MATHEMATICA Policy Research

REPORT

IMPLEMENTATION REPORT

Implementation of a Certification Program in Supply Chain Management for Early Career Professionals

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Julie Bruch
Scott Baumgartner
Sarah Dolfin
Nan Maxwell

Submitted to:
Broward College
1930 SW 145th Avenue
Miramar, FL 33027
National Principal Investigator: Leslie Backus

Submitted by:
Mathematica Policy Research
P.O. Box 2393
Princeton, NJ 08543-2393
Telephone: (609) 799-3535
Facsimile: (609) 799-0005

Project Director: Sarah Dolfin
Reference Number: 40282

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EXECUTIVE SUMMARY

In September 2013, the U.S. Department of Labor (DOL) Trade Adjustment Assistance Community College and Career Training (TAACCCT) program awarded a $24.5M Leveraging, Integrating, Networking, Coordinating Supplies (LINCS) grant in Supply Chain Management (SCM) to a Consortium to be led by Broward College. This award was in response to a proposal submitted by Broward College on behalf of the Consortium. TAACCCT funded the Consortium over a four-year period to develop and create Common Learning Blocks (CLBs), eight certifications, and the eight certification tracks listed in the box at right, all for early-career professionals in the SCM industry.

LINCS certification areas

1. Supply Chain Management Principles
2. Customer Service Operations
3. Transportation Operations
4. Warehousing Operations
5. Demand Planning
6. Inventory Management
7. Manufacturing and Service Operations
8. Supply Management and Procurement

The Consortium includes nine colleges, located in six states across the country, and most of them offered some SCM coursework before the grant. The colleges (listed in the box below) are all public institutions that offer two-year degrees and a variety of certificates; a few offer bachelor's degrees. The colleges partnered with the Council of Supply Chain Management Professionals (CSCMP), a global association for SCM, who served as subject matter experts in the Consortium. Content developed was aligned with CSCMP's eight cornerstones of SCM. The colleges also partnered with three universities—Northwestern University, Rutgers University, and the Georgia Institute of Technology—to develop materials that prepared students for exams in each of the eight certification tracks, corresponding to a specific SCM industry certification. Each track covers topics and skills relevant for entry- and mid-level employment in the industry. The materials were designed to be integrated into traditional college courses or delivered on their own in short-term workshops or classes. Concurrently, CSCMP developed certification exams that assess knowledge in each of the eight areas. The National Urban League (NUL) and nine of its affiliates became partners with the Consortium in June 2015, increasing the number of students enrolled as well as the breadth of student services offered.

Consortium colleges

- Broward College (Florida)
- Columbus State Community College (Ohio)
- Essex County College (New Jersey)
- Florida State College at Jacksonville (Florida)
- Harper College (Illinois)
- Long Beach City College (California)
- San Jacinto Community College (Texas)
- St. Petersburg College (Florida)
- Union County College (New Jersey)

University partners

- Georgia Institute of Technology
- Northwestern University (Illinois)
- Rutgers, The State University of New Jersey

Evaluation

As a condition of the grant, DOL required TAACCCT grantees to commission an independent evaluation of their funded programs. DOL specified that all evaluations focus on both program implementation and participant outcomes or impacts. As the Consortium's lead, Broward College contracted with Mathematica Policy Research to serve as the external evaluator for the LINCS program.

The first required component of this evaluation, the implementation study, is the focus of this report. This study documents four implementation activities: (1) how the Consortium collaborated to develop the LINCS program; (2) how the colleges and their partners implemented the certification tracks; (3) the characteristics, perceptions, and participation patterns of students; and (4) employer perceptions of the certifications. In the second required component, the outcomes and impact study, Mathematica will focus on the education and employment outcomes of students who enroll in LINCS certification track courses at the Consortium colleges.

For the implementation study, Mathematica used both qualitative and quantitative data. Qualitative information was drawn from (1) reviews of program documents about the Consortium's activities from the application stage through June 2016, and (2) telephone interviews conducted from July 2015 to May 2016 with the Consortium's National Program Office, staff and faculty at Consortium colleges, certification track students, and external partner organizations. These interviews captured information on a range of experiences and perspectives at various stages of program development and implementation. Student-level quantitative data were provided to Mathematica by the colleges and the National Program Office. Mathematica constructed a sample of students who participated in the LINCS program before August 1, 2016. Although the qualitative and quantitative data provided yield rich information about implementation of the LINCS program, they might not fully depict the implementation for two reasons. First, the people interviewed might have impressions of the program that differ from the impressions of people not interviewed. Second, although the LINCS grant continues through spring 2017, the information in this report only covers the period through July 31, 2016.

Key findings

In general, the LINCS program exceeded the expectations of the TAACCCT grant application, despite a number of challenges the program faced during the early grant period. The LINCS Consortium successfully developed and implemented eight industry-recognized certifications, exams, CLBs, and corresponding certification track coursework, not only in Consortium schools but also for employers, colleges, and universities outside the Consortium and NUL affiliate locations. The program's success, particularly in the unanticipated early expansion of coursework to organizations beyond the Consortium colleges, suggests that the certifications and certification track coursework are an attractive option that might help students find jobs, particularly in the SCM field. This possibility will be explored further in the subsequent outcomes and impact study.

In this report, Mathematica highlights the Consortium's four areas of success in developing and implementing LINCS.

1. **The LINCS program expanded to colleges and students outside of the Consortium during the grant period.** All key LINCS activities—developing and implementing the certification track coursework, exams, and certifications—were achieved as planned. The Consortium colleges successfully produced CLBs and content in all eight of the planned certification areas. CSCMP successfully developed and implemented its certification exams in each of the areas, and awarded the certifications. CSCMP's higher level certification program, SCPro™, provided the foundation for the new program. While SCPro™ existed prior to

LINCS, the new credentials created entry to mid-level industry certifications using content from the LINCS program. They were later officially named SCPro™ Fundamentals certifications.

All nine Consortium colleges developed and offered certification track courses and the Consortium designed its learning management system (LMS) to make the certification track content available outside of the Consortium colleges during the grant period. Students outside the Consortium colleges could access the certification content through the same LMS used by the Consortium with the National Program Office enrolling and tracking their participation. Of note, the Consortium achieved these successes by overcoming early challenges in program start-up including communication, procurement delays, and staff turnover in the National Program Office.

2. **The colleges developed the certification track courses to work within their specific contexts, which is essential for program sustainability.** College staff and faculty integrated the centrally developed LINCS content into their institutions' course offerings. The integration of content at the college level unfolded in a variety of ways: some colleges embedded the content into existing courses, some created new courses, and others offered self-study options. In addition, some partnered with employers to offer content off campus. Eight of the nine colleges partnered with the NUL affiliate in their area to offer coursework and exams in the format that worked best for the college and affiliate's students. The various approaches to implementation were shaped by each college's internal and external context, and the colleges employed approaches that worked best with their own institutional structures and processes and local labor markets. This process for development and implementation allowed each college to create a program that fit its own needs, but still offered standardized industry-validated content to prepare students for certification exams.

3. **A diverse group of students pursued certifications.** The LINCS program attracted students who were demographically diverse and had a wide range of education and employment backgrounds. Across the Consortium, LINCS students were older than the typical community college student. More than one in four had some college experience, and one in seven were veterans. Although some were not employed at the time they enrolled and may have pursued certifications to enhance their immediate job prospects, nearly two out of three students were employed when they enrolled. Interviews with a sample of students indicated that some pursued certifications in the hope of getting a promotion or changing careers, and others sought more general skill development or improved marketability.

4. **Employers thought the certifications were valuable, but it may take time before they make the certifications a requirement of their hiring process.** In spring 2016, employer partners reported that they valued the skills and knowledge of workers who had completed SCPro™ Fundamentals certifications. They demonstrated this in a variety of ways, including offering internship programs for certification track students and participating in college career events. Some employers went further and actively encouraged their employees to pursue certifications or even offered certification track courses on site. Although these actions indicate that employers valued the competencies reflected in the certifications, none of the employers Mathematica interviewed—who were identified as those most closely engaged with the LINCS program—had begun requiring certifications formally when making hiring decisions.

Next steps for the evaluation

The subsequent report on the outcomes and impact study (scheduled for publication in fall 2017) will include a detailed analysis of student outcomes, a critical measure of any program's success. The report will meet DOL's requirement for an evaluation of outcomes or impacts by (1) documenting student outcomes (employment and earnings) in each of the three quarters following completion of a LINCS certification track course, and (2) examining the association between certification track courses, certifications, and outcomes.

I. INTRODUCTION

In September 2013, the U.S. Department of Labor (DOL) Trade Adjustment Assistance Community College and Career Training (TAACCCT) program awarded a $24.5M Leveraging, Integrating, Networking, Coordinating Supplies (LINCS) grant in Supply Chain Management (SCM) to a Consortium to be led by Broward College. This award was in response to a proposal submitted by Broward College on behalf of the Consortium.

The grant provided funding for a four-year period to build students' skills and credentials through relatively short-term courses and certification exams. The goal was to build a pipeline of entry- and mid-level workers with needed skills in SCM. The key funded activities included the following:

- The Council of Supply Chain Management Professionals (CSCMP) would create proprietary exams, which became known as SCPro™ Fundamentals, to assess the skills needed for entry- and mid-level jobs in SCM. Before the grant, several industry-recognized SCM certifications existed, but they were designed for professionals with executive-level experience in management. The new certifications would be designed for people with entry- to mid-level experience.
- The Consortium member colleges would develop common learning blocks (CLBs), and learning objectives and content for courses, known as certification track courses, in conjunction with the Consortium's university partners—Georgia Institute of Technology, Northwestern University, Rutgers University—and local employers. The course content would be developed to follow CSCMP's eight cornerstones of SCM, and designed to prepare students to take CSCMP certification exams.
- The Consortium's nine colleges would deliver the certification track courses to prepare students for the CSCMP certification exams.

Figure I.1. Consortium colleges

Colleges participating in the Consortium were located throughout the country (Figure I.1):

- Broward College (Florida)
- Columbus State Community College (Ohio)
- Essex County College (New Jersey)
- Florida State College at Jacksonville (Florida)
- Harper College (Illinois)
- Long Beach City College (California)
- San Jacinto Community College (Texas)
- St. Petersburg College (Florida)
- Union County College (New Jersey)

In May 2014, Broward College awarded a contract to Mathematica Policy Research to conduct a rigorous third-party evaluation that meets the grant's requirements for evaluation. The evaluation has two components: (1) an implementation study that documents the development and implementation of grant-funded certifications and certification track courses, including a report on the factors that facilitated and challenged implementation; and (2) an outcomes and impact study that focuses on the education and employment outcomes of students who enroll in LINCS certification track courses at the Consortium colleges.

This report provides the results of the implementation study that explains how the program was implemented through July 31, 2016. The rest of this chapter discusses the LINCS program as envisioned during the design phase (Section A), gives an overview of the LINCS evaluation (Section B), and provides a roadmap to the report (Section C).

A. The LINCS program as envisioned

The TAACCCT grant program was designed to give colleges funding and resources to enhance their ability to deliver education and career training programs that (1) can be completed in no more than two years; and (2) prepare program participants for high-wage, high-skill occupations. Its intent was for colleges to help adults improve their employment prospects while also meeting employers' needs for skilled workers. Research has revealed that community colleges can play a key role in improving student success by building skills for the local labor market. Both Carnevale and Desrochers (2001) and Grubb (1996), for example, demonstrated that community colleges are a pathway between education and training and the labor market. A plethora of studies have shown that community colleges can increase the earnings of students who earn credentials (Jepsen et al. 2014; Dadgar and Weiss 2014; Bailey et al. 2004). Furthermore, research has revealed improved labor market outcomes for students holding college-level certificates (Carnevale et al. 2012) that provide a pathway toward industry-driven certifications (Cantor 2002).

Certification areas

1. Supply Chain Management Principles
2. Customer Service Operations
3. Transportation Operations
4. Warehousing Operations
5. Demand Planning
7. Inventory Management
8. Manufacturing and Service Operations
9. Supply Management and Procurement

The LINCS program reflected a two-pronged approach to addressing skill shortages that the Consortium saw in the profession of SCM.[1] First, it focused on developing learning objectives and educational content in eight areas of SCM (listed in the box at right) to help employers identify people with the interests and skills to become productive SCM workers. Upon completion of the educational component, students could take a certification exam in the area of study to earn that specific CSCMP credential. The program began by conducting surveys and interviews with employers to identify and document skills needed by early-career workers in SCM jobs. Gaining certification would provide a signal to employers that the individual had mastered the SCM content and skills for an entry- or mid-level SCM job in that particular area. These certifications were designed to align with the eight CSCMP cornerstones of SCM and developed into SCPro™ Fundamentals, which built on CSCMP's SCPro™ Certification

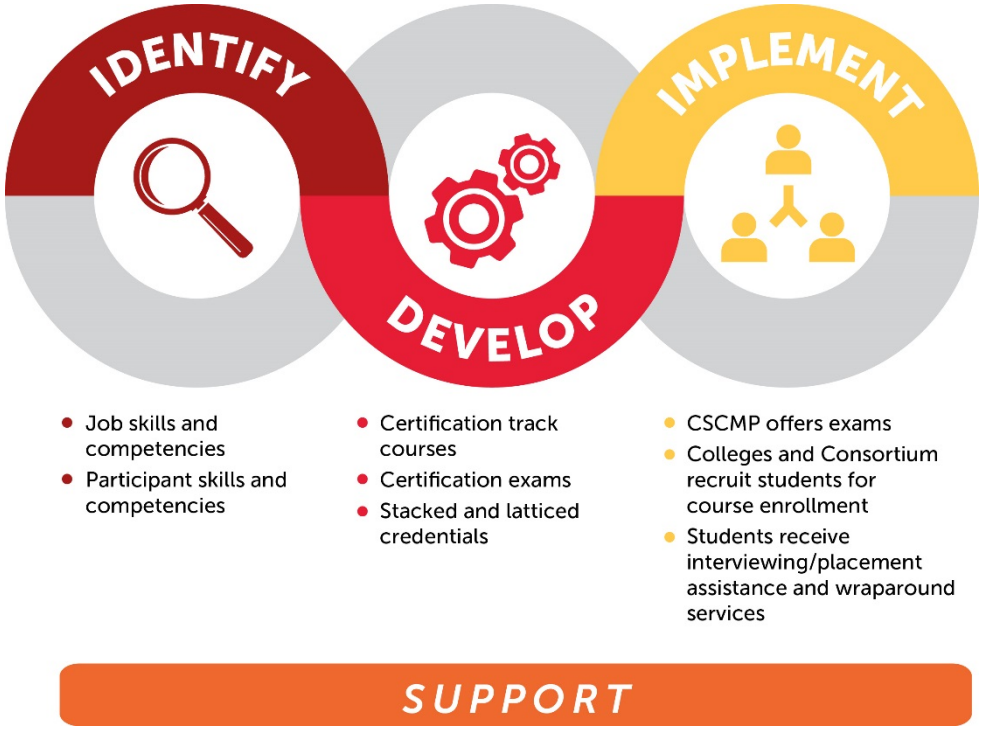
[1] Most of the information in Section A was taken from the LINCS grant application.

for advanced level professionals by assessing entry-level skills. Building on an existing platform of certifications gives students the opportunity to demonstrate higher levels of skills if they want to continue their education and pass higher level exams. Second, LINCS sought to enhance training and career pathway opportunities for people seeking entry- and mid-level employment in the SCM field. LINCS participants would receive training and education to acquire subject matter knowledge and hands-on experience that would prepare them for the certification exams and employment assistance and student wraparound services, all of which ultimately would lead to higher levels of employment and earnings in SCM jobs.

1. Developing the LINCS program for student success

Figure I.2 is a simplified model of how the Consortium planned to roll out the LINCS program. The figure is based on information from the Consortium's TAACCCT grant application.

Figure I.2. Simplified model of LINCS program



Source: LINCS grant application

The circles in Figure I.2 illustrate the key steps of program development:

- **Identify** skills needed in entry- and mid-level SCM jobs, the competencies workers must have to perform in those jobs, and the competencies of people who are interested in those jobs. This knowledge allowed LINCS to develop certification track courses to close the gap between the necessary competencies for SCM jobs and the competencies of individuals seeking employment in SCM. CSCMP had identified the eight cornerstones of SCM before the grant application was submitted. Essential knowledge and skills were verified by a survey

during the proposal period and by interviews with employers conducted by the Consortium after receipt of the grant.

- **Develop** eight certifications that could validate different competencies for entry- or mid-level SCM jobs and be used as stepping-stones to demonstrate competencies in higher level SCM jobs with higher levels of education and skill development. The content areas and competencies that corresponded to each certification were determined through employer interviews, with the grant allowing the Consortium to develop the corresponding certification track courses to prepare students for the exams. CSCMP created each certification exam and credential after ensuring that the Consortium's content aligned with its cornerstones of SCM.

- **Implement** the program by offering the exams; enrolling students in the certification track courses; registering students to take the exams; providing students assistance with job search, interviewing skills, and wraparound services; and gaining employers' confidence in the exams so they would use the certifications in their hiring decisions.

Consortium members and partners would both help develop the program and support the participating students. Their support took the form of traditional academic supports for students as well as a three-pronged marketing plan designed to (1) build awareness among potential participants, (2) increase acceptance and value of the certifications by employers, and (3) enhance the growing recognition among policymakers of SCM's impact on the national economy.

2. Developing a consortium to support the program

The LINCS program was designed to bring colleges, universities, and industry together to develop and implement all program elements. The National Program Office oversaw the program, and each National Program Office member played a role in management and communication, certification track development, and/or certification track implementation. (The plan for implementing LINCS, developed in October 2015, can be found in Appendix A.)

- **Colleges** were largely responsible for helping students build skills needed by employers. They would develop and deliver certification track courses, which included recruiting students and enrolling them in coursework, assessing their readiness for coursework and SCM jobs, and giving them academic support and career services.

- **Universities** were responsible for providing experts to work with employers, industry, and Consortium college faculty to develop a curriculum. University and Consortium colleges' SCM faculty formed an Academic Advisory Council (AAC) to oversee development of the curriculum and certification track content by (1) working with industry to review its needs, (2) developing curriculum, and (3) developing and reviewing instructional materials and technology-enabled learning content.

- **CSCMP** was responsible for developing, administering, and promoting certifications that would help employers identify people with SCM interests and skills. During the application stage, it provided market research on the need for a clearly defined set of transportable competencies and related skills. CSCMP was to have sole responsibility for developing and

awarding certifications and offering exams. CSCMP would also help colleges create and evaluate certification track course materials from the industry perspective.

- The **National Program Office**, located at Broward College, would provide overall program management support. Activities generally fell into four areas: (1) facilitating communication among Consortium members and partners; (2) supporting curriculum development; (3) promoting and building awareness of the program among potential students and other stakeholders, including increasing the acceptance and value of the certifications by employers and enhancing the recognition among policymakers of SCM's impact on the economy; and (4) serving as a liaison to DOL to meet performance management and reporting requirements.

In addition, the Consortium would engage LINCS partners to support and enhance program development and implementation:

- **Local employers** would work with the colleges to identify competencies for certification tracks that were tailored to the local labor market, and to deliver hands-on experiences to LINCS students through internships, apprenticeships, and job placements.

- The **National Urban League**, through its local affiliates, would help recruit, refer, and enroll eligible participants to pursue certifications and leverage additional resources to recruit and support them. The National Urban League (NUL) is a civil rights organization with local affiliates in 37 states that supports economic development and empowerment in urban areas through direct services, public policy research, and advocacy. Affiliates located in the nine geographic areas of Consortium colleges were to become partners in student recruitment, education, certification, placement assistance, and wraparound services.

- Local **Workforce Development Boards** or **American Job Centers** would help recruit individuals eligible for TAA (Trade Adjustment Assistance) benefits designed for workers who lost jobs due to international trade (https://www.doleta.gov/tradeact/) and recruit other interested workers into LINCS through referrals. After the grant period, they would work with the colleges to leverage existing employment and training programs and track placement of graduates. Both entities are part of the public workforce development system, a network of federal, state, and local offices that support economic expansion and develop the talent of the nation's workforce.

- **Other partners** included (1) TAACCCT grantees from previous rounds, who would support the Consortium with insights about TAACCCT program implementation; (2) state workforce offices, which would provide the data needed for both performance reporting and the evaluation; and (3) community college systems, which would support colleges in their efforts to implement the LINCS program.

B. Overview of the LINCS evaluation

The implementation study addresses a range of research questions (Table I.1).

Table I.1. Research questions guiding the implementation study

Questions about the Consortium
Who is part of the Consortium, how was it formed, and what is its role?
How do Consortium members work together in a collaborative model?
What is the relationship between the National Program Office and the colleges?
What kinds of resources and relationships facilitated Consortium activities?
What are the Consortium's plans for sustainability after the grant period?[2]
Questions about the Consortium colleges
What is the role of each college in implementing LINCS?
How does LINCS fit into the broader context of SCM instruction at each college?
What kinds of resources and relationships facilitated implementation activities at each college?
What are each college's plans for sustainability after the grant period?
Questions about the Consortium employers
What is the role of employers in working with the Consortium?
How do employers view the SCPro™ Fundamentals certifications?
Questions about the Consortium students
What kinds of students pursue SCPro™ Fundamentals certifications and why?
What are students' experiences in pursuing SCPro™ Fundamentals certifications?

Mathematica collected three different types of information to answer the implementation study questions in Table I.1. (Details on each information source can be found in Appendix B.)

1. **Program documents.** Mathematica collected information on an ongoing basis from the TAACCCT grant application, Consortium meeting minutes, quarterly narrative progress reports prepared for DOL and for the National Program Office, and program and college documents.

2. **Telephone interviews.** Mathematica conducted four rounds of telephone interviews that provided critical information on LINCS program implementation and stakeholder involvement. The first round, with faculty and staff at the Consortium colleges, the National Program Office, and the partner universities, took place from July to September 2015 and focused on program development. Everyone

Key groups interviewed

	Number of interviews
College staff and National Program Office	44
Students	43
Partners	16
Urban League	3
Council of Supply Chain Management Professionals	1

[2] LINCS colleges are aware of the requirement to sustain their individual programs, and at the time of the interviews, most had a plan for post-grant continuation (see Appendix C). The larger Consortium-wide sustainability plan was first discussed in January 2016, with the continuing development of the program during the following months. Discussion continued at subsequent Consortium meetings. Given the timing of efforts, this research question is not addressed in this report.

interviewed was involved in either curriculum and certification development at the Consortium level or implementing LINCS program components at the college level. The second round focused on implementation progress and was conducted from February to March 2016 with staff at the National Program Office and colleges that were involved in college-level course development and delivery. The third round took place from February to April 2016 and included students. The fourth round focused on contributions of external partners and took place from March to May 2016; it included respondents from CSCMP, the NUL, and local college partners. Mathematica conducted an additional interview in November 2016 with the national special projects manager to discuss students who pursued certifications and were unaffiliated with a Consortium college.

3. **Administrative data from colleges and the National Program Office.** Colleges provided student-level data to describe the characteristics and exam-taking patterns of students participating in LINCS certification track courses. Student data span the period from the start of certification track implementation at each college through July 31, 2016 (with exam data going through August 31, 2016). The National Program Office provided administrative data from the LINCS Central database containing information on students accessing LINCS through non-Consortium colleges or self-study during the same time period.

Mathematica integrated and analyzed information for the Consortium as a whole (that is, an aggregate of all participating colleges) and for each college individually (described in Appendix B). Mathematica's analysis of the interview notes and program documents followed the principles of grounded theory, which relies on the discovery of emergent themes in the data that suggest promising practices, challenges, and elements of program development and implementation (Charmaz 2006; LaRossa 2005). This process allows for comprehensive, consistent, and transparent analysis of qualitative data. In the analysis of the student-level administrative data, Mathematica uses percentage distributions to describe student characteristics reported as categorical variables, and uses averages to report student characteristics measured with continuous variables.

Although the rigorous evaluation provides rich information about how the LINCS program was implemented, it is limited in at least two important ways. First, the 107 individuals who provided information were a small and nonrandom sample of individuals involved in LINCS, and their experiences might not represent others working or engaging with the program. Second, the information reflects the implementation as it proceeded through July 2016, and the grant will continue through spring 2017. As a result, the study does not capture the full evolution of the program or the full range of implementation experiences.

C. Structure of the report

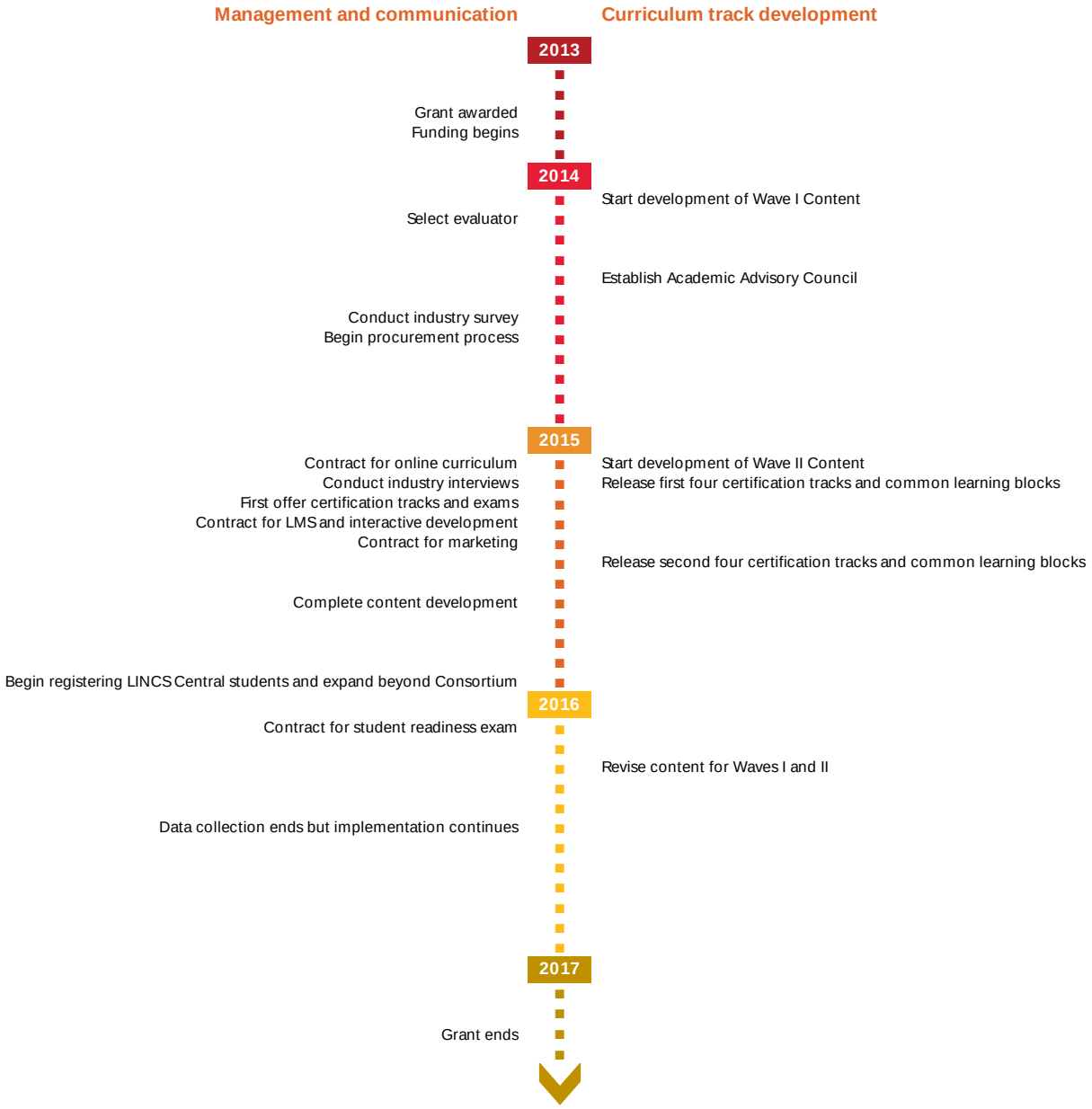
The following chapters report results of research Mathematica conducted to understand how the LINCS program was implemented. This report serves three primary purposes: (1) to meet the DOL requirements for an independent evaluation of program implementation, (2) to report on the first years of program implementation under the grant, and (3) to inform potential replication by describing for external audiences how certifications were designed and launched in different institutional contexts. Chapter II examines the development of the LINCS program, and Chapter III describes its implementation. Chapter IV focuses on how students built and demonstrated skills for the labor market, and how the skills were perceived by employers. Four appendices follow the

text. Appendix A provides a visual description of how planned LINCS program activities would lead to desired employment and education outcomes. Appendix B features a discussion of the data collection and analytic methods, Appendix C contains profiles of LINCS program implementation at each college, and Appendix D contains the data tables that underlie the discussion in Chapters III and IV of student characteristics and course and exam-taking patterns.

II. DEVELOPING THE LINCS PROGRAM

The TAACCCT grant funded the Consortium to develop and launch the plans outlined in its application as discussed in Chapter I. The research undertaken for this evaluation suggests that—by July 2016—the Consortium had not only developed the program outlined in the grant application, but also had gone beyond what was proposed for the grant period by reaching students beyond Consortium colleges through online learning technologies. Figure II.1 provides a timeline of the Consortium's key milestones and activities.

Figure II.1. Key milestones



Source: Interviews and program documents.

Note: Because program documents and interviews were conducted through June 2016, the figure does not capture activities that occurred after that point.

This chapter uses information from program documents and telephone interviews with college faculty and staff, the National Program Office, and partners to describe how LINCS was developed. Interviewees described the processes used to develop the LINCS program. Section A examines how the National Program Office managed the Consortium and the next three sections report on each of the three key areas of program development: certification tracks (Section B), certification exams (Section C), and LINCS expansion beyond Consortium colleges (Section D). Section E summarizes the development of the LINCS program.

A. The National Program Office managed the Consortium and facilitated communication and program development

The National Program Office, located at Broward College, managed the Consortium. Mathematica's findings suggest that the structure of the National Program Office, its activities, and its ability to overcome management challenges helped the Consortium and partners develop and implement the LINCS program.

1. National Program Office structure

The National Program Office was staffed by a national principal investigator (NPI) and a team who oversaw content development and integration, data collection and reporting, accounting, communications, and administration. The NPI held primary responsibility for overseeing the coordination among Consortium members; was the external contact between the Consortium, DOL, and other stakeholders; and managed National Program Office staff. Mathematica interviewed four key directors who were responsible for coordinating important aspects of the LINCS program:[3]

- The **national certification and delivery director** managed the relationship with CSCMP. The director was the primary contact person for certification exams, and relayed colleges' issues and concerns with exams to CSCMP. This director also registered students for certification exams and managed the exam delivery schedule.
- The **national workplace competencies director** was in charge of communicating with industry experts to ensure the certification track content reflected the needs of the SCM profession. This director led industry interviews and conveyed findings to the Consortium and the Academic Advisory Council (AAC). This director worked closely with the content and curriculum integration director to ensure content revisions met industry needs.
- The **national content and curriculum integration director** was responsible for all documentation editing; tracking revisions; coordinating the work of the AAC; and coordinating the content revision process. This director worked closely with the workplace competencies director to ensure content revisions met industry needs.
- The **national adaptive learning technology director** oversaw learning technology. This director adapted certification track course content into online versions, loaded and updated courses in the Consortium's learning management system (LMS) to allow for electronic

[3] The evaluation team and the NPI jointly selected these four directors for interviews. They were responsible for aspects of implementation most closely related to the evaluation's research questions.

delivery of the LINCS program, gave students access to the LMS, and responded to colleges' questions and feedback about it.

Through the interviews and review of documents, Mathematica observed two aspects of the National Program Office's structuring:

- **The National Program Office hired experienced staff members for leadership positions.** The National Program Office prioritized hiring staff with relevant management experience. All National Program Office staff interviewed had more than a decade of experience in higher education administration or corporate project management. For example, one director (who served in several national roles during the grant period) led a number of career and technical education schools before joining the National Program Office, and two directors had served as academic deans of other colleges. The NPI had experience in corporate communications, public relations, and higher education consulting. The most recent national workplace competencies director, the National Program Office's SCM expert, had experience in a number of SCM functions, including work in the aerospace industry and for federal contractors.

- **The National Program Office experienced turnover, but minimized disruption by promoting from within.** For example, the National Program Office struggled to find a suitable NPI. The first NPI hired in February 2014 left after two months and the interim NPI resumed the position until the national certification and delivery director was appointed NPI in March 2015.

2. National Program Office key functions

The National Program Office's key management activities generally fell into the four planned areas discussed in Chapter I: (1) facilitating communication between Consortium members and partners, (2) supporting curriculum development and other processes, (3) promoting and building awareness of the LINCS program, and (4) serving as a liaison to DOL to meet performance management and reporting requirements.

a. Communication

Discussions and reviews of program documents reveal that the National Program Office facilitated communication among Consortium members and partners in four distinct ways.

1. **Served as a hub for group communication among LINCS stakeholders.** The National Program Office led a biweekly phone call with all LINCS stakeholders, distributed a monthly newsletter, hosted annual in-person meetings, and provided a program website to file collaborative documents. The goal was to keep stakeholders informed of LINCS activities and foster communication among them. The national certification and delivery director communicated directly with CSCMP on behalf of the Consortium colleges and universities and handled all exam registration and scheduling. Consortium colleges and universities did not work individually with CSCMP, although coordination with CSCMP as the subject matter experts for content development required frequent communication among colleges/universities and the National Program Office directors.

2. **Recognized and remediated challenges to communication in the early stages of program implementation.** Despite the existence of activities that were designed to keep stakeholders informed, communication was challenging, particularly in the beginning of the grant. Interviews revealed that program leaders in at least three of the nine Consortium colleges thought that, in the early stages of implementation, their colleges did not get enough individual attention from the National Program Office and that the National Program Office could have done more outreach to check in on their implementation progress and challenges. Program leaders in at least five colleges thought they were left, as one lead put it, "in the dark" about LINCS activities in the early stages of program development. The NPI named in March 2015 stated an intention to ensure effective communication between the National Program Office and LINCS stakeholders. The NPI thought that the National Program Office could increase the frequency of Consortium calls and meetings, as well as engage Consortium colleges individually to draw on their strengths. The program leaders who expressed concerns early on said communication improved substantially after the NPI took office in 2015.

3. **Supported effective collaboration among Consortium members.** The National Program Office fostered collaboration by using work groups and the AAC for content development and review. Such collaboration was made easier by the fact that stakeholders had common goals and motivations for participating in the Consortium (listed in box at right).

Common goals made communication easier

Stakeholders tended to express goals in terms of labor market success for their students. Stated goals included:

- Train SCM students and prepare them for employment.
- Encourage entry-level employee certifications to promote career success and advancement.
- Gain a better understanding of training for entry-level workers, and pass this knowledge on to industry partners.
- Support local economic development throughout the implementation of the

4. **Maintained strong communication with industry,** which also facilitated successful development and implementation of the LINCS program. From the beginning, the National Program Office and Consortium prioritized the development of relationships and partnerships with industry, believing this would ensure that the certification track content would reflect industry priorities and improve employment outcomes for LINCS program graduates. The makeup of the Consortium reflected this priority. For example, Northwestern University viewed its ties to industry through its Transportation Center as one of its main contributions to the Consortium. CSCMP provided feedback on certifications, promoted the SCPro™ Fundamentals certifications, and gave the students networking and employment opportunities. The Consortium's marketing consultant created a Consortium website that included sections geared towards educating industry members about the certifications and explaining the benefits of the certification program to their workforce. The national special projects manager created *LINCSConnect*, a private LinkedIn group for LINCS students to access job opportunities and network with employers.

b. Support for program development processes

The National Program Office administered an industry survey and undertook in-depth interviews with employers that confirmed the CSCMP-identified competencies needed in entry- and mid-level SCM jobs. This survey and interview process informed the development of content for the certification track courses. The survey, conducted in July 2014, revealed the areas of focus that employers considered most helpful for early-career employees to master within each certification track. For example, survey respondents indicated that knowledge of shipping and receiving was the most important competency for the warehouse operations certification track, whereas ability to manage relationships with suppliers was the most important competency for the procurement track. The most important competencies informed the outlines of the certification track content. In follow-up interviews with 66 employers in February 2015, the employers shared their perspectives on the key challenges they faced (such as the lack of a skilled workforce) and the skills they valued highly in their organizations, such as communication and interpersonal skills in entry-level workers. Through these interviews, Consortium stakeholders learned that industry members believed the SCM Principles certification track and the Customer Service Operations certification track would add the most initial value to the workforce. These efforts were not without complications, particularly a survey response rate below 10 percent and uneven integration of survey findings into the content development process. Content development had already begun when research findings became available: survey results were released at the end of August 2014, and industry interview findings were released in May 2015.

The National Program Office also oversaw the procurement of learning tools. This included selecting suppliers to help Consortium colleges and universities engage students. As a result, Desire2Learn (D2L) was awarded contracts to provide an LMS in which both online content and interactive activities resided. In addition, the National Program Office contracted with ACT, Inc® to provide WorkKeys, a series of learning readiness tools, to help Consortium colleges assess student readiness to comprehend LINCS certification track materials.

Following the procurement processes established by both DOL and Broward College, the lead institution on the grant, proved challenging for the National Program Office. Public procurement processes are lengthy and resulted in delays in fully developing the learning tools. For example, the National Program Office released requests for proposals for the online textbook, interactive development, and an LMS in September 2014, but could not execute a contract for the online textbook until February 2015, or for the LMS and interactive simulation program until May 2015. It issued a request for proposal for the college readiness exam in October 2015, and the contract was not executed until January 2016, which was one reason why all of the Consortium colleges did not adopt the assessment tool for use with students served under the grant.

c. Promotion of LINCS

The National Program Office promoted both certifications and certification track courses in several ways. It worked with CSCMP, which promoted the SCPro™ Fundamentals certifications to its members by hosting events to promote the certifications and providing students with networking and employment opportunities (for example). The National Program Office also worked with Consortium college representatives to publicize the certifications to other

institutions in their networks, and brought the LINCS program to other non-Consortium institutions when requested. Promotional materials were extended to the NUL affiliates as well. It engaged a marketing consultant to publicize the LINCS program and certifications to students and employers.

As with the procurement of learning technologies, procurement delays also slowed down engagement with the NUL and marketing consultant. Contracting for a marketing consultant took nearly six months, and by the time the National Program Office signed a contract with the consultant, multiple Consortium colleges had complained about a lack of national branding, which they believed hindered their ability to recruit students or promote the value of certifications to employers and local industry.

d. Liaison with the Department of Labor

The National Program Office ensured that LINCS met the goals and objectives of the TAACCCT grant and the contractual obligations with DOL. In this capacity, it oversaw and ensured compliance with DOL performance measurement and evaluation requirements, including collecting, processing, and reporting data for the quarterly narrative progress reports and annual performance reports, and overseeing Mathematica's third-party evaluation. It also sought to ensure that financial reporting and procurement processes met DOL accountability requirements and complied with institutional regulations and state and federal law. Finally, the National Program Office worked to implement policy and procurement activities in a way that ensured efficient acquisition of goods and services.

B. Consortium members collaborated to develop the certification tracks and streamlined the process over time

Consortium colleges and universities, CSCMP, and the National Program Office collaborated to develop the content for the certification tracks. The colleges and universities had responsibility for developing the initial certification track content, and CSCMP provided input after identifying the required SCM competencies to be covered. The CLBs were designed to introduce each certification track and provide students with a high-level understanding of the information and enable greater success once the actual certification track was launched. All certification exams include questions from the CLBs to underscore the importance of broad SCM knowledge.

The Consortium designed certification track courses so students interested in one SCM topic could take a single course, whereas students interested in building broader SCM skills could pursue multiple certifications. It structured SCM Principles as an introductory course to give an overview of the end-to-end supply chain and serve as a foundation for the other certification tracks,[4] but did not require students to earn the SCM Principles certification before they pursued other certifications. As a result, students had the freedom to take any number of certification track courses in any order, either concurrently or sequentially.

[4] For more information, see CSCMP's website: https://cscmp.org/iMIS0/CSCMP/Certify/Fundamentals/Eight_Certification_Tracks.aspx.

In the first wave of certification track development, the Consortium colleges and universities formed work groups to develop course content. In May 2014, the Consortium established the AAC, which included a representative from each Consortium college and university, to review and approve the content for each certification track. Start-up communication challenges slowed the wave 1 content development. The initial goal was to complete the content for these four tracks by September 2014, but SCM Principles, Warehousing Operations, and Customer Service Operations were released in March 2015, and Transportation Operations followed in May 2015—between 14 and 16 months after development first started, and 5 to 6 months behind the initial goal.

Two waves of development

Wave 1

- Customer Service Operations
- Supply Chain Management Principles
- Transportation Operations
- Warehousing Operations

Wave 2

- Demand Planning
- Inventory Management
- Manufacturing and Service Operations
- Supply Management and Procurement

The National Program Office applied lessons it learned during wave 1 to later content development processes. The smoother process in wave 2 of course development allowed the certification track content to be produced more quickly. The Supply Management and Procurement track and the Inventory Management track were released in July 2015, and Demand Planning and Manufacturing and Service Operations were released in August 2015, 5 to 6 months after development began. The smoother process also facilitated the planned revision of the certification track content in early 2016. By August 2016, the National Program Office, with AAC concurrence and approval, had revised the first wave of certification tracks and began work on revising the second wave.

C. CSCMP created exams separately from certification track content

CSCMP created certification exams that aligned with the content developed for the certification tracks, which was based on CSCMP's eight cornerstones of SCM. The National Program Office forwarded AAC-approved certification track content to CSCMP, which created and internally beta-tested a bank of test questions and created 40-question exams by randomly selecting questions from the bank. Students had 90 minutes to answer the questions and needed 28 correct answers (70 percent) to pass and earn a CSCMP certification (eventually renamed as SCPro™ Fundamentals certification).

Colleges were not involved in any aspect of exam development, and CSCMP did not use TAACCCT grant funding for exam development. This strategy had two main advantages. First, the exams became an objective measure of students' mastery of learning objectives, because they were developed and beta-tested solely by the industry group using content approved by the AAC. Second, exams could be used after the grant period; if CSCMP had used grant funds to develop the exams, the questions would become public at the end of the grant period.

Although colleges did not participate in exam development, they gave CSCMP input on the exams based on feedback from students. On biweekly Consortium calls, college program leaders debated whether the exams were long enough and whether true/false questions were substantive enough to reflect the full content of the certification track courses. College faculty and staff passed along comments and concerns about the exam content. In response, CSCMP fixed

typographical errors, rephrased questions to improve clarity, and ensured that questions did not have more than one possible interpretation. At least five colleges asked CSCMP for more instructor materials (for example, sample exams) to help professors prepare students for the exams, although it is unclear whether such materials were developed or shared.

D. The LINCS program expanded to colleges and students outside of the Consortium during the grant period

The National Program Office envisioned that the SCPro™ Fundamentals certifications would eventually become nationally available and recognized, and designed its LMS and enrollment process to make the certification track content available outside of the Consortium colleges during the grant period, as noted in the grant proposal. Students outside the Consortium colleges could access the certification content through the same LMS used by the Consortium; the National Program Office tracked their participation through a database called LINCS Central. Two types of students enrolled: those at non-Consortium colleges and those who were not near any of the Consortium colleges and pursued LINCS through self-study.

- **Non-Consortium colleges.** Several colleges learned about the LINCS program and were interested in providing it to their students. Ultimately, six additional institutions offered certification track courses to their students and were included in the LINCS Central database. Five (listed in the box at right) were not previously affiliated with the Consortium. Georgia Institute of Technology, one of the three universities that participated in the Consortium, also provided certification track courses even though it had not initially planned to enroll students. The opportunity to provide certification track courses outside of the Consortium colleges sprang up organically from preexisting relationships.

Expansion beyond the Consortium

- City Colleges of Chicago (Illinois)
- Embry Riddle Aeronautical University (Florida)
- Hudson County Community College (New Jersey)
- Ohio Dominican University (Ohio)
- Urban League of Chicago (Illinois)

- **Self-study.** Students outside of the Consortium and non-Consortium colleges can enroll in LINCS courses by submitting an intake form to the National Program Office along with a receipt showing they paid for access to Proctor U, the online test-taking platform used for the certification exams.[5] The National Program Office assigned a student identification number, enrolled the student in a course, and emailed instructions from the LMS about how to access the course. Because the LMS includes all of the certification track content, certification track courses could be provided as self-study courses with no adaptations and no instructor support. The National Program Office recommended taking four weeks to finish a certification track course, and the national special projects manager contacted each LINCS Central student after two weeks to check on their progress. No instructor was assigned to teach the self-study courses, but students could contact the National Program Office's national workplace competencies director with questions.

[5] Although students had to pay the fee for Proctor U, the Consortium did not charge self-study students for access to the certification track course materials, as in Consortium colleges.

E. Summary

The implemented LINCS program closely matched the vision set forth in the TAACCCT grant application, with some adaptations to resolve program start-up challenges. By August 2015, about 23 months after receiving funding and 20 months after certification track development had begun, colleges could provide all eight certification tracks, students could take all eight exams, and the National Program Office had procured key centralized resources—an LMS, learning tools, and marketing—to help the LINCS program reach students and to help Consortium colleges deliver certification track course content. By that time, the National Program Office had identified and addressed early communication challenges and navigated lengthy procurement processes that resulted in delays in obtaining centralized resources. By 2016, LINCS had expanded beyond the Consortium.

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III. IMPLEMENTING LINCS

Although the certification track content and certification exams were developed centrally, each college took a somewhat different approach to implementing the certification tracks. This was informed by (1) internal institutional context, including existing SCM programs, college resources and supports, and student needs; and (2) external context, including partnerships with local employers, community organizations, and other higher education institutions.

This chapter uses information from interviews and administrative data (described in Chapter I, Section b) to show how Consortium colleges delivered content and supported students. It describes how colleges integrated the certification content into courses (Section A), offered non-traditional modes of delivery (Section B), and supported students (Section C). Both administrative data and interviews with a non-representative sample of 43 students across all colleges are used to describe the students who enrolled in the certification track courses (Section D). Appendix B contains information about the samples for all data sources.

A. Colleges took different approaches to integrating certification track content into college courses

One essential component of the LINCS program was to deliver certification track content. Each college came to the Consortium with a different history of SCM course offerings; six of the nine had offered some type of credential in SCM and five had offered an SCM credential program. One of the colleges that did not have an SCM program had partnered with other institutions to provide SCM courses. Details on the pre-grant SCM courses and programs at each college can be found in Appendix C.

Although colleges integrated certification track content into existing SCM courses when possible, all created some new courses (Table III.1 provides a summary). Three colleges integrated much of the content into existing for-credit courses and created new for-credit courses when their existing courses did not map to the content. The other six colleges offered the certification track content only in newly created courses, either for-credit or non-credit.[6] Program leaders at two of those colleges said they tried to integrate the content into existing courses, but found it difficult because material did not have enough overlap or there was not enough time between the release of content and the launch of the courses. These colleges offered the certification track content in alternative formats—either non-credit courses or self-study while continuing to offer their existing for-credit SCM courses as well.[7]

[6] This report uses the term “non-credit” certification track courses when discussing the Consortium or groups of colleges, but some colleges use the term “not-for-credit” courses.

[7] Two of the six institutions outside the Consortium colleges that offered certification track courses created for-credit courses, and four created non-credit options (one of the four planned to transition to for-credit courses in the future).

Table III.1. Certification track implementation at Consortium colleges

	Total number of tracks offered	Certification track courses								
		Approach for offering content		Credit status		Mode of delivery		Off-campus providers		
		Revised existing SCM courses	Created new courses	Credit	Non-credit	In-person or hybrid	On-line	Urban League	Local employer or workforce partner	Local university
Broward	8	X	X	X	X	X	X	X	.	.
Columbus State	7	X	X	X	X	X	X	X	X	.
Essex	4	.	X	X	.	X	X	.	X	.
FSCJ	8	X	X	.	X	X	X	X	.	.
Harper	7	X	X	X	.	X	.	.	.	.
Long Beach	8	.	X	.	X	X	X	X	X	X
San Jacinto	8	.	X	X	X	X	X	X	.	.
St. Petersburg	8	.	X	.	X	X	X	.	.	.
Union	8	.	X	.	X	X	.	.	X	.

Source: Colleges

Note: SCM = Supply chain management; FSCJ = Florida State College at Jacksonville.

Local employers helped Consortium colleges adapt certification track content to local labor markets. Five of the colleges established employer advisory boards to gather systematic feedback on how the LINCS program could better meet the needs of local employers. At one college, for example, the employer attended monthly advisory board meetings with college program staff and helped the college develop realistic case studies and identify appropriate terminology as used by local employers. This involvement allowed employers to learn more about the certifications and to tailor the skills taught in certification track courses to their needs.

B. Colleges varied course delivery to meet student needs

The research suggests that student needs for alternative modes of course delivery drove some of the variation in implementation. Six of the nine colleges chose to offer certification track content in non-traditional formats because program leaders believed that shorter or self-paced courses could better meet the needs of some of their students. This was a particular concern for students who were employed or faced logistical challenges. For example, in addition to integrating certification track content into its degree program courses, one college also offered 12–16 hour workshops for each of the eight certification tracks. Similarly, another embedded some content into existing courses but also developed new one-credit, online, self-paced courses. Four other colleges also developed short-term options for students to move through the certification tracks faster than they would in traditional courses (Table III.1).

Non-traditional course delivery

Some colleges offered certification track courses in non-traditional formats to meet student needs. For example:

- 12–16 hour in-person workshops
- One-credit online self-paced courses
- Saturday courses
- Online self-study courses with no instructor
- Short-term courses running for 2, 6, or 8 weeks
- Webcasts of in-person courses

Some colleges adapted to student needs by leveraging external partnerships to offer courses off campus. For example, three colleges partnered with their local Urban League affiliates to offer in-person certification track courses at the Urban League sites; two others partnered with the Urban League to offer online courses (Table III.1). The program leader at one of these colleges noted that it was helpful to refer students to the Urban League if they could not afford college courses. Several respondents from the colleges and the Urban League affiliates noted that offering on-site or online courses made them more accessible for students who were not able to travel to the college campuses.

Urban League partnerships for delivering content

Some Urban League affiliates delivered content directly to individuals interested in taking certification exams. For example:

- Broward College provided an instructor for the Urban League affiliate to offer on-site, in-person workshops twice a week to prepare students for the certification exams.
- Florida State College at Jacksonville (FSCJ) collaborated with the Urban League affiliate to make online learning materials for the certification tracks available to their clients. FSCJ also held information sessions at the affiliate's site to tell potential students about the LINCS

Four colleges offered courses to employees at employer sites, another of the innovative approaches taken by colleges to offer certification track courses (Table III.1). Of these, one college partnered with three different local employers to offer courses on-site for employees, with one employer substituting certification track courses for in-house training courses. One employer noted that the courses were helpful for employees, who often "ended up in SCM by default" and did not have any formal training in the field. Offering courses to students at their workplaces helped address logistical challenges for students and could also signal to students that their employers valued the certifications.

C. Colleges leveraged institutional resources and external partnerships to support students

In addition to integrating certification track content into courses, colleges provided academic and career support to their students. Most colleges used the same kinds of approaches to student support: they leveraged their internal institutional resources and used community partners to augment services and provide wraparound supports to some students. About half of the colleges hired support staff dedicated to the LINCS program, and these staff focused primarily on career supports.

All colleges that enrolled for-credit certification track students directed them to on-campus student support services, although some supplemented these services with additional supports for the LINCS students. The on-campus institutional support services included counselors, tutoring, academic support centers, and campus workshops. This type of support is typically only available to for-credit students, however, and five of the colleges offered some or all of their certification track courses in a non-credit format. To serve non-credit students and to enhance the supports offered to for-credit students, these five colleges hired student support staff to give certification track students one-on-one help. LINCS support staff focused primarily on career supports, including sending job postings to students, helping them with their resumes, and conducting mock interviews.

Student support staff roles

Colleges used grant funds to hire student support staff in various capacities. For example:

- **Case manager.** Meets with students regularly, manages intake process, helps students create career plans, tracks progress, and refers students to institutional and external support services.
- **Career support specialist.** Helps students with their resumes, conducts mock interviews, sends newsletters or emails to students with job postings.
- **Business outreach specialist.** In addition to career support described above, also cultivates relationships with SCM companies and invites companies to campus to provide feedback on resumes and mock interviews.
- **Student success specialist.** Assesses student needs at intake

Despite their access to institutional support, some program leaders said they struggled to support students. Respondents at four colleges reported that take-up of support services was low, but one noted that students' needs often went beyond the program's capacity to help. Respondents from three colleges said that key challenges were the small program staff size and the fact that staff had multiple roles. As a result, case management was limited, and most colleges offered just one meeting with support staff shortly after enrollment. In addition, one program leader noted that students taking courses in non-traditional formats (for example, online or in the evening) had a hard time meeting in person with support staff.

The Consortium also partnered with NUL affiliates to enhance the services (for example, recruitment, student supports, and hosting certification tracks). Local Urban League affiliates worked with eight of the nine colleges on one or more activities.[8] Respondents at three colleges said their local Urban League affiliate helped with student needs including addiction treatment, childcare and housing assistance, and criminal record expungement. Local Urban League affiliates also provided academic support, such as tutoring and high school equivalency courses, as well as a wide range of career services and workforce development workshops. Career supports included job placement, resume development, and workshops that taught "soft skills" such as interpersonal skills and conflict management—traits that employers consider valuable in employees. The types of support varied in part because the Urban League affiliates served different types of clients. For example, staff from one affiliate reported that most clients already had associate's or bachelor's degrees, while staff at another affiliate said that they served many clients without a high school diploma or GED, as well as clients with criminal records and substance abuse problems.

The Urban League's wraparound services gave support to students who needed more comprehensive help than the colleges could offer. One Urban League staff person said that clients often wanted to take the certification track courses, but the Urban League's intake conversations made it apparent that the clients needed other forms of support to succeed in the certification track courses. Another Urban League staff member at a different location said the Urban League's case management helped identify and address challenges to participation and retention that the college might not recognize; this staff person believed that the case management and wraparound services offered by the Urban League could help retain some students who would otherwise have dropped out before they obtained certifications. For example, one affiliate developed a three-week program that integrated job and life skills with

[8] One college declined to partner with its Urban League affiliate, citing distance as a challenge.

certification track content. The program leader at the local college said this type of support was a good fit for the highest need students.

D. Students had diverse backgrounds

By July 31, 2016, 3,295 students had participated in one or more certification track courses, surpassing the Consortium's target of 3,000 by March 2017. Only 13.5 percent of the students had enrolled in the Consortium colleges before taking a certification track course (Table III.2). Administrative data reveal their diversity, which reflects the wide range of characteristics of community college students across the country.

Table III.2. Student characteristics

	Percentage unless noted
Demographics	
Male	54.7
Average age (in years)	38.9
Race/ethnicity	
Black or African American	43.8
White	29.5
Hispanic	20.0
Other race	2.0
Asian or Pacific Islander	4.6
Veteran	13.8
Disability	2.9
Labor market characteristics	
Not employed	27.5
Trade Adjustment Assistance (TAA)-eligible	1.5
Education	
Ever enrolled in any postsecondary institution	30.1
Completed any postsecondary credential	15.4
Enrolled in Consortium college term before first certification track course enrollment	13.5
Sample size	3,295

Source: Administrative data. See Appendix B for details.

Note: Age and employment status were defined when a student first enrolled in a certification track course (that is, the status was not updated), and TAA-eligible, veteran status, and disability status were defined if a student ever had the status while enrolled in certification track courses (that is, the status was updated with each term of enrollment).

- **Race/ethnicity.** Nearly half of students identified themselves as Black or African American, although this percentage varied substantially across colleges, and two colleges served majorities of Black or African American students. One in five students identified as Hispanic.
- **Other demographics.** The average certification track student was 39 years old when he or she first started taking certification track courses, about 10 years older than the average for-credit community college student in 2014 (American Association for Community Colleges [AACC] 2016) and 5 to 8 years older than the non-credit community college student

population (Xu and Ran 2015). Nearly 14 percent were veterans, higher than the national community college average of 4 percent (AACC 2016), and only about 1.5 percent were TAA-eligible, a percentage consistent with participation levels in services provided by other TAACCCT grantees in the same regions of the country (for example, Person et al. 2016, Dunham et al. 2016).

- **College experience.** About 30 percent had some college experience, and 15.4 percent held a postsecondary credential.
- **Employment.** About 27 percent of students were not employed at the time of enrollment, similar to community college students nationwide (AACC 2016). In 2016, 27 percent of part-time and 38 percent of full-time community college students were not employed.

Interviews with a few students at each college suggested that the reasons for pursuing certifications reflected a range of career objectives. About 28 percent of the students that Mathematica interviewed enrolled in certification track courses with the goal of getting a new job or changing careers and nearly 20 percent had the goal of getting promoted at their current job. Other students said they wanted to refresh or develop their skills or improve their marketability. Opportunities to network, as well as the low cost and short length of courses, were also cited by students as other motivating factors for enrollment. Although the students interviewed do not necessarily represent the opinions of all students, they had, on average, characteristics similar to students enrolled in LINCS before August 1, 2016.

E. Summary

Each Consortium college was responsible for delivering certification track content to students and supporting them as they pursued certifications and leveraged the certifications to get jobs. Colleges used a variety of methods to deliver SCM content, including integrating it into existing courses, developing new courses, and partnering with local workforce and community partners. They adapted the delivery modes, locations, and content, based in part on employer input and student needs. Student support services included case management, academic help, and career guidance. To provide these support services, colleges drew on existing resources within their institutions—including institutional academic and career support services as well as faculty members who had previously taught other SCM courses. They also leveraged the program partnership with local Urban League affiliates or workforce agencies.

A demographically diverse group of students pursued SCPro™ Fundamentals certifications. On average, they were older than the typical community college student, with about one-third not employed at the time they enrolled in their first certification track course. Although most had never been enrolled at a Consortium college, nearly one-third had some postsecondary experience before enrollment in their first certification track course. According to the students Mathematica interviewed, common motivations for enrolling included getting a new job, getting promoted in a current job, and developing general skills.

IV. BUILDING AND DEMONSTRATING SCM SKILLS

LINCS was designed to help students build and demonstrate the competencies needed for early-career SCM jobs. In this chapter, Mathematica presents key research findings to describe the extent to which students pursued (Section A) and obtained (Section B) certifications, and reports on employers' perceptions of the certifications (Section C). Mathematica used administrative data to describe certification track course and exam participation, interviews with college staff and a small sample of students to describe challenges students faced when pursuing certifications, and interviews with industry partners to describe how employers viewed the certifications and used them in the hiring process. Appendix B provides information about all data and samples.

A. Students enrolled in the certification tracks that industry considered most important

By conducting surveys and interviews with employers, the Consortium could identify the areas of competency needed in SCM jobs. The employers told the Consortium that it was hard to find qualified employees, especially well-rounded candidates with SCM competencies and general business and organizational skills. They identified the Customer Service Operations certification track as the most valuable of the eight SCPro™ Fundamentals certifications, and commonly cited the Supply Chain Management Principles track as important because it indicates an understanding of the elements of the supply chain. In addition, employers identified areas of value that align nicely with certification tracks, including customer service operations, transportation operations, and warehouse operations. For example, more than 90 percent of employers in the Consortium survey identified competencies in supply chain operations, transportation operations, and warehouse operations as important, and employers interviewed by both the Consortium and Mathematica emphasized the importance of soft skills, including customer focus and communication skills.

Industry-valued skills and competencies

The Consortium presented employers with three categories and asked which skills were most valued by their organization in each category. The most sought-after skills included:

- **Communication** (91 percent; in interpersonal category)
- **Basic data analysis** (71 percent; in technical skills category)
- **Customer focus** (40 percent; in workplace and leadership skills category)

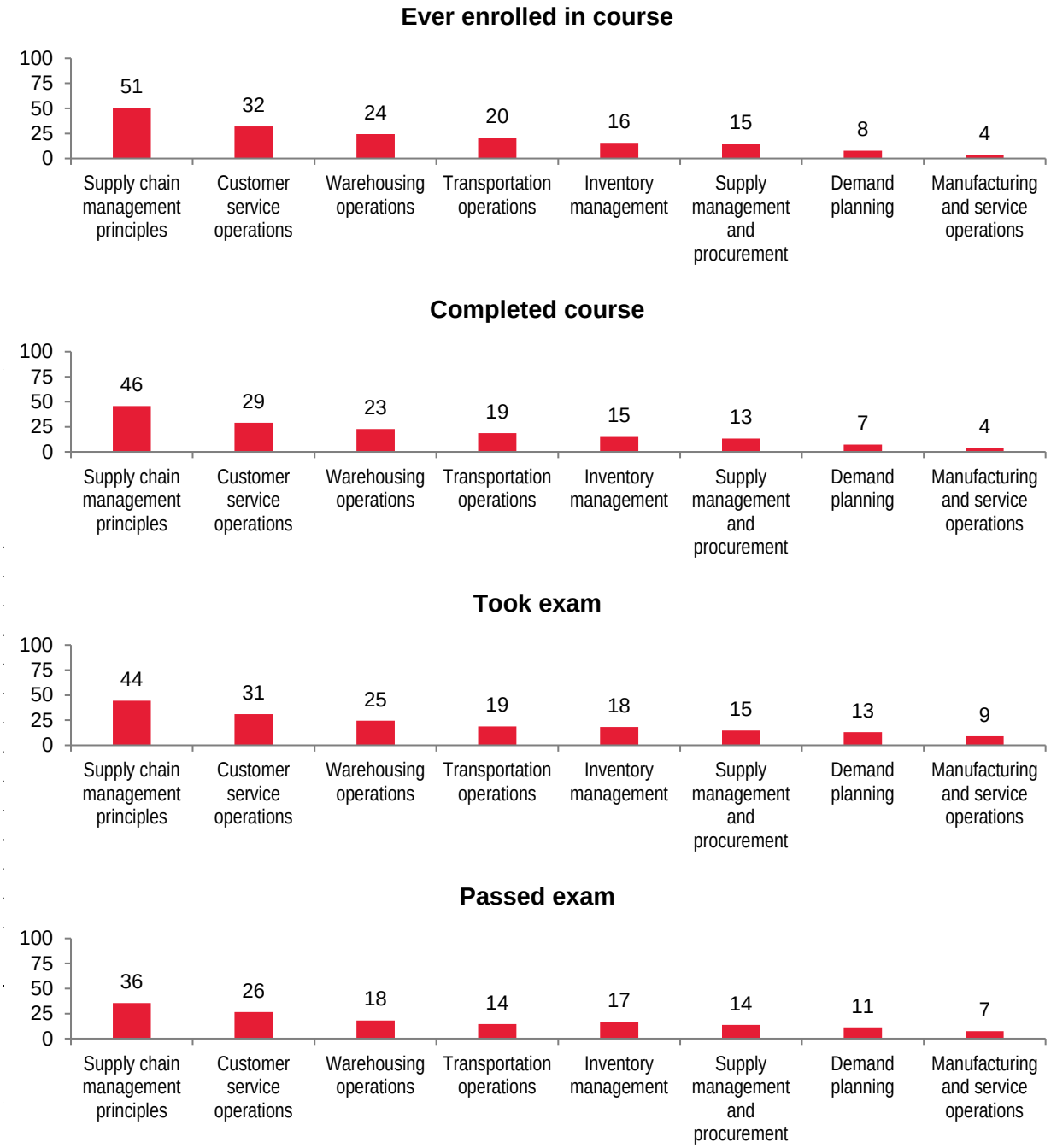
The Consortium also surveyed employers about the importance of various competencies. The three competencies they valued most were:

- Supply chain operations (94 percent)
- Transportation operations (91

Although students expressed interest in a wide range of certification track courses, they most often enrolled in those that employers cited as valuable: SCM Principles, Customer Service Operations, Warehousing Operations, and Transportation Operations. About half enrolled in SCM Principles, and nearly one-third enrolled in Customer Service Operations; more than one in five enrolled in each of the other two courses (Figure IV.1). These four courses were the first to be released by the Consortium, but were still among the courses with the highest enrollment in later terms. Several indicators suggest high levels of student interest in all courses: the students Mathematica interviewed expressed an interest in taking all the courses offered at their college, 39 percent of all students in the administrative data sample had enrolled in more than one course

by the end of July 2016, and more than 90 percent who enrolled in two or more courses completed two or more of them (Table D.3, Appendix D).

Figure IV.1. Course and exam participation, completion, and success



attempted by LINCS Central students were not available, the National Program Office reported that 55 percent of LINCS Central students in the sample passed at least one exam, while 50 students in the database took an exam and did not pass. Students and staff at four colleges reported that transportation and scheduling challenges arose for some students, particularly those taking courses online or off campus, and suggested that such challenges might have prevented

them from attempting to take exams. Such issues were cited as challenges by staff or students at four colleges; college staff noted the problems were most severe for students who took courses remotely or off campus.

C. Employer partners valued the certifications, but had not made them a requirement for employment during the hiring process

Mathematica's research suggests that employers who partnered with Consortium colleges valued certification track courses and certifications. For example, staff at one college reported that local employers liked to hire students who completed certification track courses because they could perform work independently and quickly. Employers interviewed for the evaluation said they encouraged their employees to enroll in LINCS certification track courses. According to one employer, the workers were "better at customer service, logistics terms, and [understood] the general SCM environment better." According to another, the employees with SCPro™ Fundamentals certifications "made better decisions" and were better able to understand the "big picture" of how their work fit into the supply chain. Two employers noted that learning the specific terminology of the industry was a valuable outcome of completing the certification track courses. When asked to compare the SCPro™ Fundamentals certifications to other industry certifications in the field, the most common response—provided by four employers Mathematica interviewed—was that they covered a broader range of subjects than other certifications did.

Examples of employers' positive view of certifications

- **Referred employees** to enroll in certification track courses
- Offered **on-site certification track courses**
- **Promoted certifications** to industry stakeholders
- Participated in **college job fairs**
- Held **information sessions** about SCM and their company, and hosted **facility tours** for students
- Created **internship programs** for students in certification track courses

Employers also promoted certification track courses and certifications to employees and other industry stakeholders. As described in Chapter III, four colleges worked with employers to offer certification track courses on site to current employees. In addition, some local employers actively marketed the courses to their employees. For example, one employer hosted information sessions about the certification tracks for new employees. Another employer sent emails to all staff notifying them about the certification tracks and emphasizing that courses and exams were free of charge and could be taken through self-study and at convenient times; these emails resulted in a number of employees enrolling in the certification track courses, according to an executive at the company. One employer reported promoting the certifications to other businesses in the SCM field through local industry groups and meetings, and three others said they informally discussed the certifications with colleagues in the field.

Employers' enthusiasm for certification track courses was further evidenced in their outreach to Consortium college students. Three of the eight employer partners Mathematica interviewed said they participated in job fairs, although these events were targeted generally at SCM students and not specifically at students pursuing SCPro™ Fundamentals certifications. Employers conducted more personalized outreach about their companies and potential job openings to certification track students at four of the colleges as well. Two employers also hosted

site visits and facility tours for students to learn more about the company and working in SCM. Two employers reported that they send SCM job openings to the LINCS staff at their local colleges, and two employers created internship programs for certification track students.

Despite employers' positive views of the certifications, few used them as a requirement during the hiring process. Although some postings on the Consortium's *LINCSConnect* web portal listed certifications as a "plus" for applicants, they were not a job requirement for any of the employer partners interviewed. One employer said that when certifications are listed on resumes of applicants, it could help demonstrate skills, particularly for jobs in warehousing, a field that attracts many unskilled seasonal workers. Another employer said that a certification could "come into play" in a hiring decision, but was not used in screening applications. Three employers said they planned to incorporate certifications into hiring decisions more formally in the future, but were unsure if they would require them for new hires. One employer recommended to a supervisor that a certification be included as a preferred qualification in a job posting. Several employers suggested more could be done to raise the profile of the SCPro™ Fundamentals certifications so they could be integrated into hiring decisions.

D. Summary

Employers told the Consortium and individual colleges about skill demands in the SCM field and recommended ways to create courses that could give students the needed competencies. Students most commonly pursued the certification tracks that employers identified as important. Although not all students took and passed the exams that corresponded to the courses they enrolled in, more than half of students who enrolled in each certification track course eventually completed the course, took the corresponding exam, and passed the exam to receive the certification. The employers Mathematica interviewed had favorable views of the certifications, and some encouraged their employees to take certification track courses or promoted the certifications to other industry stakeholders. However, few employers had begun to use the certifications formally in making hiring decisions. Of note, the interviews with employer partners took place between March and May 2016, one year into certification track implementation, and it is possible that they made certifications part of their hiring decisions after the interviews were conducted.

The evaluation's outcomes and impact report in September 2017 will provide further insight into the employment of students who pursue and attain SCPro™ Fundamentals certifications. The outcomes study will include a detailed analysis of employment experiences after students at Consortium colleges complete certification track courses or pass certification exams, and the impact study will deliver exploratory evidence of how student employment and education changed as a result of certification track coursework and certifications. Taken together, the implementation and outcomes and impact studies may shed light on how much employers value the SCM competencies taught in the courses and demonstrated on the exams, and on how successful students who pursue LINCS coursework and certifications are at finding and advancing in their jobs.

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APPENDIX A

PROGRAM LOGIC MODEL, OCTOBER 2015

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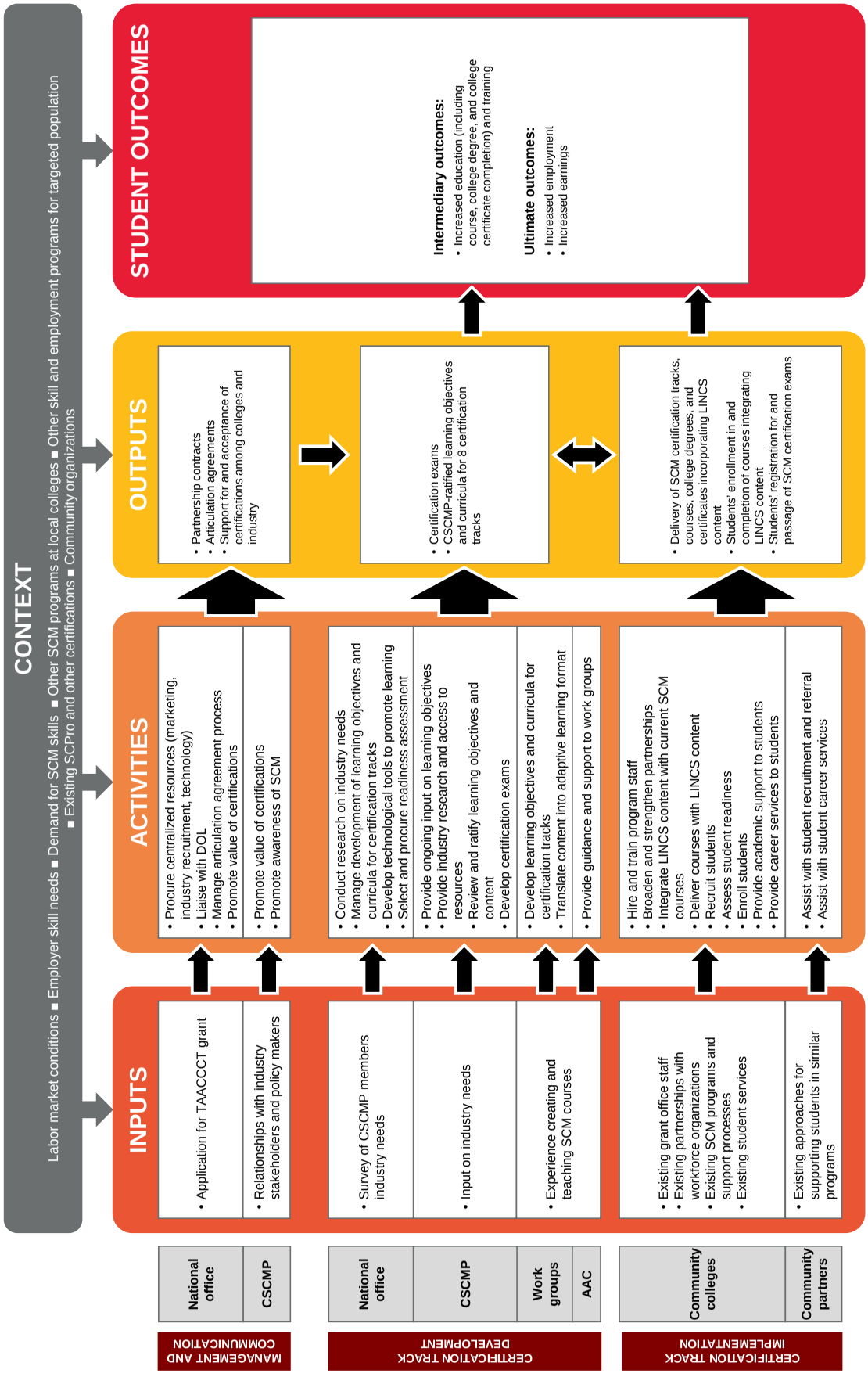
CONTEXT
Labor market conditions ■ Employer skill needs ■ Demand for SCM skills ■ Other SCM programs at local colleges ■ Other skill and employment programs for targeted population ■ Existing SCPro and other certifications ■ Community organizations
INPUTS
• Application for TAACCCT grant
• Relationships with industry stakeholders and policy makers
• Survey of CSCMP members industry needs
• Input on industry needs
• Experience creating and teaching SCM courses
• Existing grant office staff
• Existing partnerships with workforce organizations
• Existing SCM programs and support processes
• Existing student services
• Existing approaches for supporting students in similar programs
ACTIVITIES
• Procure centralized resources (marketing, industry recruitment, technology)
• Liaise with DOL
• Manage articulation agreement process
• Promote value of certifications
• Promote value of certifications
• Promote awareness of SCM
• Conduct research on industry needs
• Manage development of learning objectives and curricula for certification tracks
• Develop technological tools to promote learning
• Select and procure readiness assessment
• Provide ongoing input on learning objectives
• Provide industry research and access to resources
• Review and ratify learning objectives and content
• Develop certification exams
• Develop learning objectives and curricula for certification tracks
• Translate content into adaptive learning format
• Provide guidance and support to work groups
• Hire and train program staff
• Broaden and strengthen partnerships
• Integrate LINCS content with current SCM courses
• Deliver courses with LINCS content
• Recruit students
• Assess student readiness
• Enroll students
• Provide academic support to students
• Provide career services to students
• Assist with student recruitment and referral
• Assist with student career services
OUTPUTS
• Partnership contracts
• Articulation agreements
• Support for and acceptance of certifications among colleges and industry
• Certification exams
• CSCMP-ratified learning objectives and curricula for 8 certification tracks
• Delivery of SCM certification tracks, courses, college degrees, and certificates incorporating LINCS content
• Students' enrollment in and completion of courses integrating LINCS content
• Students' registration for and passage of SCM certification exams
STUDENT OUTCOMES
Intermediary outcomes:
• Increased education (including course, college degree, and college certificate completion) and training
Ultimate outcomes:
• Increased employment
• Increased earnings
MANAGEMENT AND COMMUNICATION
National office
CSCMP
CERTIFICATION TRACK DEVELOPMENT
National office
CSCMP
Work groups
AAC
CERTIFICATION TRACK IMPLEMENTATION
Community colleges
Community partners

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APPENDIX B

DATA COLLECTION AND ANALYSIS METHODS

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This appendix describes the methods Mathematica used to collect and analyze data for the implementation study portion of the evaluation of the Leveraging, Integrating, Networking, and Coordinating Supplies (LINCS) in Supply Chain Management (SCM) program. The study analyzed qualitative and quantitative data from multiple sources. Mathematica conducted interviews and reviewed program documents to obtain qualitative information on program implementation and stakeholders' perceptions of the program. In addition, Mathematica used quantitative data for the Department of Labor's (DOL's) annual performance reporting that was gathered from the colleges and interviews with the Consortium's National Program Office staff members to document student characteristics and participation patterns. Section A describes the qualitative data and analysis and Section B describes the quantitative data and analysis.

A. Qualitative data and analysis

The qualitative information from program documents and interviews laid the foundation for evaluating LINCS program implementation by describing how the program unfolded from grant award in September 2013 through implementation in the Consortium colleges up until June 2016 and outside of Consortium colleges in November 2016. It allows tracking of implementation progress and changes over this period, and provides insights into the experiences and perspectives of a wide variety of stakeholders.

1. Data collection

Qualitative data used in this report include reviews of program documents and four rounds of interviews with key staff from the Consortium's National Program Office, the nine Consortium colleges, the three university partners, employer and workforce partners, and students (Table B.1). Information was collected at multiple points in time, starting with program documents from 2013 and continuing through June 2016. Mathematica conducted interviews with National Program Office staff, Consortium college staff and faculty, and university faculty about program development, implementation, and participation from July to September 2015 (Round 1) and again from February to March 2016 (Round 2). Mathematica interviewed a small number of students from each college during February to April 2016 (Round 3) and industry and community partners from March to May 2016 (Round 4). Although the LINCS program continued to evolve after the reporting period, the interviews captured information about program development, implementation, and participation from September 2013 to May 2016. An additional interview was held with the national special projects manager in charge of the LINCS Central database to gather information on how LINCS served unaffiliated individual students and institutions.

a. Program documents

The evaluation team collected and reviewed a comprehensive set of program documents from several sources to chart the development of the LINCS program and provide granular detail about processes and partnerships. Because documents are not subject to the recall bias inherent in qualitative interviewing, they provide a check on the accuracy and completeness of qualitative interviews that reflect respondents' recollections of how the program developed. In addition, they include details that the interviews did not cover.

Table B.1. Data sources for qualitative analysis

Data source	Topics	Respondents	Collection period
Program documents			
Planning documents	Consortium organization and plans	n.a.	June 2013 – May 2015
Consortium meeting minutes	Consortium activities and progress	n.a.	October 2013 – October 2016
QNPR and supplemental questions	Consortium activities and progress	n.a.	December 2013 – June 2016
Telephone interviews			
Round 1	Program development	College staff and faculty, National Program Office, and universities	July–September 2015
Round 2	Program implementation	College staff and faculty and National Program Office	January–April 2016
Round 3	Program participation	Students	February–April 2016
Round 4	Partnerships	CSCMP, employers, Urban League, and workforce development boards	March–May 2016
Additional interview	Non-Consortium students	National Program Office	November 2016

n.a. = not applicable; CSCMP = Council of Supply Chain Management Professionals; QNPR = Quarterly narrative progress report.

Documents collected for review included:

1. **Planning documents.** These documents include:

- The Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant application, which provided insights into the original plans for the program, including resources, stakeholders, activities, and participation targets, as well as background information about the Consortium's formation and the goals for the TAACCCT grant.
- The colleges' websites and follow-up calls to them about the grant application, which provided an overview of SCM offerings prior to LINCS.
- Reports from the Consortium's employer and industry survey and interviews, conducted by the National Program Office in July 2014 and May 2015, respectively, which contain information about the needs of SCM employers.

2. **Consortium meeting minutes.** Meetings for all Consortium members were initially held monthly and later every other week, and a staff person in the National Program Office prepared minutes of the meetings. To keep abreast of program development and implementation progress, the evaluation team participated in as many meetings as possible and collected and reviewed all agendas, notes, and minutes from all meetings. Materials were emailed to Mathematica or posted by the National Program Office on the Consortium's SharePoint site.

3. **Quarterly narrative progress reports** (QNPRs). DOL required Consortium members to submit QNPRs for performance measurement to the National Program Office. Mathematica collected and reviewed the QNPRs as well as the quarterly submissions that the National Program Office collected from each college. The submissions to the National Program Office included the colleges' responses to the questions required by DOL and to supplemental questions developed by Mathematica, which helped track progress on program development and delivery and changes to the program model. The supplemental questions fell into four categories: (1) student recruitment, (2) student support services, (3) engagement with the certification process, and (4) staffing.

b. Telephone interviews

Mathematica conducted telephone interviews with a wide range of LINCS stakeholders, including the National Program Office and Consortium colleges as well as students and external partner organizations. These interviews were designed to capture a range of experiences and perspectives at various stages of program development and implementation.

Mathematica took several steps for each of interviews to ensure the collection of high quality, accurate information:

- Interviewers told respondents that their information would be confidential and they would not be identified to anyone outside the study team to facilitate candid discussions.
- Mathematica evaluation team members conducted all interviews. Interviewers participated in an internal training that covered the purpose of the interviews, research questions and evaluation goals, professionalism, interview techniques, use of the interview protocol, consent procedures, note-taking, and interview write-ups. To support complete and accurate data collection, before interviewing, all trained interviewers observed a senior team member conducting an interview, and a senior team member observed them conducting an interview and provided feedback to them.
- Interviewers used a semi-structured protocol that was organized by topics aligned with the program logic model (Appendix B) to conduct interviews. Having all interviewers follow the same protocol ensured that all interviews would be thorough and consistent.
- A trained note taker assembled information, took notes during interviews, and compiled interviews from multiple respondents into a single document (by entity and topic) for analysis.

i. Round 1: Program development

The first round of interviews was conducted during July to September 2015. At this point, the Consortium had developed content for four of the eight certification tracks and was finalizing content for the remaining four. All colleges had offered at least one certification track course to students, and some had offered at least one certification track course for more than one term.

Interviews during this round were 60 to 90 minutes long and focused on the Consortium's formation and working relationships, development of certification tracks, and early implementation experiences. Specific topics included:

1. Development of learning objectives and content for certification track courses
2. Development of certification processes
3. Alignment of current or new courses with certification tracks and learning objectives
4. Collaboration among Consortium members, including university partners, colleges, and the Council of Supply Chain Management Professionals (CSCMP)
5. Coordination and implementation of the first round of certification track courses, including staffing and student recruitment
6. Colleges' plans for the future, including learning objectives, content, course modifications, new courses, student services, and staffing changes

Mathematica interviewed 22 individuals from 13 entities, including National Program Office staff, college faculty and staff from all nine colleges, and faculty at each of the three partner universities. All respondents were involved in curriculum and certification development at the consortium level or in implementing LINCS program components at the college level.

ii. Round 2: Program implementation

Mathematica conducted a second round of interviews during January to April 2016. By this time, all certification tracks were complete and all colleges had offered certification track courses. The same interviewers conducted both rounds of interviews. Interviewers reviewed responses from the first round before conducting the second round, so they were familiar with early implementation experiences and could probe about any changes that occurred.

Interviews were 45 to 90 minutes long and focused on program implementation since September 2015 (the time of the previous interview), including:

1. Implementation of certification tracks at the colleges
2. Administration of certification exams
3. Student recruitment and support
4. Partnerships with employers, the Urban League, CSCMP, and workforce development boards

Some interview questions were the same as or similar to those asked in round 1 to allow us to identify changes in plans and approaches during the first year of implementation.

Mathematica interviewed 31 individuals including National Program Office staff, program leadership, student support staff, and instructors from all nine colleges.

iii. Round 3: Program participation

Mathematica conducted interviews with a small number of students from each college during February to April 2016 to learn about student perspectives on issues addressed in staff and faculty interviews. All students interviewed had taken at least one certification track course and some had taken multiple courses and certification exams.

Interviews lasted 15 to 20 minutes, and focused on students' background and experiences, including:

1. Employment and education history before enrollment in certification track courses
2. Participation in certification track courses and exams
3. Labor market experiences after completion of certification track courses

The sample of students interviewed was not designed to be representative of all students enrolled in certification track courses. Mathematica asked each college to identify a group of its "strongest students" who had participated in at least one certification track course, with the goal of interviewing both current and former students. Mathematica interviewed 43 of the 62 students identified by the nine colleges (three to eight students per college).[9] Nearly one-third of students interviewed were not employed before they enrolled in their first certification track course, and 14 percent were enrolled in the college (Table B.2). These proportions are similar to those of students who were enrolled prior to August 1, 2016.

Table B.2. Student characteristics: those interviewed and those enrolled prior to August 1, 2016

	Students interviewed	Students enrolled before August 1, 2016
Before enrollment in first certification track course		
Completed any postsecondary credential	NA	15.4
Enrolled in Consortium college in prior term	14.0	13.5[a]
Not employed	30.2[b]	27.5
Any work experience in SCM field	76.7	NA
At time of interview		
Enrolled in LINCS courses	72.1	n.a.
Enrolled in degree/certificate program	34.9	n.a.
Employed in SCM field	58.1	n.a.
Employed in non-SCM field	4.7	n.a.
Not employed	37.2	n.a.
Sample size	43	3,295

Notes: Numbers are percentages, except sample size. Students interviewed provided information reported in the table. Data on the students enrolled are from college records and intake survey data provided by the Consortium colleges.

[a] Data on prior enrollment are not available for two of the nine colleges. This number represents the percentage of students at the seven colleges with non-missing data who were enrolled at the Consortium college in the term before they enrolled in their first certification track course.

[b] Among students interviewed, 30.2 percent were not employed or currently enrolled in the Consortium college before they enrolled in their first certification track course. In addition, 55.8 percent of students in the sample reported that they were employed prior to enrollment. We do not have complete information on the prior employment status of the 14 percent of students in the sample who were previously enrolled in the college.

SCM = supply chain management; LINCS = Leveraging, Integrating, Networking, and Coordinating Supplies in Supply Chain Management; NA = not available; n.a. = not applicable.

[9] The majority of students identified but not interviewed could not be contacted; fewer than 10 percent of students contacted declined to participate or did not show up for a scheduled interview.

iv. Round 4: Partnerships

During March to May 2016, Mathematica interviewed organizations affiliated with each college. We timed the interviews to be as late as possible during the grant period to allow colleges time to offer a full year of certification track courses and to develop employer partnerships, and to allow employers time to become aware of the certifications and incorporate them into hiring or promotion decisions. We conducted 16 interviews of 30 to 45 minutes with one or two local partners per college and two national partners.

Respondents included staff from local employer partners, Workforce Development Boards, CSCMP, and the Urban League. If a college identified more than two partners, Mathematica selected the partner to interview so as to include a range of types of partners for each college and across the Consortium. The National Program Office provided names of representatives from the National Urban League and the national CSCMP organization. Table B.3 provides a list of the type of partners interviewed.

Table B.3. Partner interviews

Partner type	Number interviewed
Local partners	
Employers	8
Workforce Development Boards	1
Council of Supply Chain Management Professionals (CSCMP) roundtable members	1
Urban League affiliates	4
National partners	
CSCMP	1
Urban League	1
Total	16

Interviews focused on how partners contributed to the LINCS program, how they viewed the certifications, and the broader context of skill and certification needs within the SCM industry. Mathematica identified interviewees through college recommendations for names of partners with whom they had worked closely as part of the TAACCCT grant.

v. Additional interview: Information on non-Consortium students

In November 2016, Mathematica conducted one 30-minute telephone interview with a staff member from the National Program Office about students who pursued SCPro™ Fundamentals certifications during the grant period through LINCS Central, which included students taking certification track courses at a non-Consortium college partner or through self-study by accessing certification track content through the centralized Learning Management System. The staff member interviewed coordinated the registration and tracking of these students, which started after Consortium colleges adopted the certification track content. The interview focused on issues related to how non-Consortium students access certification track content, how non-Consortium colleges became involved in the LINCS program, and the Consortium's experiences enrolling and supporting these students.

2. Data analysis

Information from documents and interview write-ups was systematically collected, cataloged, and reviewed on an ongoing basis using NVivo 11, a qualitative data analysis program. All information was tagged, or coded, using a high-level coding scheme developed to align with the implementation research questions (Table I.1 in Chapter 1) and second-level codes to capture more specific themes. For example, one code captured broad information related to the research question, "What is the role of each college in implementing LINCS?" and second-level codes identified challenges, recruitment, staffing, student support, and integrating LINCS into existing courses. Mathematica trained all coders—who had served as telephone interviewers—to apply codes to all text consistently. In addition, we assessed inter-rater reliability on three documents before coding of all documents occurred, with a coding supervisor reviewing the coding of these three documents after completion to confirm their accuracy.

Mathematica used the coded information to identify statements or sentiments echoed by more than one respondent (called emergent themes). For example, an emergent theme might be a specific implementation challenge that more than one college encountered. Second-level codes allowed researchers to count and compare different responses on each topic. Researchers used those counts to draft analytic memos that corresponded to each second-level code. Each memo listed Consortium-wide emergent themes and supporting evidence, as well as detailing supporting evidence organized by college. Analytic memos were reviewed both to confirm the emergent themes and to flag evidence for additional review or coding. Findings described in the analytic memos shaped the major themes of the implementation report.

B. Quantitative data and analysis

The student-level data used for quantitative analyses in this report are a subset of the data used to calculate measures for DOL's annual performance reporting. These data allow us to describe students in certification track courses and document their participation patterns.

1. Data collection

The data were provided by Consortium colleges and by National Program Office staff, and include information on LINCS participants from the term that each college began offering certification track courses through July 31, 2016.[10] The colleges provided data on enrolled students as well as students who accessed the certification track content through their local Urban League affiliates.[11] The colleges compiled data from administrative records (for enrolled students only), intake surveys completed by students before enrollment in certification track courses (for enrolled students and Urban League students), and exam records provided to the colleges by CSCMP (for enrolled students and Urban League students). A National Program Office staff member provided data on students who accessed certification track content through non-Consortium colleges or online self-study (that is, students in the LINCS Central database).

[10] Seven colleges began implementation in the spring term of 2015, and two in the summer term of 2015. We defined enrolled students as those who enrolled at any point between the first term that each college offered certification track courses through July 31, 2016.

[11] LINCS Central contains information for the one local Urban League affiliate that did not work with a Consortium college.

The National Program Office compiled data from intake surveys completed by students before enrollment in certification track courses and exam records provided to the National Program Office by CSCMP.

The quantitative data analyzed for this report include information on student (1) demographic characteristics, (2) education prior to enrollment in certification track courses, (3) postsecondary programs, (4) course-taking, and (5) CSCMP exam taking (Table B.4).

Table B.4. Data elements and sources used for quantitative analysis

Type of student data	Data elements provided	Data source(s)
Demographic characteristics	– Gender – Date of birth – Race and ethnicity – TAA eligibility status – Veteran status – Disability status – Pell Grant recipient status – Employment status at enrollment into first-ever certification track course	– College student information systems – Program intake form or online survey
Education prior to enrollment in certification track courses	– Prior postsecondary enrollment – Prior credential(s) – Prior postsecondary credits	– College student information systems – Program intake form or online survey – Student-level course records
Course-taking data	– Course ID – Name of course – Course start and exit dates – Course credit status – Course grade – Course credit hours, possible and completed	– Student-level course records
CSCMP exam data	– Name of each certification exam – Date of each certification exam – Score on each certification exam	– CSCMP exam records (provided to college by CSCMP)

TAA = Trade adjustment assistance; CSCMP = Council of Supply Chain Management Professionals.

Mathematica ensured accuracy and consistency in data collection within and across colleges by:

- **Developing a data dictionary** for each college that defined each data element requested.
- **Holding calls** with college program leaders and staff from research offices in fall 2014 and before each data collection round to review the data dictionary, discuss any data gaps or challenges, and establish processes for data collection and submission.
- **Providing a customized data request memo** that reflected details discussed during calls, including specific college sources for data elements and issues with collecting them; it also provided instructions for submitting data through Mathematica's secure file transfer site.
- **Providing ad hoc guidance and other technical assistance to all colleges and the National Program Office** that was tailored to the needs and capacities of each college. For example, following data submissions, the study team worked with stakeholders to address data questions and issues uncovered during review, cleaning, and linking of student records.

- **Conducting presentations** with the colleges and National Program Office before each data collection round to review the data requested and stress the importance of maintaining cumulative files, assigning a unique identifier to each participant to allow the linking of student records across files and years, validating data before submissions, and providing preliminary files before final deadlines to address issues and questions with ample time.

During each round of data collection, Mathematica prepared data submitted by the colleges in three steps. First, preliminary checks addressed immediate issues, such as failure to include certain participants, data for linking records, terms of data, or requested data elements. Colleges were asked to provide replacement or supplemental files as needed. Second, we cleaned and standardized data across colleges and conducted another round of diagnostic checks, following up with colleges as needed. Third, we conducted final quality assurance procedures on the final analytic file and made corrections as necessary.

The ultimate sample for administrative data analyses included 3,295 students across the nine Consortium colleges and 121 students from the LINCS Central database (Table B.5). It included all students who began participating in LINCS before August 1, 2016. Since LINCS certification track content was delivered in a variety of ways, the concept of participation includes participating in certification track courses or coursework or accessing certification track content. The multiple delivery methods also made it necessary to examine several data sources to determine participation status for each student. Mathematica determined LINCS participation and participation start dates using ordered decision rules that examined information from four data sources in sequential stages. Data sources were examined in order of importance, and criteria for participation were defined based on information from each source. At each stage, a set of students (shown in bold in Table B.5) were considered; students not meeting a participation criterion were dropped from the sample, students meeting the criterion were included in the sample, and students for whom the information was missing or unavailable were retained for consideration in the next stage. The stages examined (1) course information from college student information systems to determine whether a student first enrolled in a certification track course before August 1, 2016; (2) information from program leads to determine whether a student first began participating in LINCS before August 1, 2016; (3) LMS data to determine whether the student first accessed LINCS content through the LMS before August 1, 2016; and (4) supplemental application program intake survey data to determine whether the student first began participating in LINCS prior to the launch of the LMS in September 2015.

Table B.5. Number of students in administrative data sample

	Number dropped from Consortium Colleges	Number in sample from Consortium Colleges	Number in sample from LINCS Central
1. Course information	**4,253**		
Start date prior to August 1, 2016	365	2,758	n.a.
2. Program lead information	**1,130**		
Provided start date prior to August 1, 2016	0	205	121
Confirmed did not participate prior to August 1, 2016	506	0	0
3. LMS	**419**		
Access date prior to August 1, 2016	0	325	0
4. Supplemental application	**94**		
Application date prior to September 1, 2015 (when LMS was launched)	0	7	0
Application date after September 1, 2015	83	0	0
No supplemental application or do not have data on supplemental application	4	0	0
Total	**958**	**3,295**	**121**

Source: Administrative data and colleges.

Note: Data for 4,253 students were provided by the colleges. 958 of these students were excluded from the administrative data sample because there was no evidence provided by the Consortium or colleges that they participated in LINCS before August 1, 2016.

n.a. = not applicable; LMS = Learning management system.

2. Data analysis

Mathematica used descriptive analysis to summarize students' demographic characteristics, employment status before enrollment, higher education experience before enrollment, enrollment in and completion of certification track courses, and registration for and performance on certification examinations. Of note, for some colleges, values for the response "no" and missing values were indistinguishable for certain variables (TAA eligible, veteran, has a disability, HS diploma or GED, prior college enrollment in any postsecondary institution, prior credential completion). To define the variables in the same way across colleges, we coded both their "no" and missing values as zero. We used percentage distributions for binary and categorical variables and averages for continuous variables, and present summary statistics for each college and for the Consortium as a whole.

The analysis includes all students in the administrative data sample shown in Table B.5 (3,295 students across the nine Consortium colleges; Table D.1 also includes 121 students from the LINCS Central database), although some students are missing data for some variables and are excluded from the analysis of those variables. Table B.6 shows the percentage of students in the sample from each college and from the LINCS Central database that have missing data for the variables analyzed in this report.

Table B.6. Percentage of administrative data sample with missing data

		Consortium colleges									
	All colleges	Broward	Columbus State	Essex	FSCJ	Harper	Long Beach	San Jacinto	St. Petersburg	Union	LINCS Central
Demographics											
Male	0.9	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Age	19.9	71.8	0.3	0.0	0.1	0.0	0.4	58.9	9.7	6.1	100.0
Race/ethnicity	13.7	25.6	5.1	0.0	13.6	4.5	0.0	32.4	17.6	0.0	0.8
Labor market and other characteristics											
Not employed	7.4	5.0	6.5	12.6	0.0	0.0	0.0	48.3	0.0	4.7	0.0
TAA eligible	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Veteran	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Has a disability	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pell receipt	72.0	71.8	0.6	0.0	100.0	0.0	100.0	53.6	100.0	100.0	100.0
Education before enrollment in certification tracks											
High school diploma or GED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n.a.
Prior college enrollment in Consortium college	26.9	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	n.a.
Prior college enrollment in any postsecondary institution	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n.a.
Prior credential completion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n.a.
Certification track courses											
Enrollment in courses	16.3	57.3	0.0	0.0	1.8	0.0	0.0	58.9	0.0	0.0	n.a.
Completion of courses	16.3	57.3	0.0	0.0	1.8	0.0	0.0	58.9	0.0	0.0	n.a.
Missing grades for all courses enrolled in (for those who enrolled)	0.5	0.0	0.3	1.1	0.0	0.0	0.0	0.0	3.9	0.0	n.a.
Missing grades for any courses enrolled in	0.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.6	0.0	n.a.
Certification exams											
Attempt of exams	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Passage of exams	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Missing scores for all exams attempted (if attempted exams)	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	n.a.
Missing scores for any exams attempted	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	n.a.
Total sample size	3,295	579	336	190	887	88	285	321	330	279	121
Sample size with all data present	686	134	297	163	0	84	0	8	0	0	0

Source: Administrative data.

FSCJ = Florida State College at Jacksonville; TAA = Trade adjustment assistance; GED = General Education Development; LINCS = Leveraging, Integrating, Networking, and Coordinating Supplies in Supply Chain Management; n.a. = not applicable.

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APPENDIX C

COLLEGE PROFILES

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This appendix provides a profile for each of the nine Consortium colleges. Each college profile contains information from the U.S. Department of Education College Scorecard (https://collegescorecard.ed.gov), the college's website, information on LINCS program implementation collected for the evaluation, and information provided by the colleges through February 2017. This means that the profiles cover implementation as reported by the colleges through February 2017, and thus may not reflect the analysis presented in the text of this report or changes made as the programs continued to evolve.

For ease in exposition, the same structure is used for each profile to answer three questions:

- How did the college support the LINCS program?
- What was in place before the LINCS program?
- How did the college implement the LINCS program?

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BROWARD COLLEGE

Broward College is a large public college with campuses in the greater Fort Lauderdale, Florida, metropolitan area. In fall 2016, about 39,000 students enrolled in the college (31 percent full time and 69 percent part time). About three-fourths (77 percent) of the students described themselves as non-white, and 54 percent received federal Pell Grants. The majority of the college's academic programs were designed to lead to associate's degrees. The most commonly awarded degrees were in liberal arts and sciences, general studies, or humanities (47 percent), followed by business, management, marketing, and related support services (25 percent).[12]

Local labor market

Unemployment rate: 5.1 percent in August 2016 (Miami-Fort Lauderdale-West Palm Beach metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to major railways, major ocean ports including Port Everglades, and several airports with cargo services.
- Florida ranks fourth in the country for employment in transportation and material moving (https://www.bls.gov/oes/current/oes530000.htm#st).
- The largest nonfarm sector of employment in the Miami metropolitan area is trade, transportation, and utilities, which employed 594,200 workers in August 2016 (23.2 percent of total employment) and increased 2.1 percent over the prior year (http://www.bls.gov/regions/southeast/summary/blssummary_miami.pdf).

How did the college support the LINCS program?

Broward College played three key roles in the LINCS Consortium. First, it housed the LINCS National Program Office. This office coordinated the activities of LINCS Consortium members, managed centralized resources, promoted the value of the eight Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certifications, and led the development of certification tracks. Second, the college participated in content development for the first four certification tracks. Third, it integrated content from all eight LINCS certification tracks into its own course offerings to prepare students for the SCPro™ Fundamentals certification examinations.

What was in place before the LINCS program?

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

Before the LINCS program, Broward College offered a number of supply chain management (SCM) courses, including four with content similar to that covered in the certification tracks. Three faculty members taught these courses. The college offered a logistics and transportation specialist certificate, associate's and bachelor's degrees in SCM, and related degree programs in business administration and manufacturing. The college had developed relationships with local SCM employers before the grant.

[12] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (http://www.broward.edu/academics/programs/Pages/default.aspx).

How did the college implement the LINCS program?

Broward College offered certification track courses starting in spring 2015, and ultimately offered coursework in all eight certification track areas. Some certification track content overlapped with college SCM courses in place before the grant. As such, the college revised some existing courses to correspond with the certification tracks, and created new courses to complete the certification offerings as part of the grant. It also removed from its course catalog some courses that were redundant with the new ones. The college initially offered five certification track courses for credit, and offered all eight certification track courses on a non-credit basis, using an online self-study workshop and in-person workshops available on campus and through the local Urban League affiliate. Broward College later offered all eight certification track courses for credit, with the associate's degree in SCM covering four SCPro™ Fundamentals certifications, and the bachelor's degree in SCM covering the other four SCPro™ Fundamentals certifications.

Staffing. A project lead who formerly served as the college's associate dean of business and computer science managed LINCS program activities at Broward College. The college hired three adjunct faculty to teach certification track courses, in addition to the three faculty who were already teaching SCM courses when the grant started.

Student support. The college used grant funds to hire two full-time job placement specialists, who served only students enrolled in certification track courses. These specialists helped students write resumes and develop non-academic professional skills and sought internships and job interviews with local employers. Students also had access to support from professors and through the college's academic success center and career services office.

Student recruitment. The project staff used word-of-mouth recruitment by promoting the program to for-credit SCM students, discussing it at CSCMP Southern Florida roundtables and with local veteran-affiliated organizations, and sending email blasts to CSCMP local members and affiliates. The college's local Urban League affiliate also promoted the program on its website.

Broward College certification track enrollments and certifications, spring 2015 to summer 2016

Certification tracks offered	8
Students who participated in any certification track course	247
Students who completed any certification track course	95%
Students who took any certification exam	79%
Students who passed any certification exam	63%
Students who passed all 8 certification exams	0%

COLUMBUS STATE COMMUNITY COLLEGE

Columbus State Community College is a mid-sized public community college serving the greater Columbus, Ohio, metropolitan area. In 2016, about 12,500 students enrolled in the college (35 percent full time and 65 percent part time). The majority (62 percent) of the students described themselves as white, and 37 percent received federal Pell Grants. The majority of the college's academic programs were designed to lead to associate's degrees. The largest category of degrees was in health professions and related programs (37 percent). The third largest category was in business, management, marketing, and related support services (about 10 percent).[13]

Local labor market

Unemployment rate: 3.9 percent in August 2016 (Columbus, Ohio, metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to eight major interstate highways, railway connections to three major sea- and airports, including Rickenbacker Inland Port, and cargo-dedicated Rickenbacker International Airport.
- The largest nonfarm sector of employment in the Columbus metropolitan area is trade, transportation, and utilities, which employed 196,200 workers in October 2016 (18.3 percent of total nonfarm employment) and decreased 1.3 percent over the prior year (http://www.bls.gov/regions/midwest/summary/blssummary_columbus_oh.pdf).

How did the college support the LINCS program?

Columbus State Community College played two key roles in the LINCS Consortium. First, the college participated in the development of the certification tracks—helping to write the content for two of the tracks and participating on the Academic Advisory Council for the second set of four tracks developed. Second, the college integrated content from all eight of the LINCS certification tracks into new and existing courses to prepare students for the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations.

What was in place before the LINCS program?

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

Before the LINCS program, Columbus State Community College offered a number of supply chain management (SCM) courses, including six courses with content similar to that covered in seven of the certification tracks. Two full-time faculty members and six adjunct instructors taught these courses. The college offered an SCM associate's degree, and certificates in International Commerce, Strategic Procurement, and SCM, all of which could be completed online. The college had strong relationships with local SCM employers before the LINCS program.

[13] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (http://www.cscc.edu/academics/).

How did the college implement the LINCS program?

Columbus State Community College offered certification track courses starting in summer 2015, and ultimately offered courses that prepared students for all eight SCPro™ Fundamentals certification exams. The college had existing three-credit courses that aligned with seven of these exams, and each course provided students access to the certification track course materials. These courses were part of existing degree programs and were not modified to align with the certification tracks. However, students who completed these courses were encouraged to take the related certification exams and had access to the educational materials created through the grant. In addition to the existing degree courses, the college developed one-credit courses to offer content in all eight of the certification track areas. The college also developed an in-person non-credit Customer Service Operations course specifically for individuals in career transition, and it partnered with The Ohio State University (OSU) to develop a non-credit boot camp to prepare OSU students for the certification exams.

Staffing. A college grant supervisor oversaw LINCS program activities. A program manager oversaw day-to-day operations, coordinated the grant efforts within the college and with the LINCS Consortium, and served as a student support specialist for certification track students. Two faculty members who were already on staff before the grant taught the certification track courses, and a third instructor was hired to teach non-credit courses. The grant funded a full-time instructional designer to digitize content.

Student support. The college used grant funds to support LINCS students in two ways. First, it provided enhanced support for students in certification track courses, including streamlined admissions, advising, a student newsletter, in-person review sessions, and a student computer lab. It provided these services by leveraging two existing staff and hiring two additional staff who were dedicated, respectively, to (1) enrollment-related support and helping students overcome challenges to enrollment, and (2) content remediation and supporting career advancement through in-person and digital job coaching. Certification track students had access to a streamlined and personalized enrollment process that allowed them to bypass placement testing and transcript submission requirements, if appropriate. Second, the college partnered with the local Urban League affiliate to provide support services outside the college, including a three-week program that combined certification content with essential life skills for students determined to be "high risk" at the initial program screening interview.

Columbus State Community College certification track enrollments and certifications, summer 2015 to summer 2016

Certification tracks offered	7
Students who participated in any certification track course	336
Students who completed any certification track course	80%
Students who took any certification exam	68%
Students who passed any certification exam	62%
Students who passed all 7 certification exams	2%

Student recruitment. The LINCS program manager used local Workforce Development Boards, community organizations, employers, presentations at CSCMP roundtable meetings, job fairs, meetings with college enrollment staff, and on-campus sessions to recruit students. Several local employers paid for cohorts of employees to enroll in certification track courses.

ESSEX COUNTY COLLEGE

Essex County College is a mid-sized public community college serving the greater Newark, New Jersey, metropolitan area. In 2016, about 10,250 students enrolled in the college (54 percent full time and 46 percent part time). The majority (92 percent) of the students described themselves as non-white, and 59 percent received federal Pell Grants. The majority of the college's academic programs led to associate's degrees or certificates. The most commonly awarded degrees were in health professions and related programs (21 percent), followed by business, management, accounting, and related support services (19 percent).[14]

Local labor market

Unemployment rate: 5.1 percent in August 2016 (New York-Newark-Jersey City metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to the largest east coast port (Port Newark), seven major highways, freight railways, and three major airports (Newark Liberty International Airport, LaGuardia Airport, and John F. Kennedy International Airport).
- New York State ranks third in the country for employment in transportation and material moving (New Jersey is not ranked in the top five; https://www.bls.gov/oes/current/oes530000.htm#st).
- The third largest nonfarm sector of employment in the Newark metropolitan area is trade, transportation, and utilities, which employed 250,000 trade and transportation workers in September 2016 (7.4 percent of total nonfarm employment) and increased 3.1 percent over the prior year (http://www.bls.gov/regions/new-york-new-jersey/summary/blssummary_newark_div.pdf).

How did the college support the LINCS program?

Essex County College played two key roles in the LINCS Consortium. First, it participated in the Academic Advisory Council to develop the content for the first four certification tracks. Second, the college used content from four LINCS certification tracks to develop new supply chain management (SCM) course offerings that prepared students for the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations.

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

What was in place before the LINCS program?

Before the LINCS program, Essex County College offered business degree programs but did not offer any SCM courses and did not have existing relationships with local SCM employers.

[14] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (http://www.essex.edu/academics/programs/).

How did the college implement the LINCS program?

Essex County College offered certification track courses starting in spring 2015 and offered coursework in four certification track areas. Each course is equivalent to one college credit. The certification track courses were offered for credit, and they were considered transferable as free electives and count toward an associate's degree. The college does not offer non-credit courses; all are credit courses. As a result of the LINCS grant, Essex developed an associate's degree in Supply Chain Management that has been approved by the State of New Jersey.

Staffing. The project director, who was hired using grant funding, managed all LINCS program activities. The chairperson of the academic Business Division was also involved in developing content and establishing new courses aligned with the certifications. Two business division faculty who were employed before the grant taught certification track courses, and the college hired one additional adjunct instructor with grant funding to teach certification track courses. Additionally, the college provided classroom space and used the LINCS funds to create a new computer lab to support the LINCS grant.

Student support. The college used grant funds to hire a career developer to work with students enrolled in certification track courses. Certification track students received additional support from instructors who hosted extra sessions and one-on-one tutoring outside of normal class time. In addition, the LINCS project director met individually with all students who enrolled in certification track courses prior to course enrollment to discuss the requirements of the program.

Student recruitment. The project staff recruited students using an online brochure posted on the college's website, flyers, open houses, and word of mouth. Grant funds were used to hire a data analyst and a market outreach specialist to engage local employers, veterans' groups, and local high schools in student recruitment. The college also established a partnership with the local Urban League affiliate to recruit students for the program.

Essex County College's certification track enrollments and certifications, spring 2015 to summer 2016

Certification tracks offered	4
Students who participated in any certification track course	198
Students who completed any certification track course	85%
Students who took any certification exam	81%
Students who passed any certification exam	63%
Students who passed all 4 certification exams	2%

FLORIDA STATE COLLEGE AT JACKSONVILLE

Florida State College at Jacksonville is a large public college with campuses in the greater Jacksonville, Florida, metropolitan area. In 2016, about 22,500 students enrolled in the college (32 percent full time and 68 percent part time). About half (51 percent) of the students described themselves as non-white, and 39 percent received federal Pell Grants. The majority of the college's academic programs led to associate's degrees. The most commonly awarded degrees were in liberal arts and sciences, general studies, or humanities (45 percent), followed by business, management, marketing, and related support services (24 percent).[15]

Local labor market

Unemployment rate: 4.7 percent in August 2016 (Jacksonville, Florida, metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to the Port of Jacksonville, the Jacksonville International Airport, two major highways, an intermodal transit facility, and two freight railways.
- Florida ranks fourth in the country for employment in transportation and material moving (https://www.bls.gov/oes/current/oes530000.htm#st).
- The largest nonfarm sector of employment in the Jacksonville, Florida, metropolitan area is trade, transportation, and utilities, which employed 139,600 workers in September 2016 (20.5 percent of total nonfarm employment) and increased 2.5 percent over the prior year (http://www.bls.gov/regions/southeast/summary/blssummary_jacksonville.pdf).

How did the college support the LINCS program?

Florida State College at Jacksonville played two key roles in the LINCS Consortium. First, the college was involved in content development of the first four certification track courses, as well as content review of the second four certification track courses through participation on the Academic Advisory Council. Second, Florida State College at Jacksonville integrated content from all eight LINCS certification tracks into its own course offerings to prepare students for the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations.

What was in place before the LINCS program?

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

Before the LINCS program, Florida State College at Jacksonville offered a number of supply chain management (SCM) courses with content similar to that covered in the certification tracks. The college offered a logistics and SCM degree and related certificates, and related degree programs in business administration and manufacturing. The college had developed relationships with local SCM employers before the grant.

[15] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (https://www.fscj.edu/academics).

How did the college implement the LINCS program?

Florida State College at Jacksonville offered certification track courses starting in spring 2015, and ultimately offered courses in all eight certification track areas. The college hired staff to develop non-credit self-study workshops for all eight certification tracks using the online learning modules developed for the LINCS program.

Staffing. A program manager served as the project lead and managed LINCS program activities, including coordinating certification track workshop offerings, coordinating with staff, and communicating with the Consortium. The college provided stipends to full- and part-time SCM faculty members to teach the non-credit workshop offerings. These faculty members taught for-credit courses prior to the LINCS grant and development of the certification tracks.

Florida State College at Jacksonville's certification track enrollments and certifications, spring 2015 to summer 2016

Certification tracks offered	8
Students who participated in any certification track course	881
Students who completed any certification track course	99%
Students who took any certification exam	54%
Students who passed any certification exam	43%
Students who passed all 8 certification exams	5%

Student support. The college used grant funds to support a LINCS program case manager and an academic advisor for certification track students, both of whom had previously worked at the college in other roles. All students in certification track courses received case management from the case manager, one-on-one advising from the academic advisor, and career networking assistance from the project lead. As part of the grant, the college developed a relationship with the local Urban League affiliate, which works with local employers to develop student opportunities. The Urban League also provided wraparound support to some students with greater needs, such as adult students with no college experience.

Student recruitment. The project staff recruited students who were already enrolled at the college by visiting SCM classrooms and advertising the program directly to them. The college also worked with local employers and business leaders in the community to recruit individuals who work in the SCM field and other non-students by hosting information sessions at employer locations. Other recruitment efforts included job fairs, networking through the local CSCMP roundtable, online media campaigns, and email blasts. The local Urban League affiliate also assisted with student recruitment by holding information sessions about LINCS.

HARPER COLLEGE

Harper College is a mid-sized public community college serving the greater Chicago, Illinois, metropolitan area. In 2016, approximately 25,000 students enrolled in the college (41 percent full time and 59 percent part time). A little more than half (58 percent) of the students described themselves as white, and 23 percent received federal Pell Grants. The majority of the college's academic programs led to associate's degrees. The largest category of degrees was in liberal arts and sciences, general studies, or humanities (33 percent). The third largest was in business, management, marketing, and related support services (11 percent).[16]

Local labor market

Unemployment rate: 5.4 percent in August 2016 (Chicago-Naperville-Elgin metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to six major interstate highways, six major freight railways, the Inland Port of Chicago, and major airports (O'Hare and Midway).
- Illinois ranks fifth in the country for employment in transportation and material moving (https://www.bls.gov/oes/current/oes530000.htm#st).
- The largest nonfarm sector of employment in the Chicago metropolitan area is trade, transportation, and utilities, which employed 943,000 workers in August 2016 (20.1 percent of total nonfarm employment) and increased 0.4 percent over the prior year (https://www.bls.gov/regions/midwest/summary/blssummary_chicago.pdf).

How did the college support the LINCS program?

Harper College played two key roles in the LINCS Consortium. First, the college helped develop the first four certification tracks, and was involved in the review processes for all eight tracks as part of the Academic Advisory Council. Second, it integrated content from seven of the LINCS certification tracks into its own course offerings to prepare students for the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations.

What was in place before the LINCS program?

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

Before the LINCS program, Harper College offered ten supply chain management (SCM) courses, some with content related to that covered in the certification tracks. Five faculty members taught these courses. The college offered four certificates in SCM fields, as well as an associate in applied sciences degree in advanced manufacturing with a specialization in SCM. The college had developed relationships with local SCM employers before the grant.

[16] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (http://goforward.harpercollege.edu/academics/index.php).

How did the college implement the LINCS program?

Harper College offered certification track courses starting in spring 2015, and ultimately offered coursework in seven certification track areas. The college revised existing courses to include the certification track content. Separately, the college offered seven certification track courses through its SCM "fast-track" series, an accelerated, part-time, cohort-based program that was designed to move students through four certifications or 8 to 10 SCM courses in just over one year. Both the traditional and fast-track certification track courses are offered as a hybrid of in-person and online instruction.

Staffing. A program manager in the college's grant office managed activities for LINCS as well as for another TAACCCT grant at the college. Five adjunct faculty members who had taught at the college before LINCS taught the certification track courses, and one full-time faculty member and a department coordinator were hired with grant funds.

Student support. The college used grant funds to hire three job placement specialists to work with students enrolled in certification track courses; their contract positions will end at the end of the grant period. The faculty members who taught the traditional, for-credit certification track courses provided one-on-one academic support to students. Fast-track students received additional academic support from the program manager through mandatory one-on-one advising and group orientation, including discussion of expected progress and outcomes. As part of the orientation, fast-track students also received training on the Blackboard learning management system that houses the certification track course materials, time management skills, and study tips.

Harper College's certification track enrollments and certifications, spring 2015 – summer 2016

Certification tracks offered	7
Students participating in any certification track course	95
Students completing any certification track course	99%
Students taking any certification exam	60%
Students passing any certification exam	50%
Students passing all 7 certification exams	1%

Student recruitment. The college used online resources, radio ads, career fairs, and relationships with local employers and the local CSCMP roundtable to market the program and recruit students.

LONG BEACH CITY COLLEGE

Long Beach City College is a large public community college serving the greater Long Beach, California, metropolitan area. In 2016, about 23,000 students enrolled in the college (42 percent full time and 58 percent part time). About half (54 percent) of the students described themselves as non-white, and 39 percent received federal Pell Grants. The majority of the college's academic programs led to associate's degrees. The largest number of degrees awarded were in business, management, marketing, and related support services (32 percent).[17]

Local labor market

Unemployment rate: 5.1 percent in August 2016 (Los Angeles-Long Beach-Anaheim metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to seven major highways, two major ports (the Port of Los Angeles and the Port of Long Beach), Los Angeles International Airport, and freight multimodal railway.
- California ranks highest in the country for employment in transportation and material moving (https://www.bls.gov/oes/current/oes530000.htm#st).
- The largest nonfarm sector of employment in the Los Angeles area labor market is trade, transportation, and utilities, which employed 1,086,400 workers in September 2016 (18.2 percent of total nonfarm employment) and increased 0.7 percent over the prior year (http://www.bls.gov/regions/west/summary/blssummary_losangeles.pdf).

How did the college support the LINCS program?

Long Beach City College played two key roles in the LINCS Consortium. First, as a member of the Academic Advisory Council, it reviewed LINCS certification track content for all eight tracks and worked with the Consortium to determine appropriate reading levels for content and to revise content. Second, the college created new not-for-credit course offerings to prepare students for all eight of the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations. The college also contracted with California State University, Long Beach's Center for International Trade and Transportation to provide content development for the Transportation Operations track.

What was in place before the LINCS program?

LINCS In the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

Before the LINCS program, Long Beach City College had a commercial driver training program which was a not-for-credit program in the supply chain sector. Additionally, the college offered four for-credit courses in the Business Administration program that led to a logistics certificate. The college offered an associate's degree through the Business Administration program.

[17] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (http://www.broward.edu/academics/programs/Pages/default.aspx).

How did the college implement the LINCS program?

Long Beach City College offered certification track courses starting in spring 2015, and ultimately offered coursework in all eight certification track areas. The college embedded the Transportation Operations certification track into the Commercial Driver Training Program, and developed new not-for-credit courses for all eight tracks. All certification track courses were offered fully online, and five tracks were available as not-for-credit hybrid courses that combined in-class learning with self-study via the Consortium's learning management system. The college worked with the local Urban League affiliate, KRA Corporation (a nonprofit workforce agency), and local employers to offer not-for-credit certification track modules off campus, in a hybrid format. The college also partnered with California State University, Long Beach, to align one of the certification tracks with the University's Global Logistics Specialist Program.

Staffing. A project lead, who also managed other grant activities and the college's Commercial Driver Training Program, managed LINCS program activities at the college. The college hired a subject matter expert to create instructional materials for the certification tracks developed by the Consortium, as well as multiple instructors to teach the courses.

Student support. The local Urban League affiliate and KRA Corporation provided wraparound services and career supports to students taking not-for-credit modules at their sites. Both organizations sent participants to classes at Long Beach City College as well and offered support services to these students. Pacific Gateway Workforce Investment Network was also contracted to provide support services and job placement to students. Students enrolled in courses through the college did not have access to institutional supports because all courses were not-for-credit.

Long Beach City College certification track enrollments and certifications, spring 2015 to summer 2016

Certification tracks offered	8
Students who participated in any certification track course	285
Students who completed any certification track course	98%
Students who took any certification exam	75%
Students who passed any certification exam	53%
Students who passed all 8 certification exams	0%

Student recruitment. The project staff promoted the program through presentations at local Workforce Development Boards and American Job Centers, industry association meetings, veterans' events, and job fairs. The local Urban League affiliate and KRA Corporation also recruited students.

SAN JACINTO COMMUNITY COLLEGE

San Jacinto Community College is a large public community college with campuses in the greater Pasadena, Texas, metropolitan area. In 2016, about 24,000 students enrolled in the college (27 percent full time and 73 percent part time). Almost three-fourths (72 percent) of the students described themselves as non-white, and 29 percent received federal Pell Grants. The majority of the college's academic programs were designed to lead to associate's degrees. The largest category of degrees was in liberal arts and sciences, general studies, or humanities (22 percent). The third largest category was in business, management, marketing, and related support services (10 percent).[18]

Local labor market

Unemployment rate: 5.8 percent in August 2016 (Houston-The Woodlands-Sugar Land metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to class 1 railroads, intermodal rail facilities, the deep water sea Port of Houston, four major interstate highways, an international border, and two commercial airports (Houston Bush Intercontinental and Houston Hobby).
- Texas ranks second in the country for employment in transportation and material moving (https://www.bls.gov/oes/current/oes530000.htm#st).
- The largest nonfarm sector of employment in the Houston metropolitan area is trade, transportation, and utilities, which employed 617,600 workers in September 2016 (20.5 percent of total nonfarm employment) and increased 6.1 percent over the prior year (http://www.bls.gov/regions/southwest/summary/blssummary_houston.pdf).

How did the college support the LINCS program?

San Jacinto Community College played two key roles in the LINCS Consortium. First, the project director at the college served as co-chair of the Academic Advisory Council and coordinated content development for the first four certification tracks. Second, the college integrated content from six LINCS certification tracks into its existing and new course offerings, and offered study guides for the other two tracks, to prepare students for the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations.

What was in place before the LINCS program?

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2014 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

Before the LINCS program, San Jacinto Community College offered a number of supply chain management (SCM) courses, including five courses with content similar to that covered in the certification tracks. The college offered a certificate and an associate's degree in International Business, Logistics and Maritime. The college had developed relationships with local SCM employers and a local Workforce Center before the grant.

[18] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (http://www.broward.edu/academics/programs/Pages/default.aspx).

How did the college implement the LINCS program?

San Jacinto Community College offered certification track courses starting in fall 2014, and it created new for-credit courses aligned with six of the certification tracks. The content of the two remaining certification tracks was partially covered in existing SCM courses, and the college provided study guides to help students in those two courses prepare for the corresponding certification exams. The two SCM courses that did not align with certification tracks were removed from the college course catalog. All eight certification tracks are also offered as non-credit, self-paced online modules.

Staffing. A project director led the LINCS program activities at the college, including student and employer outreach, and served as an adjunct professor for several SCM courses. The college hired two additional adjunct faculty members to teach certification track courses.

Student support. For-credit students had access to services offered at the college support center, as well as academic and career support from the instructors and program manager at the college. Both for-credit and non-credit students had access to supports provided by the local Urban League affiliate, including help with transportation challenges, interview skills coaching, and referrals for career opportunities.

San Jacinto Community College certification track enrollments and certifications, fall 2014 to summer 2016

Certification tracks offered	8
Students who participated in any certification track course	137
Students who completed any certification track course	77%
Students who took any certification exam	66%
Students who passed any certification exam	50%
Students who passed all 8 certification exams	12%

Student recruitment. The program manager recruited students through the local Workforce Development Board, local high schools, and the University of Houston SCM program, in addition to reaching out to current students at San Jacinto Community College. The college's local Urban League affiliate also promoted the program at veterans' events and workforce events, as well as to other community-based nonprofit organizations and industry partners.

ST. PETERSBURG COLLEGE

St. Petersburg College is a state college in Pinellas County, Florida, with 10 locations across the county. It is Florida's first two-year college and the first to offer bachelor's degrees. It offers more than 100 degree and certificate programs, including many high-demand, high-skill industry-recognized workforce certifications. In 2015, about 57,000 students (credit and non-credit) were enrolled at the college (30 percent full time and 70 percent part time). About two-thirds (64 percent) of the students described themselves as white, and 43 percent received federal Pell Grants. The majority of the college's academic programs lead to associate's degrees. The most commonly awarded degrees were in liberal arts and sciences, general studies, or humanities (51 percent). Degrees in business, management, marketing, and related support services comprised the fourth largest category (5 percent).[19]

Local labor market

Unemployment rate: 4.6 percent in August 2016 (Tampa-St. Petersburg-Clearwater metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to St. Pete-Clearwater and Tampa international airports, two major interstate highways, freight railway, and Port Tampa Bay.
- Florida ranks fourth in the country for employment in transportation and material moving occupations (https://www.bls.gov/oes/current/oes530000.htm#st).
- The Tampa metropolitan area employed 243,300 workers in trade, transportation, and utilities in September 2016 (19 percent of total nonfarm employment), a 2.2 percent increase over the prior year (http://www.bls.gov/regions/southeast/summary/blssummary_tampa.pdf).

How did the college support the LINCS Consortium?

St. Petersburg College played two key roles in the LINCS Consortium. First, as part of the Academic Advisory Council, it reviewed the certification track course materials before the final release of each track. Second, the college created eight non-credit certification classes that mirrored the LINCS certification tracks. The non-credit certification classes prepared students for the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations. In addition, St. Petersburg College created a new Supply Chain Management (SCM) track as part of the Business Administration associate's degree and a new SCM certificate program. The content from seven LINCS certification tracks were integrated into the new course offerings (the new degree track consists of three new supply chain courses and a business internship).

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

[19] Information was provided by the college.

What was in place before the LINCS program?

Before the LINCS program, St. Petersburg College offered a number of SCM courses as part of their bachelor's degree program. In addition, the Advisory Board for the College of Business provided guidance and suggestions for curriculum development and program enhancements.

How did the college implement the LINCS program?

St. Petersburg College offered certification track classes starting in spring 2015, and ultimately offered all eight certification track areas. It developed eight new non-credit certification track classes, offered in hybrid and online formats. During the grant period, the college also developed seven for-credit certification track courses that were a core part of the curriculum of a new SCM track of the Business Administration associate's degree and an SCM certificate program. The degree and certificate programs launched in fall 2016.

Staffing. A program lead with experience working with other Trade Adjustment Assistance Community College and Career Training (TAACCCT) grants managed all LINCS program activities. The program lead oversaw development, implementation, student outreach, and intake for the certification track courses. The college used grant funding to hire adjunct instructors to teach certification track classes and a curriculum development specialist to integrate the certification track content into course materials.

St. Petersburg College certification track enrollments and certifications, spring 2015 to summer 2016

Certification tracks offered	**8**
Students who participated in any certification track course	**330**
Students who completed any certification track course	**87%**
Students who took any certification exam	**70%**
Students who passed any certification exam	**60%**
Students who passed all 8 certification exams	**4%**

Student support. The college used grant funding to hire a student success specialist to assist with retention activities as well as a career outreach specialist to help program participants build skills and obtain jobs. In addition, a program newsletter, written by the program lead, included information about employer tours, current job opportunities, and other career readiness resources for current and former students. The local Urban League affiliate provided wraparound services to students that they refer to the LINCS program.

Student recruitment. Recruitment for the certification track classes initially focused on targeting current students at the college. A marketing campaign was developed to promote the program via print, online, and social media. Other efforts included outreach to community organizations, employers, recruitment agencies, and professional organizations. The program staff facilitated monthly information sessions and career workshops and attended various industry and community events. Information sessions were also conducted at various employer and community locations to further promote the program. In addition, the program newsletter, created for current and former students as well as external partners, included information about upcoming classes, workshops, employer tours, current job opportunities, and other career readiness resources. The local Urban League affiliate also recruited students and assisted them with completing the online application before referring them to the college.

UNION COUNTY COLLEGE

Union County College is a mid-sized public community college serving the greater Newark, New Jersey, metropolitan area. In 2016, about 11,200 students enrolled in the college (46 percent full time and 54 percent part time). Union County College is a designated Hispanic Serving Institution, with about one-third of students describing themselves as Hispanic (34 percent). More than four-fifths (81 percent) of students were non-white, and 44 percent received federal Pell Grants. The majority of the college's academic programs led to associate's degrees. The largest category of degrees was in health professions and related programs (31 percent). The third largest was in business, management, marketing, and related support services (14 percent).[20]

Local labor market

Unemployment rate: 5.1 percent in August 2016 (New York-Newark-Jersey City metropolitan area; http://www.bls.gov/lau/lamtrk15.htm).

SCM environment:

- The area has access to the largest east coast port (Port Newark), seven major highways, freight railways, and three major airports (Newark Liberty International Airport, LaGuardia Airport, and John F. Kennedy International Airport).
- New York State ranks third in the country for employment in transportation and material moving (New Jersey is not ranked in the top five; https://www.bls.gov/oes/current/oes530000.htm#st).
- The third largest nonfarm sector of employment in the Newark metropolitan area is trade, transportation, and utilities, which employed 250,000 trade and transportation workers in September 2016 (7.4 percent of total nonfarm employment) and increased 3.1 percent over the prior year (http://www.bls.gov/regions/new-york-new-jersey/summary/blssummary_newark_div.pdf).

How did the college support the LINCS program?

Union County College played two key roles in the LINCS Consortium. First, the college participated in the content development for the first four certification tracks, as part of the Academic Advisory Council and a certification track work group. Second, Union County College integrated content from all eight LINCS certification tracks into its own course offerings to prepare students for the Council of Supply Chain Management Professionals (CSCMP) SCPro™ Fundamentals certification examinations.

LINCS in the colleges

The LINCS Consortium of nine colleges, three universities, and CSCMP developed content for eight certification examinations, which led to the creation of relatively short-term courses in supply chain management for entry- and mid-level workers. The program was funded in 2013 by a four-year $24.5 million Trade Adjustment Assistance Community College and Career Training grant from the U.S. Department of Labor.

What was in place before the LINCS program?

Before the LINCS program, Union County College offered a basic introduction to logistics workshop and a preparation course for the U.S. Customs Broker exam, but did not offer any other supply chain management (SCM) courses or credential programs.

[20] Information on the college is provided by the U.S. Department of Education (https://collegescorecard.ed.gov) and the college's website (http://onlinecatalog.ucc.edu/).

How did the college implement the LINCS program?

Union County College offered certification track courses starting in summer 2015, and ultimately offered coursework in all eight certification track areas. It offered all eight certification track courses on campus as two-week, non-credit, in-person classes. Several local employers partnered with Union County College to provide certification track courses to employees on site at their companies.

Staffing. The college had two project leaders. One project leader, who also served as the associate vice president of academic affairs and provost of Union County College's Elizabeth, New Jersey, campus, managed LINCS program activities at the college. The other project leader was hired after the grant started and oversaw recruitment, job placement, marketing, training, reporting, and budgeting with input from the first project leader. Ten part-time instructors taught certification track courses, nine of whom were hired explicitly for the LINCS program.

Student support. The college used grant funds to hire a full-time business outreach specialist, who served only students enrolled in certification track courses. The specialist helped students write resumes, provided lists of job leads, organized career days and job fairs, facilitated job readiness workshops, and provided one-on-one assistance. Students could also access employment assistance at the college's Career Services Center.

Student recruitment. Program leaders used grant funds to hire a marketing assistant and a student outreach specialist to promote the LINCS program to students. These staff recruited students by advertising the program in the college's community-wide Job Connection newsletter, attending weekly orientations at the American Job Center, conducting outreach to veterans' groups, sending email blasts to college mailing lists, and attending local industry events. The college's local Urban League affiliate also recruited clients to the program and distributed flyers about the program throughout the community.

Union County College's certification track enrollments and certifications, summer 2015 to summer 2016

Certification tracks offered	8
Students who participated in any certification track course	279
Students who completed any certification track course	88%
Students who took any certification exam	88%
Students who passed any certification exam	73%
Students who passed all 8 certification exams	5%

APPENDIX D

TABLES DESCRIBING STUDENTS

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The tables in this appendix show the results of the quantitative analyses of the student-level administrative data from the colleges (see Appendix B for a description of the data). Tables D.1 and D.2 provide information on student demographics and other background characteristics. Tables D.3 and D.4 provide information on student course- and exam-taking patterns.

The tables contain information on two types of students, those who:

1. **Participated in LINCS at a Consortium college or a partner organization affiliated with a Consortium college.** This sample is defined as students who began participating in certification track courses or coursework or accessed certification track content before August 1, 2016.

2. **Accessed certification track content through courses at a non-Consortium college or university or self-study** (that is, students in the LINCS Central database) before August 1, 2016. Because only a subset of the information is available for these students, only the table describing student characteristics (Table D.1) includes detailed information for this group.

Mathematica used the following guidelines when developing the tables in this appendix:

- Show percentages, except where noted.
- Include the size of the sample analyzed, although item-specific nonresponse reduces that sample size in some cells. We do not report information when more than 70 percent of the observations are missing.
- Show information for all nine Consortium colleges together in the All Colleges column. Students in the LINCS Central database are not included in this column.
- Use acronyms and symbols including the following:

GED	General Education Development
LINCS	Leveraging, Integrating, Networking, and Coordinating Supplies in Supply Chain Management
n.a.	Not applicable (a college did not offer a specific certification track)
NR	Not reported (more than 70 percent of students are missing data)
TAA	Trade Adjustment Assistance

Table D.1. Student characteristics

	All colleges	Consortium colleges									LINCS Central
		Broward	Columbus State	Essex	FSCJ	Harper	Long Beach	San Jacinto	St. Petersburg	Union	
Demographics											
Male	54.7	57.7	53.6	50.0	52.6	62.5	62.1	52.6	55.2	51.3	61.2
Age (average)	38.9	NR	37.8	36.0	41.0	35.2	41.2	30.2	37.5	42.7	NR
Race/ethnicity											
Asian or Pacific Islander	4.6	2.8	5.0	3.7	3.4	10.7	9.1	8.8	4.0	2.2	1.7
Black or African American	43.8	35.5	34.5	68.9	61.0	8.3	42.5	25.8	38.2	34.1	43.3
Hispanic	20.0	41.5	3.8	21.1	8.4	14.3	25.3	45.6	14.0	19.4	11.7
Other race	2.0	3.2	0.6	0.0	0.1	3.6	8.8	1.4	1.5	1.8	32.5
White	29.5	16.9	56.1	6.3	27.2	63.1	14.4	18.4	42.3	42.7	10.8
Labor market and other characteristics											
Not employed	27.5	35.1	29.0	62.7	25.0	18.2	0.0	57.8	3.6	39.8	49.6
TAA eligible	1.5	2.8	0.0	NR	0.1	1.1	1.1	NR	5.5	0.0	0.8
Veteran	13.8	17.1	5.4	3.2	23.9	8.0	12.3	9.3	10.9	3.9	7.4
Has a disability	2.9	2.9	5.4	0.0	2.9	3.4	4.2	1.2	2.4	2.5	3.3
Pell receipt	NR	NR	7.8	41.1	NR	4.5	NR	27.5	NR	NR	NR
Sample size	3,295	579	336	190	887	88	285	321	330	279	121

Notes: Age and employment status were defined when a student first enrolled in a certification track course (that is, the status was not updated), and TAA eligible, veteran status, disability status, and Pell receipt were defined if a student ever had the status while enrolled in certification track courses (that is, the status was updated with each term of enrollment). For example, if a student was reported to have received a Pell grant in one of four terms enrolled during the evaluation period, that student would be included as a Pell grant recipient in this table.

Table D.2. Student education before participation in LINCS

	All Colleges	Broward	Columbus State	Essex	FSCJ	Harper	Long Beach	San Jacinto	St. Petersburg	Union
High school diploma or GED	75.7	80.7	90.8	100.0	77.9	100.0	83.2	56.1	90.3	NR
Prior college enrollment										
Enrolled in Consortium college[a]	13.5	28.0	15.5	1.1	NR	34.1	0.0	19.6	NR	4.3
Ever enrolled in any postsecondary institution	30.1	37.5	83.6	16.8	0.2	88.6	33.3	36.1	42.4	11.5
Prior credential completion										
Completed any postsecondary credential[b]	15.4	12.4	NR	4.7	0.2	44.3	33.3	2.5	25.8	4.3
Certificate	3.5	NR	NR	NR	NR	8.0	10.9	1.9	1.2	0.4
Associate's degree	3.0	1.9	NR	3.7	0.1	9.1	3.2	0.6	8.5	0.7
Bachelor's degree	5.4	0.2	NR	0.0	0.1	27.3	17.2	NR	16.1	2.2
Post-baccalaureate degree	0.6	0.2	NR	0.0	NR	0.0	2.1	NR	0.0	1.1
Other credential	NR	NR	NR	1.1	NR	NR	0.0	NR	NR	0.0
Sample size	3,295	579	336	190	887	88	285	321	330	279

Notes: Almost three-quarters (74.4 percent) of students in the LINCS Central database had enrolled in any postsecondary institution before pursuing certifications.

[a] Prior enrollment in a Consortium college is defined as enrollment in the term before the first term in which a student enrolled in a certification track course.

[b] Credential completion is defined as any postsecondary credential completed before the first term in which a student enrolled in a certification track course. Completion rates of individual credentials may not sum to the completion rate of any credential due to rounding.

Table D.3. Student certification track course enrollment and completion

	All Colleges	Broward	Columbus State	Essex	FSCJ	Harper	Long Beach	San Jacinto	St. Petersburg	Union
A. Percentage who ever enrolled in:										
Any certification track course[a]	83.7	42.7	100.0	100.0	98.2	100.0	100.0	41.1	100.0	100.0
One certification track course only	45.6	14.9	69.6	69.5	49.8	21.6	75.1	15.0	63.0	42.3
Two or more certification track courses	38.1	27.8	30.4	30.5	48.4	78.4	24.9	26.2	37.0	57.7
Individual courses										
Customer Service Operations	32.0	4.3	30.1	47.9	58.4	n.a.	26.0	21.5	29.4	28.0
Demand Planning	7.7	n.a.	5.1	n.a.	12.2	2.3	6.0	n.a.	12.1	25.4
Inventory Management	15.7	n.a.	3.3	n.a.	25.9	51.1	16.1	15.9	11.2	34.8
Manufacturing and Service Operations	3.9	n.a.	n.a.	n.a.	6.3	n.a.	3.5	n.a.	9.7	11.5
SCM Principles	50.6	30.1	64.3	60.5	41.7	81.8	45.6	24.6	73.6	95.7
Supply Management and Procurement	14.7	7.1	6.0	n.a.	24.9	44.3	9.5	10.9	19.1	13.3
Transportation Operations	20.4	28.7	14.0	11.6	23.6	55.7	15.4	9.0	11.5	24.7
Warehousing Operations	24.4	12.1	19.9	18.4	34.3	55.7	28.1	15.6	23.6	25.8
B. Percentage of those enrolled who completed:[b]										
Any certification track course	91.6	95.1	80.4	84.7	98.7	98.9	97.5	78.0	87.0	88.2
One certification track course only	86.5	87.2	72.2	83.3	97.7	94.7	96.7	58.3	80.8	77.1
Two or more certification track courses	91.1	91.9	89.2	69.0	95.6	88.4	100.0	70.2	95.1	92.5
Individual courses										
Customer Service Operations	91.2	88.0	80.2	86.8	97.1	n.a.	100.0	71.0	87.6	85.9
Demand Planning	92.9	n.a.	82.4	n.a.	95.4	100.0	100.0	n.a.	97.5	87.3
Inventory Management	94.4	n.a.	100.0	n.a.	97.8	97.8	100.0	68.6	97.3	93.8
Manufacturing and Service Operations	97.7	n.a.	n.a.	n.a.	98.2	n.a.	100.0	n.a.	100.0	93.8
SCM Principles	90.1	93.1	81.5	83.5	96.5	98.6	95.4	84.8	87.2	88.4
Supply Management and Procurement	90.7	97.6	95.0	n.a.	87.8	100.0	100.0	60.0	98.4	97.3
Transportation Operations	91.8	93.4	74.5	59.1	98.6	100.0	100.0	69.0	92.1	88.4
Warehousing Operations	93.5	94.3	91.0	77.1	96.1	100.0	98.8	80.0	91.0	94.4
Sample size	3,295	579	336	190	887	88	285	321	330	279

[a] The colleges did not provide data confirming enrollment in specific certification track courses for 16.3 percent of the students. For these students, LINCS participation prior to August 1, 2016 was confirmed with (1) confirmation from the college's program lead, (2) a record of the student accessing the learning management system, or (3) the presence of a supplemental application before prior to the launch of the learning management system.

[b] The sample in Panel B includes students who have non-missing course completion data and who attempted any course, one course, two or more courses, and individual courses, respectively. The denominator varies in each *Individual course* (complete) row with the number of students who enrolled in courses.

Table D.4. Student certification exam attempt and pass rates

	All Colleges	Broward	Columbus State	Essex	FSCJ	Harper	Long Beach	San Jacinto	St. Petersburg	Union
A. Percentage who attempted:										
Any certification exam	70.8	78.4	67.6	80.5	53.7	62.5	74.7	86.3	70.0	88.2
Certification exams for all courses completed	58.8	70.8	62.5	75.8	33.9	18.2	68.8	80.7	60.9	72.4
Certification exams without completing the corresponding courses[a]	22.7	51.1	13.1	9.5	7.9	25.0	0.4	76.9	2.1	15.4
Individual certification exams										
Customer Service Operations	31.2	26.8	25.6	43.7	36.5	6.8	17.9	57.3	21.5	24.7
Demand Planning	13.0	13.0	6.0	0.0	9.8	15.9	4.9	43.6	11.2	14.3
Inventory Management	18.2	12.6	6.5	0.0	14.3	31.8	13.3	61.1	10.3	29.7
Manufacturing and Service Operations	9.0	7.8	1.5	0.0	8.2	0.0	2.8	33.6	8.2	10.8
SCM Principles	44.4	56.5	39.3	44.7	27.4	50.0	38.6	40.8	47.6	83.5
Supply Management and Procurement	14.7	15.0	9.8	0.0	12.3	23.9	8.4	38.9	15.5	12.2
Transportation Operations	18.7	31.1	14.3	7.9	13.3	9.1	11.9	37.1	10.3	21.1
Warehousing Operations	24.5	30.7	17.6	14.2	20.7	31.8	18.6	40.2	21.2	28.3
B. Percentage of those attempting who passed:[a]										
Any certification exam	80.9	79.3	91.6	76.5	79.4	81.8	70.9	81.9	85.7	82.5
Certification exams for all courses completed	67.5	57.6	89.5	70.1	61.5	62.5	65.8	59.5	79.6	72.3
Individual certification exams										
Customer Service Operations	84.6	84.5	90.7	79.5	87.3	100.0	76.5	82.1	85.9	81.2
Demand Planning	86.4	86.7	100.0	n.a.	90.8	85.7	100.0	74.3	100.0	95.0
Inventory Management	90.3	93.2	100.0	n.a.	92.1	92.9	92.1	81.6	100.0	97.6
Manufacturing and Service Operations	82.1	80.0	100.0	n.a.	79.5	n.a.	75.0	78.7	92.6	93.3
SCM Principles	80.2	71.3	93.2	71.8	81.9	77.3	78.2	83.2	83.4	84.1
Supply Management and Procurement	94.2	92.0	100.0	n.a.	93.6	100.0	91.7	93.6	96.1	94.1
Transportation Operations	77.1	74.4	89.6	66.7	74.6	25.0	64.7	79.0	91.2	84.7
Warehousing Operations	74.5	60.1	94.9	81.5	77.2	78.6	67.9	73.6	85.7	77.2
Sample size	3,295	579	336	190	887	88	285	321	330	279

Notes: Data on the exams attempted by LINCS Central students were not available. The National Program Office reported that 55 percent of LINCS Central students in the administrative data sample passed at least one exam prior to September 2016, while 50 students from the full LINCS Central database took an exam but did not pass.

[a] The *Percentage of those attempting who passed* was determined using information provided by each Consortium college about which courses are aligned with each certification track.

[b] The sample used for the analyses in Panel B includes students who have non-missing course completion data and who attempted any exam, all eligible exams, and individual exams, respectively. The denominator varies in each *Individual course* (complete) row with the number of students who enrolled in courses.

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