calculations used by the Consortium colleges.[15] Course grades are available only for the subset of students who complete the course.

We find that course completion rates are high (above 90 percent) for all students regardless of whether the course included any HL-SCI components (figure 26). There are no statistically significant differences for the HL-SCI components in either model, which suggests that the booster modules and the online and hybrid course format do not influence the likelihood that students will complete courses.

[15] Course grades were assigned numeric values as follows: A=4.0, A-=3.7, B+=3.3, B=3.0, B-=2.7, C+=2.3, C=2.0, C-=1.7, D+=1.3, D=1.0, D-=0.7, and F=0.0.

Figure 26. Predicted probability of course completion for students in courses with and without booster modules, and courses with and without online or hybrid format

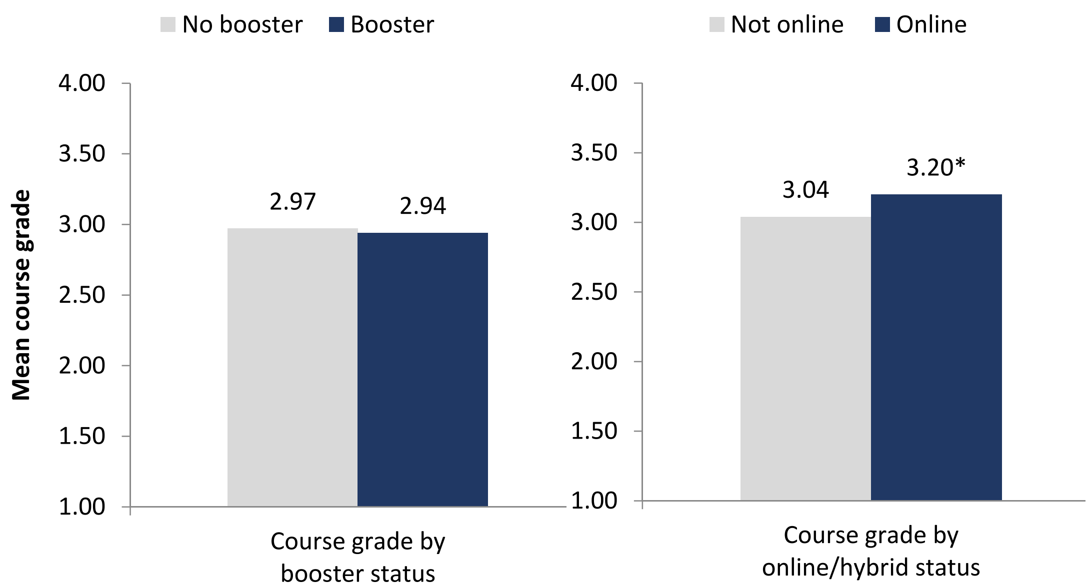


Notes: Results are from a logit model that accommodates for clustering of students within colleges (N=9,597 for the booster module analysis and N=7,408 for the online and hybrid analysis). The model is used to calculate the probability of course completion by HL-SCI component status, while holding constant all other variables. The coefficient on the booster variable is -0.188 (p=0.190) and the coefficient on the online and hybrid variable is 0.712 (p=0.206).

* Coefficient (of the HL-SCI component) is statistically significant at the 95 percent confidence level using a two-tailed test.

There is some evidence that course grades may be higher for students in online and hybrid courses than for students in the same course in traditional in-person format (figure 27). The regression-adjusted mean course grade is 3.20 for online and hybrid courses, compared with 3.04 for traditional courses, a difference of 0.16 (p=0.05). However, differences in unobserved characteristics between the two groups may contribute to differences in course grades. For example, students who choose to take online and hybrid courses may have greater internal motivation, which may also influence course grades. It is also possible that the content of the courses may have changed before and after the HL-SCI component for online and hybrid courses, which may also contribute to differences in course grades. Booster modules did not contribute to significant differences— course grades were similar (around 2.9, which is almost a B) for students in the same courses with and without booster modules.

Figure 27. Regression-adjusted mean course grade for students in courses with and without booster modules, and courses with and without online or hybrid format



Notes: Results are from a linear regression model that accommodates for clustering of students within colleges (N=9,467 for the booster module analysis and N=7,362 for the online and hybrid analysis). The model is used to calculate the mean course grade by HL-SCI component status, while holding constant all other variables. The coefficient on the booster variable is -0.027 (p=0.451) and the coefficient on the online and hybrid variable is 0.167 (p=0.051).

* Coefficient (of the HL-SCI component) is statistically significant at the 95 percent confidence level using a two-tailed test.

Summary

This report provides the final results from an independent, third-party evaluation of the Connecticut HL-SCI. The implementation evaluation assesses actual performance relative to grant deliverable goals, and the qualitative analysis provides feedback on how the design and implementation of HL-SCI creates both opportunities for and barriers to student success. The quantitative evaluation of the grant's impact assesses actual performance relative to goals for student outcomes related to enrollment and completion of HL-SCI programs of study and continuing education and employment of program completers. It also employs a quasi-experimental design to determine the impact of the HL-SCI on student outcomes of college persistence, credential completion, and credit accumulation. The results for both the implementation and impact analyses are summarized below.

Implementation evaluation

Actual performance relative to grant deliverable goals

The HL-SCI grant exceeded all 17 deliverable goals, which were designed to measure progress toward each component of the HL-SCI grant: the new or revised certificate or degree programs, booster modules in math and science, online and hybrid courses, PLA, and internships and job placements. This indicates that the Consortium greatly expanded access to HL-SCI programs of study, the types of programs offered, and the availability of academic supports.

Program enrollment and recruitment recommendations

Increase efforts to recruit students through Consortium activities. Even though the Consortium exceeded its goals for the number of participants, relatively few study respondents reported learning about their programs through targeted grant activities. Most HL-SCI students learned about their programs independently, either through an online search or word-of-mouth from friends or family. However, those students who did learn about their program through contact with a faculty or staff member at their college found this input beneficial. A third of survey respondents indicated that staff member or professors at their colleges were "extremely influential" in their decisions to enroll. The colleges might consider how to target recruitment activities so that additional students are recruited through Consortium activities. Data on why students chose their programs may be helpful to these efforts. For example, most students enrolled in HL-SCI programs of study because they were interested in the subjects they were studying and/or wanted to pursue a new job or career path. Convenience and affordability were also important factors in their enrollment decisions.

Have college staff members guide students in selecting a program of study. Advising is particularly important for prospective students who are considering multiple programs. Focus group and interview participants and survey respondents who received guidance from college staff members in selecting a program prior to enrolling found it helpful. Colleges should also ensure that advising staff have adequate training to help students understand their options among the programs of study and the career pathways for each.

Booster modules recommendations

Maintain and expand student access to booster modules. Most of the students who provided feedback through interviews and focus groups had not participated in booster modules and were unfamiliar with them. The colleges might consider expanding access to booster modules, given that self-reported data indicate that they support student success. With few exceptions, those who had taken booster modules found them useful because they provided another method through which to learn course material. Students who completed the Survey Monkey questionnaire on booster modules also offered positive feedback overall. They found the boosters appropriately challenging and easy to follow. The majority would recommend the booster modules they completed to other students.

Online and hybrid course recommendations

Improve student engagement and interaction with faculty in online and hybrid courses. Most focus group and interview participants preferred in-person courses to the online and hybrid formats because the traditional courses provided the opportunity for more interaction between students and professors. Students could also have their questions answered immediately. However, some faculty members found ways to ameliorate these challenges. For example, a number of students said that their instructors created in-person lab sessions or offered office hours to increase interaction between faculty and students.

Continue to offer online and hybrid courses to ensure flexibility for students. Although many students expressed a preference for in-person classes, some students appreciated online and hybrid courses because they were convenient and they could complete content at their own pace. Sixty-four percent of student survey respondents had completed at least one online or hybrid course. These students also found them convenient and easy to access. Nearly two-thirds would recommend online or hybrid courses to others.

Further investigate why students perceive that they learn more in in-person courses. Only half of the students believed that they learned as much in their online or hybrid courses as they would in a traditional course. The Consortium should collect additional student feedback on why they believe that they learn more in in-person courses than online and hybrid courses.

Prior learning assessment recommendations

Ensure that students who might benefit from prior learning assessments take advantage of the opportunity. Generally, interview and focus group participants were aware of the prior learning assessment process, but few students had applied for a review of their prior learning experiences. It is unclear whether these students had the prior experience and education to benefit from the prior learning process. The Consortium should ensure that the criteria for the prior learning assessment process are clear and widely disseminated. Most students who applied previously earned credit toward their degrees did so through the more traditional process of transferring academic credit from another postsecondary institution.

For the most part, students found the process of transferring credits straightforward and fair. Similarly, the majority of survey respondents indicated that the process for receiving prior learning credit was easy to understand and that they received the right amount of credit based on their prior knowledge and experience. Nearly 70 percent believed they would complete their programs in a shorter time frame as a result of receiving credit.

Ensure that the process for awarding credit is straightforward and transparent. Some interview and focus group respondents experienced administrative challenges or would have liked more transparency in how their college awarded prior learning or transfer credit. For example, colleges could create a list of common experiences that can be transferred with the corresponding credits that could be received or a guide to CLEP exams with suggestions on how to study for them.

Employment and placement service recommendations

If possible, ensure that clinical hours are flexible so that students can meet other obligations. Most students who participated in internship experiences as part of their program had completed clinical practicums. Students liked that clinical experiences were hands-on and allowed them to apply what they had learned in the classroom. Some students would like more flexible scheduling for clinical hours, which would allow them to simultaneously hold full- or part-time jobs.

Expand access to college and career guidance for continuing students and graduates. Focus group and interview participants who received career guidance from their colleges generally found them helpful. Additionally, the majority of survey respondents who received specific career guidance or placement services found them very or somewhat helpful. Students especially appreciated employment feedback from faculty members who had worked in their fields. Some participants expressed the need for additional career guidance and placement services at their colleges. These opportunities should be sustained and expanded.

Recommendations from general student feedback from focus groups and interviews

Ensure that course content continues to be applied and hands-on. Overall, students provided very positive feedback on their programs and professors. They liked that courses were offered in a hands-on format that allowed them to apply their skills in both laboratory and real-world settings.

Maintain the quality of professors and their pedagogical approach. Students praised their instructors, indicating that they were engaging and accessible. They liked that most of their instructors had previous experience as professionals in their field, which allowed them to connect lectures and laboratory sessions to on-the-job situations.

Continue to provide additional support for veterans. Veteran students provided positive feedback about the targeted supports they received on their campuses, such as having a designated veterans' coordinator on campus. Additionally, the grant allowed the Consortium to develop booster modules to help veteran students with their transition to college and provide college staff with specialized information on advising veterans.

Ensure that students have access to courses and facilities at a time that meets their schedules. The biggest challenge for many students was balancing coursework with family and work responsibilities. A few students suggested offering courses at additional times that would be convenient to their schedules. Another challenge for some students was perceived limited access to facilities that supported their academic progress, such as laboratories and therapeutic gymnasiums.

Impact evaluation

Actual performance relative to student outcome goals

The HL-SCI grant exceeded seven of the nine student outcome goals, which were designed to measure progress toward student enrollment and completion of HL-SCI programs of study and continuing education and employment of program completers. The two goals that were not met were related to initial employment and sustained employment after study completion for students who were not employed at initial program enrollment. However, there was considerable variation in these outcomes by program type and college. In addition, many HL-SCI participants were still enrolled in their programs of study at the end of the grant period so there was insufficient follow-up time to assess these outcomes for the majority of participants.

Overall impact of the HL-SCI grant

We examined the overall impact of the HL-SCI grant on student outcomes, including college persistence, credential completion, and credit accumulation. Outcomes for HL-SCI students were compared with those of a matched comparison group of students enrolled in the same or similar programs of study prior to the new or revised HL-SCI programs of study. Overall, we found that results were similar on all outcomes for the HL-SCI students and the matched comparison students one year and two years after initial program enrollment. However, this evaluation included only students who entered a HL-SCI program of study in the first two years of the grant and tracks outcomes for one to two years, so it is possible that it may be too early to detect an impact of the HL-SCI grant.

Although there are several differences in outcomes by program category in the comparison group, HL-SCI students tend to perform similarly regardless of program category. The one exception is that HL-SCI students in science programs tend to complete 5 to 6 fewer credits after two years of program enrollment than HL-SCI students in all programs. One reason might be that courses required for science programs may be more rigorous than those required for some other HL-SCI programs of study. For example, students may have difficulty taking upper-level biology and chemistry courses in the same semester.

Effectiveness of HL-SCI components

We also conducted separate effectiveness analyses for three components of HL-SCI: PLAs, booster modules, and online and hybrid courses. Results for PLAs were mixed. On the positive side, students who received PLA credit were more likely to complete a credential than participants without PLA credits. PLA credits should allow students to progress through their programs more quickly than if they had to accumulate all of their credit hours through new coursework, so this may contribute to higher credential completion rates, particularly given the short follow-up period of only one to two years. On the negative side, participants who received PLA credits were less likely to persist after the first year than participants without PLA credits. The reasons for the negative impact of PLAs on first-year persistence are uncertain, but it could be that students may not possess the background they need to master material in more advanced courses if PLA credits are granted too freely.

In addition, we compared course outcomes (course completion and course grade) for an intervention group of HL-SCI participants who enrolled in a booster or online and hybrid course with those of a comparison group consisting of students who enrolled in a prior year in the same course without the HL-SCI component. Course completion rates were high at over 90 percent for all students, regardless of course format or component. Students in online and hybrid courses had slightly higher course grades than students in a traditional in-person version of the same course. Differences in unobserved characteristics between the two groups may contribute to differences in course grades. For example, students who choose to take online and hybrid courses may have greater internal motivation, which may also influence course grades. It is also possible that the content of the courses may have changed before and after the HL-SCI component for online and hybrid courses, which may also contribute differences in course grades. There was no difference in course grades for students in courses with and without booster modules. Although it is uncertain why boosters did not have a measurable impact on course outcomes, students who participated in the implementation evaluation reported that boosters generally increased their level of understanding of a subject, so colleges may want to continue to offer boosters.

Technical Appendix

This technical appendix provides additional detail on the data, methods, and findings from the impact evaluation. It begins by describing the data sources and the key variables constructed from each. Next, it describes the process for identifying the analytic sample and assigning students to intervention or comparison conditions. Third, it details the matching procedures used to match students in the intervention group to similar students in the comparison group. Fourth, it defines the statistical models used to estimate the impact of the intervention. Finally, it provides detailed results from the regression models used to estimate the impact of the intervention.

Data sources and key variables

The primary source of data for the impact evaluation consisted of student-level records provided by each of the college's institutional research departments. The files received included:

- F02: Course transcript records including course number, credit hours attempted and earned for each course, and course grades.
- F05: Student census data including demographic characteristics (such as race and gender) and program of study.
- F22 AC: Academic records including semesters of enrollment, credit hours attempted and earned for each semester, and GPA in each semester.
- F22 TS: Accuplacer test score records.
- H08: Certificate and degree completion records.

Each file contained a unique student identifier, which we used to merge together all of the files for each college. HL-SCI curriculum innovation coordinators maintained their own files in Excel or Access to track HL-SCI participants, and these files contained many of the same variables. However, we used the data from the institutional research departments instead to ensure that variables were being collected and coded consistently across colleges, as well as between the intervention and comparison group students.

The institutional research data was used to construct the outcome measures for the overall impact of the HL-SCI grant, which were selected because they are manifestations of the goals of the HL-SCI grant. Table A1 describes each of the outcome variables for the impact evaluation, including the variable type (continuous or dichotomous), the data source, and the timing of the variable.

Table A1. Summary of outcome variables for the overall impact of the HL-SCI grant, by research domain.

	Research domain		
	College Persistence	Credential completion	Credit accumulation
Outcome	Whether the student persisted in college 1 or 2 years after initial program enrollment	Whether the student completed a credential after 1 or 2 years of program enrollment	Total number of credits earned after 1 or 2 years of program enrollment
Variable type	Dichotomous (0=no longer enrolled, 1=still enrolled or completed the program)	Dichotomous (0=did not complete a credential within the follow-up period, 1= completed a credential)	Continuous (number of credits)
Data source	F22 AC and H08	H08	F02
Timing of variable	College enrollment in the same semester 1 year and 2 years after program entry	Credentials earned in any semester within 1 or 2 years after program entry	Credits earned by the end of the last semester 1 year and 2 years after program entry

The analyses of the effectiveness of the booster module and online and hybrid HL-SCI components used data from the course transcript records to compare outcomes for students enrolled in the same courses with and without the HL-SCI components. The sample includes the students from the overall impact analyses enrolled in one of these courses, as well as some additional students in these courses who had less than one year of follow-up data. A summary of the outcome variables for these analyses is provided in table A2.

Table A2. Summary of outcome variables for the effectiveness of booster modules and online and hybrid courses, by research domain

	Research domain	
	Course completion	**Course grade**
Outcome	Whether the student successfully completed the course with a grade of C- or above	Grade earned in the course
Variable type	Dichotomous (0=course grade of D+ to F, 1=course grade of A to C-)	Continuous (scale of 0 for F to 4 for A)
Data source	F02	F02
Timing of variable	End of course	End of course

The data for the analysis of the effectiveness of HL-SCI components also includes lists provided by the HL-SCI coordinators of courses that contain booster modules at each college by semester, as well as lists of online and hybrid courses offered by each college by semester. In addition, the HL-SCI staff provided data on the number of credits HL-SCI participants earn through PLAs.

Procedures used to identify students in the sample

One of the challenges to the impact evaluation was identifying which students should be categorized in the intervention group versus the comparison group because many students had noncontinuous patterns of enrollment both before and after the implementation of the HL-SCI grant. If we restricted the intervention group to students who were enrolled only after the HL-SCI grant and the comparison group to students who were enrolled only prior to the HL-SCI grant, we would lose a large portion of the students served by the grant, which would limit the generalizability of the findings. Another challenge to identifying the treatment and comparison groups is that new and revised HL-SCI programs of study were rolled out over several semesters, so the intervention did not always begin along with the grant initiation in spring 2013.

To address these challenges, we used the new or revised program start dates to define when the intervention began for each program of study. We then categorized three types of students who belonged to the intervention group:

- **New students:** Students who earned their first credit after their program of study was added or revised under the HL-SCI grant were coded as new students in the intervention group.

- **Continuing students:** If students took a course in any semester (spring, summer, fall, winter) during the academic year prior to the new or revised program start dates AND after the start of the HL-SCI grant, they are defined as continuing students. Even though their specific program of study had not yet been added or revised, they may have benefitted from other activities or services provided under the grant as a whole. For example, they may have taken prerequisite courses common to other HL-SCI programs of study that had already been updated to include booster modules or online and hybrid course formats. For this reason, we also code these students as belonging to the intervention group, although we conduct sensitivity analyses to see if the results change if these students are excluded from the sample.

- **Returning students:** Students who were not enrolled in the year prior to the new or revised HL-SCI programs of study (not continuing students), but earned their first credit more than one year prior to this time are categorized as returning students. A discussion with an HL-SCI staff member indicated that Consortium colleges typically consider students to have dropped out if they have not taken classes in any semester for more than a year. The HL-SCI grant serves a large number of students who are returning to complete their credential after previously dropping out, or beginning a new credential program in a different field of study. These students are coded in the intervention group in the first semester that they begin taking courses once they return to college. In order to control for length of time that returning students have been out of college, we include a continuous variable in the regression models for the number of semesters between the student's first term and the first term in the study period.

The comparison group consists of students who were enrolled in the same or similar programs of study at Consortium colleges prior to the start of the grant. The students in the comparison group entered their program of study between fall 2009 and winter 2011. This allows up to one full year of follow-up (until winter 2012) before the HL-SCI grant began implementation in spring 2013. We only track outcomes two years after initial program enrollment if there is sufficient follow-up time prior to implementation of HL-SCI. For example, comparison students who enter their program of study in fall 2009 can be tracked through fall 2011 so they have two years of follow-up data. However, students who enter their programs of study in fall 2011 can only be tracked for one year through fall 2012 since the HL-SCI grant would have started during their second year of program enrollment.

Table A3 provides a summary of students in the intervention and comparison groups by student status. The full sample consists of 1,836 intervention students and 5,464 comparison students for a total of 7,300 students. This includes some students with less than one full year of follow-up, who are included only in analyses of the effectiveness of booster modules and online and hybrid course HL-SCI components.

Table A3. Summary of students in the intervention and comparison groups in the full sample (N=7,300), by student status

Intervention group (N=1,836)			
Student status	**Description**	**Analytic procedures**	**Sample size**
New student	Student earns first credit after new/revised program started.	Include in all analyses.	N=1,078
Continuing student	Student was enrolled in any semester in the year prior to the program being new/revised and continued on to a new/revised program.	Include in primary analyses (in the body of the report). Conduct sensitivity analyses to see if the results change if they are excluded from the sample.	N=630
Returning student	Student was not enrolled in the year prior to the program being new/revised, but had their first credit at an earlier time.	Include in all analyses. Control for the number of semesters between first term ever and first term in the study period.	N=128
Comparison group (N=5,464)			
Student status	**Description**	**Analytic procedures**	**Sample size**
New student	Student earns first credit during comparison period (fall 2009 to winter 2011).	Include in all analyses.	N=3,037
Continuing student	Student was enrolled in any semester in the year prior to the first course in an HL-SCI comparison program.	Include in primary analyses (in the body of the report). Conduct sensitivity analyses to see if the results change if they are excluded from the sample.	N=568
Returning student	Student was enrolled during comparison period, but first credit was at an earlier time.	Include in all analyses. Control for the number of semesters between first term ever and first term in the study period.	N=1,859

The number of students in the intervention group for the evaluation differs from the number of participants in each semester in HL-SCI reports to the U.S. Department of Labor. Consortium colleges differed in how they classified students' term of HL-SCI entry. For example, some colleges coded students as HL-SCI participants once they had enrolled in the college and indicated their intent to major in an HL-SCI program of study, whereas other colleges coded students as HL-SCI participants after they had completed all of their prerequisites and been accepted into an HL-SCI program of study. This means that students classified as HL-SCI participants by grant staff may have completed different amounts of progress toward their program of study depending on the college they attended. The procedures used in the impact evaluation to assign students to the intervention group ensure that all students are coded as HL-SCI participants at the same point of program entry.

Matching procedures

After identifying the students in the full sample, we used matching methods to create an analytic sample of intervention and comparison students who are similar on observed characteristics. Matching methods reduce the selection bias that is associated with nonrandom assignment into intervention and comparison groups by forming a sample of comparison students that is similar to the group of intervention students.

We implemented coarsened exact matching (CEM) to obtain a matched sample of treatment and comparison students. We used CEM as opposed to exact matching because some of the matching variables are continuous (for example, program duration), which can make it hard to obtain matches. CEM temporarily coarsens continuous variables into categorical variables during the matching process, in which the category bin size is determined in a way that maintains balance across the treatment and control groups while also maximizing the sample size (Iacus, King, & Porro, 2011). Then the uncoarsened, matched data can be used in a statistical model by weighting observations based on the size of their strata. We also avoided propensity score matching because the standard errors from the treatment model are biased as the treatment model includes the *estimated* propensity score as a regressor. Additionally, propensity score matching "increases imbalance, inefficiency, model dependence, and bias," which can be avoided by using a randomized block design such as CEM (King & Nielsen, 2016, p. 1).

Our matching variables are summarized in table A4. We used an exact match for the student status variable to ensure that the comparison and treatment groups are comparable in terms of prior college experiences. Additionally, we required an exact match by program category so that both groups are similar in terms of program content and occupational outlook.[16] Lastly, we used a coarsened exact match to identify students in programs of similar duration. This is important because it allows credential completion rates to be compared among students in programs that take a similar amount of time to complete.

[16] Programs of study were categorized based on input from all of the HL-SCI curriculum innovation coordinators, who are familiar with the programs offered at each college.

Table A4. Summary of matching variables

Characteristics to match	Variables included	Type of match
Student status	Whether the student is a new, continuing, or returning student.	Exact match
Program category	Whether the student's program of study is classified as health/medical, science, or data/IT.	Exact match
Program duration	Number of credit hours required for credential completion, ranging from 8 to 69.	Coarsened exact match

Observations are dropped if the stratum does not include at least one treated student and one comparison student. In our analysis, 1,364 of the 1,366 HL-SCI students (99.9 percent) and 5,428 of the 5,461 of the potential comparison students (99.4 percent) are matched. The observations remaining in the analytic sample are weighted according to the size of their strata.

Baseline equivalence of the analytic sample

After obtaining the matched sample, we conducted a preliminary analysis to establish whether the intervention and matched comparison groups were similar at baseline (prior to program entry). We compared the means of the intervention and comparison groups on the following characteristics:

- Student demographic characteristics: percent female, percent Black, percent Hispanic, and age.
- Test scores: scale scores on the Accuplacer assessment in algebra, arithmetic, reading, and sentence skills.
- Student characteristics: number of terms enrolled prior to study entry, and percent enrolled full-time.
- College attended (Capital, Gateway, Manchester, Middlesex, or Norwalk Community College).

To examine whether any differences exist between the HL-SCI students and the matched-comparison students, we examine the absolute standardized bias on each of the baseline characteristics. This is calculated using the equation:

$$\text{Absolute standardized bias}=\left|\frac{\overline{X}_i - \overline{X}_c}{\sigma_{ic}}\right|$$

where $\overline{X}_i$ is the mean of the intervention group, $\overline{X}_c$ is the mean of the comparison group, and σ_{ic} is the pooled standard deviation of the intervention and comparison groups. The absolute standardized bias is a diagnostic of the balance between the intervention and comparison groups on the variables of interest.

Stuart (2007) recommends that absolute standardized bias values greater than 0.50 are "particularly problematic," and should ideally be less than 0.25. Tables A5 and A6 show the absolute standardized bias and level of bias for each of the baseline variables among students with at least one year and two years of follow-up data, respectively. After matching, no variables have an absolute standardized bias greater than 0.50, and most are also less than 0.25.

Among the variables with moderate bias, the intervention group is slightly younger (average age of 28 years versus 32 years for the comparison group in the one-year follow-up sample) and the distribution of colleges differs somewhat because some campuses expanded more rapidly than others after the HL-SCI grant began.

To further control for any remaining differences between the intervention and comparison groups, we include covariates in the regression models for all baseline characteristics except test scores. Many students are advised to take the Accuplacer upon college entry to help determine their level of placement into their first math or English course, but testing is not required. The majority of students in our sample do not have any Accuplacer scores, so too many students would be dropped from the sample due to missing data if test scores were included as covariates in the impact models. Although bias levels are low among students with test scores, there may be unobserved differences in academic ability among students who did not take the Accuplacer exam.

Table A5. Baseline equivalence for students in the matched sample with at least one year of follow-up data

	Comparison group		Intervention group					
	N	Mean	N	Mean	Difference	Pooled Std. Dev.	Std. Bias	Bias Level
Student demographics								
% Female	5428	0.69	1362	0.63	0.06	0.48	0.12	Low
% Black	5428	0.20	1364	0.15	0.05	0.39	0.14	Low
% Hispanic	5428	0.17	1364	0.16	0.01	0.38	0.03	Low
Age	4988	32.10	1361	28.39	3.71	10.90	0.34	Moderate
Test scores								
Algebra score on Accuplacer	2097	49.88	650	54.87	-4.99	25.64	-0.19	Low
Arithmetic score on Accuplacer	1132	43.90	271	48.03	-4.13	24.70	-0.17	Low
Reading score on Accuplacer	1955	71.25	562	73.81	-2.56	23.47	-0.11	Low
Sentence skills score on Accuplacer	1883	79.60	530	82.39	-2.79	21.35	-0.13	Low
Student characteristics								
% New students	5428	0.50	1364	0.50	0.00	0.50	0.00	Low
% Continuing students	5428	0.46	1364	0.46	0.00	0.50	0.00	Low
% Returning students	5428	0.05	1364	0.05	0.00	0.21	0.00	Low
Number of terms prior to study entry	5428	-3.15	1364	-3.74	0.59	11.30	0.05	Low
% Enrolled full-time	5305	0.28	1357	0.37	-0.09	0.46	-0.20	Low
Program characteristics								
% Health/medical program	5428	0.64	1364	0.64	0.00	0.48	0.00	Low

	Comparison group		Intervention group					
	N	Mean	N	Mean	Difference	Pooled Std. Dev.	Std. Bias	Bias Level
% Science program	5428	0.18	1364	0.18	0.00	0.39	0.00	Low
% Data/IT program	5428	0.18	1364	0.18	0.00	0.38	0.00	Low
Program duration (number of terms)	5428	60.85	1364	60.66	0.19	11.14	0.02	Low
College attended								
Capital Community College	5428	0.32	1364	0.15	0.17	0.45	0.37	Moderate
Gateway Community College	5428	0.31	1364	0.22	0.09	0.45	0.21	Low
Manchester Community College	5428	0.18	1364	0.32	-0.14	0.41	-0.34	Moderate
Middlesex Community College	5428	0.14	1364	0.18	-0.04	0.35	-0.12	Low
Norwalk Community College	5428	0.06	1364	0.14	-0.08	0.27	-0.30	Moderate

Table A6. Baseline equivalence for students in the matched sample with at least two years of follow-up data

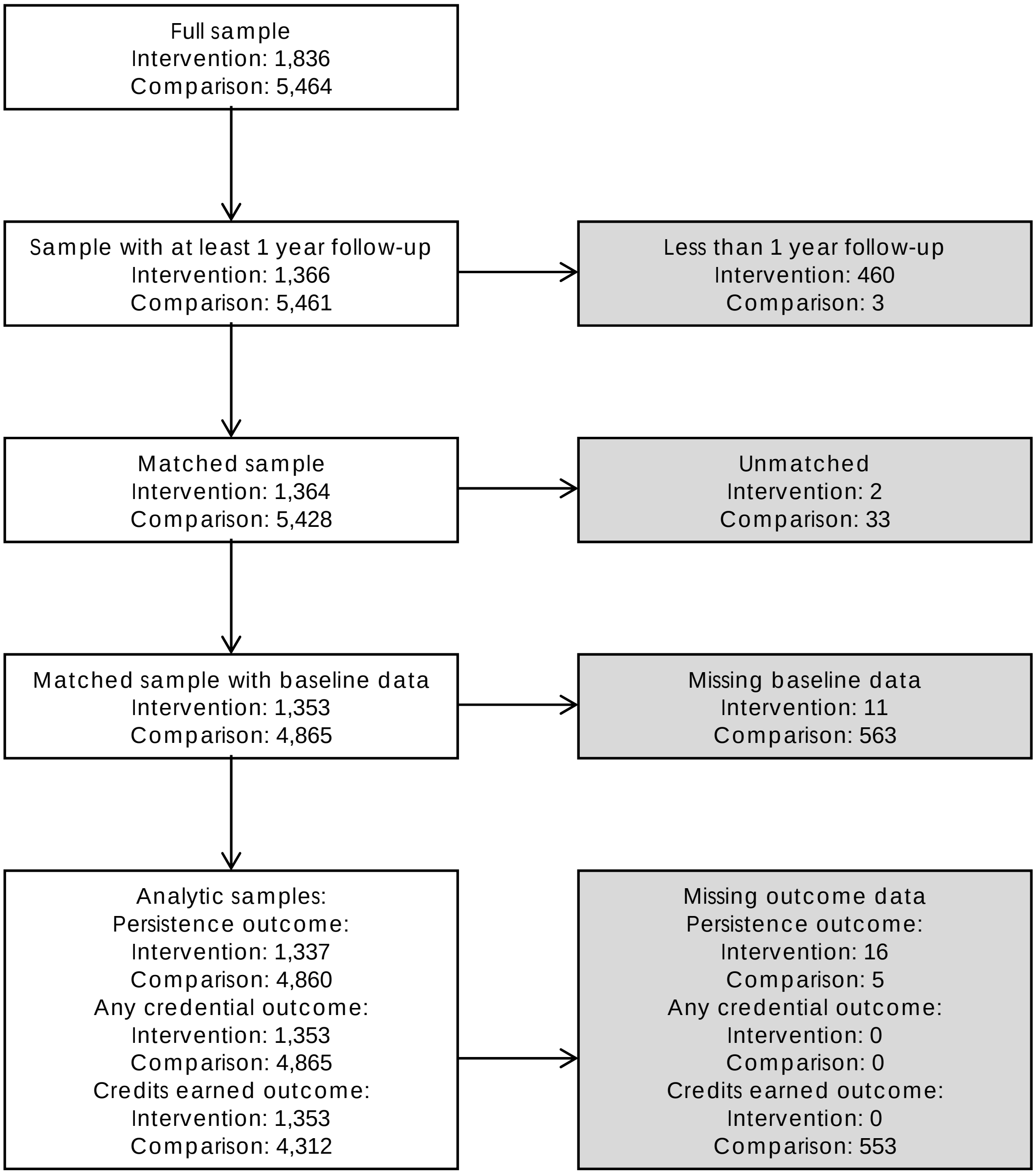
	Comparison group		Intervention group					
	N	Mean	N	Mean	Difference	Pooled Std. Dev.	Std. Bias	Bias Level
Student demographics								
% Female	3592	0.67	709	0.67	-0.01	0.47	-0.01	Low
% Black	3592	0.20	709	0.14	0.07	0.39	0.17	Low
% Hispanic	3592	0.16	709	0.17	-0.01	0.37	-0.01	Low
Age	3216	33.04	709	28.56	4.48	10.89	0.41	Moderate
Test scores								
Algebra score on Accuplacer	1546	49.57	373	55.87	-6.30	25.40	-0.25	Low

	Comparison group		Intervention group					
	N	Mean	N	Mean	Difference	Pooled Std. Dev.	Std. Bias	Bias Level
Arithmetic score on Accuplacer	786	44.46	139	45.14	-0.68	24.75	-0.03	Low
Reading score on Accuplacer	1433	70.60	322	73.40	-2.80	23.58	-0.12	Low
Sentence skills score on Accuplacer	1384	79.59	298	83.86	-4.27	21.03	-0.20	Low
Student characteristics								
% New students	3592	0.24	709	0.24	0.00	0.43	0.00	Low
% Continuing students	3592	0.73	709	0.73	0.00	0.45	0.00	Low
% Returning students	3592	0.03	709	0.03	0.00	0.18	0.00	Low
Number of terms prior to study entry	3592	-3.63	709	-4.70	1.07	10.23	0.10	Low
% Enrolled full-time	3511	0.26	705	0.34	-0.08	0.45	-0.17	Low
Program characteristics								
% Health/medical program	3592	0.68	709	0.68	0.00	0.47	0.00	Low
% Science program	3592	0.15	709	0.15	0.00	0.36	0.00	Low
% Data/IT program	3592	0.17	709	0.17	0.00	0.37	0.00	Low
Program duration (number of terms)	3592	61.72	709	61.56	0.16	10.51	0.01	Low
College attended								
Capital Community College	3592	0.35	709	0.16	0.19	0.47	0.41	Moderate
Gateway Community College	3592	0.31	709	0.18	0.13	0.45	0.29	Low
Manchester Community College	3592	0.18	709	0.39	-0.21	0.41	-0.52	High
Middlesex Community College	3592	0.13	709	0.15	-0.02	0.34	-0.06	Low
Norwalk Community College	3592	0.04	709	0.12	-0.09	0.22	-0.39	Moderate

Summary of sample selection

Figure A1 summarizes how the analytic samples for the overall impact of the HL-SCI grant relate back to the full sample, and the number of students who were lost from the full sample for various reasons. First, students were lost from the full sample if they had less than one year of follow-up data. Whereas almost all comparison students could be tracked for at least one full year, about one-quarter of students in the intervention group entered their program of study after fall 2014, so they could not be followed for a full year by the end of the data collection period in fall 2015. Second, students were dropped from the full sample if there were no students in programs of similar duration or category in the other treatment status group. Less than 1 percent of students in both the intervention and comparison groups were unable to be matched. Third, students were dropped from the sample if they were missing baseline data on student demographics, student characteristics, or program characteristics These baseline variables were included as covariates in the regression models to further control for any differences between the intervention and comparison groups. Lastly, some students were lost from the full sample because they were missing outcome data. Only about 1 percent of students were missing school enrollment records, which were used to create the outcome variable college persistence. None of the students were missing data on credential completion because it was assumed that a student had not completed a credential if they did not have a credential record. For the credits accumulated outcome, data are missing in the comparison group for continuing students who started taking courses in the year prior to fall 2009 because this was the first semester for which transcript records were available.

Figure A1. Summary of the samples for the overall impact of the HL-SCI grant after one year of follow-up



Statistical models for impact analysis

After establishing the matched sample, we used weighted regression analysis to obtain the treatment effect for each of the outcomes of interest. Weights were used to take into account the matching process, so that comparison units within each stratum are weighted to equal the number of intervention units in that stratum. The credit accumulation outcome is a continuous variable and was estimated using ordinary least squares. For the binary outcomes, we used a logit model specification with maximum likelihood estimation. The effect of the HL-SCI grant for each outcome is then obtained by estimating the following model:

$$y_i = \alpha + \hat{\beta}(intervention\ status_i) + (baseline\ covariates_i)\boldsymbol{\theta} + \varepsilon_i$$

Here, the outcome (y) is a function of the following:

- $\hat{\beta}$: The intervention status, which is equal to one if the student is in a HL-SCI program of study under the TAACCCT grant and equal to zero if the student is in a comparison program.
- $\boldsymbol{\theta}$: A vector of covariates for baseline characteristics representing student demographics, student characteristics, program characteristics and college attended (as shown in tables A5 and A6).
- ε_i: A random component.

We clustered the standard errors by college attended. We then obtained the average treatment effect on the treated by calculating the average derivative for the intervention status indicator. For ease of interpretation, we also report the predicted probabilities or regression-adjusted mean for each outcome in the intervention and comparison groups. We compared the results for two hypothetical populations—one with all HL-SCI students and one with all comparison students—that have the same values on all other variables in the model. This shows how outcomes for the two groups would differ if all other factors were held constant.

Full results from the estimates of the impact of the intervention

Table A7 provides detailed regression results for the results presented in the body of the report about the overall impact of the HL-SCI grant on student outcomes. Table A8 shows the same results for the sensitivity analyses that exclude continuing students.

Table A7. Full results from the estimates of the overall impact of the HL-SCI grant on student outcomes (all students)

Years of exposure	Comparison group N of students	Treatment group N of students	Comparison group standard deviation	Treatment group standard deviation	Comparison group mean	Impact estimate	Impact standard error	p-value
College persistence								
1	4,860	1,337	0.456	0.466	0.682	0.007	0.095	0.938
2	3,134	702	0.476	0.472	0.653	0.033	0.142	0.817
Credential completion: any credential								
1	5,428	1,364	0.104	0.129	0.011	0.401	0.299	0.180
2	3,592	709	0.353	0.375	0.146	0.145	0.189	0.442
Credential completion: associate's degree								
1	4,420	1,214	0.080	0.094	0.006	0.227	0.488	0.641
2	2,838	644	0.308	0.343	0.106	0.065	0.216	0.765
Credential completion: certificate								
1	445	133	0.155	0.219	0.025	1.040	0.482	0.031*
2	279	59	0.494	0.484	0.415	-0.297	0.521	0.569
Credits accumulated								
1	4,312	1,353	9.067	9.108	14.009	-0.266	0.392	0.499
2	2,590	705	16.657	16.331	23.227	1.289	1.308	0.324

Notes: Results are from a linear regression model (for continuous outcomes) or logit model (for dichotomous outcomes) that accommodates for clustering of students within colleges.

* Coefficient (of estimated intention-to-treat impact) is statistically significant at the 95 percent confidence level using a two-tailed test.

Table A8. Full results from the estimates of the overall impact of the HL-SCI grant on student outcomes (sensitivity analysis excluding continuing students)

Years of exposure	Comparison group N of students	Treatment group N of students	Comparison group standard deviation	Treatment group standard deviation	Comparison group mean	Impact estimate	Impact standard error	p-value
College persistence								
1	4,311	712	0.495	0.487	0.573	0.122	0.102	0.231
2	2,589	187	0.499	0.501	0.535	-0.052	0.181	0.775
Credential completion: any credential								
1	4,316	728	0.140	0.137	0.020	-0.227	0.365	0.534
2	2,590	174	0.336	0.342	0.129	-0.131	0.277	0.636
Credential completion: associate's degree								
1	3,914	641	0.109	0.110	0.012	-0.177	0.557	0.751
2	2,336	158	0.292	0.303	0.094	-0.244	0.336	0.467
Credential completion: certificate								
1	402	85	0.194	0.211	0.039	0.453	0.613	0.460
2	254	16	0.453	0.342	0.281	-1.210	0.864	0.194
Credits accumulated								
1	4,312	728	9.067	9.447	14.009	-0.399	0.406	0.326
2	2,590	190	16.657	18.281	23.227	1.328	1.380	0.336

Notes: Results are from a linear regression model (for continuous outcomes) or logit model (for dichotomous outcomes) that accommodates for clustering of students within colleges.

* Coefficient (of estimated intention-to-treat impact) is statistically significant at the 95 percent confidence level using a two-tailed test.

References

Aberson, C. L., Berger, D. E., Healy, M. R., & Romero, V. L. (2003). Evaluation of an interactive tutorial for teaching hypothesis testing concepts. *Teaching of Psychology*, *30*(1), 75–78.

Carnevale, A. P., Jayasundera, T., & Gulish, A. (2016). *America's divided recovery: College haves and have-nots, 2016.* Washington, DC: Georgetown University, Center on Education and the Workforce.

Council for Adult and Experiential Learning. (2010). *Fueling the race to postsecondary success: A 48 institution study of prior learning assessment and adult student outcomes.* Chicago, IL.

DeBord, K. A., Aruguete, M. S., & Muhlig, J. (2004). Are computer-assisted teaching methods effective? *Teaching of Psychology, 31*(1), 65–68.

Hagerty, G., & Smith, S. (2005). Using the web-based interactive software ALEKS to enhance college algebra. *Mathematics and Computer Education, 39*(3), 183–194.

Hayward, M. S. (2012). *Adult learner graduation rates at four U.S. community colleges by prior learning assessment status and method* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. UMI No. 3529173

Hodara, M. (2011). *Reforming mathematics classroom pedagogy: Evidence-based findings and recommendations for the developmental math classroom* (CCRC Working Paper No. 27). New York: Columbia University, Teachers College, Community College Research Center.

Iacus, S. M., King, G., & Porro, G. (2011). Causal inference without balance checking: Coarsened exact matching. *Society for Political Methodology.* Oxford University Press: Oxford, UK.

Jenkins, D., Speroni, C., Belfield, C., Jaggars, S. S., & Edgecombe, N. (2010). *A model for accelerating academic success of community college remedial English students: Is the Accelerated Learning Program (ALP) effective and affordable?* (CCRC Working Paper No. 21). New York: Columbia University, Teachers College, Community College Research Center.

King, G., & Nielsen, R. (2016). *Why propensity scores should not be used for matching.* Working Paper, Harvard University.

Means, B., Toyama, Y., Murphy, R., Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record, 115*(3), 1–47.

Pearson, Daponte, & Cruz (2015a). *Interim Report: Evaluation of the Connecticut Health and Life Sciences Career Initiative, January 2015*. Arlington, VA: CNA Education and Social Science Consultants.

Pearson, Daponte, & Cruz (2015b). *Interim Report: Evaluation of the Connecticut Health and Life Sciences Career Initiative, August 2015*. Arlington, VA: CNA Education and Social Science Consultants.

Pearson, Daponte, & Cruz (2016). *Interim Report: Evaluation of the Connecticut Health and Life Sciences Career Initiative, February 2016*. Arlington, VA: CNA Education and Social Science Consultants.

Stuart, E. (2007). Estimating causal effects using school-level data sets. *Educational Researcher, 36*(4): 187–198.

Xu, D., & Jaggars, S. S. (2013). *Examining the effectiveness of online learning within a community college system: An instrumental variable approach* (CCRC Working Paper No. 56). New York: Columbia University, Teachers College, Community College Research Center.

CNA

This report was written by CNA's Education (EDU) division.

EDU uses applied research, experimental trials, program evaluations, and technical assistance in assessing a broad range of education issues and their real-world implications. EDU operates the Regional Educational Laboratory Appalachia, funded by the U.S. Department of Education's Institute of Education Sciences, which provides technical assistance and research support to educators and policy-makers in Kentucky, Tennessee, Virginia, and West Virginia.

IRM-2016-U-014073

CNA is a not-for-profit research organization
that serves the public interest by providing
in-depth analysis and result-oriented solutions
to help government leaders choose
the best course of action
in setting policy and managing operations.

Nobody gets closer—
to the people, to the data, to the problem.

www.cna.org ● 703-824-2000

3003 Washington Boulevard, Arlington, VA 22201